A New Foundation for Microfinance Impact Studies

An Empirical Analysis on the Household Level in Uganda

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Abstract

This thesis tests the impact of microfinance banks on households in Uganda. The test hypothesis states that microfinance loans have a positive and significant impact on Ugandan household well-being. Two alternative specifications for household well-being are estimated and compared; one is based on a calculation of household consumption expenditure and the other on the total value of household non-land assets. Additionally this paper is used to test a method that controls for the client self-selection bias. The results of the estimation were largely significant. The estimation for microfinance loan impact was positive, yet only in one of the two alternate models. The Uganda Bureau of Statistics and The World Bank Group provided access to the 1999 to 2000 cross-sectional data set used in this evaluation.

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Chapter 1 – Introduction

For years people in poverty have been denied access to formal sector finance due to their lack of "credit-worthiness." Microfinance institutions (MFIs) introduce a new model in the provision of financial products to those most in need. These programs supply credit-worthiness to their clients by spreading risk and responsibility through small groups of mutually responsible borrowers. The dynamics of these groups provide enough group collateral and loan security to open its members to market-based interest loans and a number of other services. Loan recovery rates are often as high or higher than ninety five percent in many countries. This system makes credit and financial service provision profitable for the microfinance institutions and hopefully beneficial to their clients. Since the benefits of program participation are not visible market outcomes, studies must be undertaken to establish what impacts it has at the household level. If for example MFIs could be shown to be both profitable ventures and effective in the reduction of household poverty, these intuitions may act as market driven poverty reduction institutions.

It was observed from a relatively extensive search of microfinance impact literature that the large majority of papers focused on the county of Bangladesh. The Bangle-centric movement is due to the fact that it was the home of the first microfinance bank in the world, The Grameen Bank. The majority of literature has focused on the impact of the original banks. Literature for the most part has entirely overlooked the impact of Grameen clone institutions within other countries' widely variable cultural and economic circumstances. This paper will attempt to fill a small scrap of the hole in academia with a microfinance evaluation based on The Republic of Uganda.

The tested hypothesis for this paper is: microfinance loans have a positive and significant impact on Ugandan household well-being.

This hypothesis will be tested with the use of district-level fixed effects ordinary least squares method. Hypotheses will be tested on the 5% level of significance.

The rest of the paper is as follows: chapter two introduces the two key theoretical models, first the intertemporal budget model and second the isocost / isoquant model. These models will be used to introduce how microfinance credit effects household outcomes. The third chapter first introduces and then reviews six different pieces of scholarly literature. These reviews are used to create a solid foundation of knowledge on econometric techniques used in microfinance impact assessment. The fourth chapter introduces the two econometric models that are used to evaluate the impact of microfinance credit. The fifth chapter discusses a number of tests for statistical problems, undergoes the necessary correction process, and sums up the results. The sixth and final chapter reviews the finding of the paper, makes suggestions for policy and supplies advice to future researchers.

Chapter 2 – Theory

2.1 Introduction

In the developed world, access to savings and credit facilities are synonymous with increased household production and consumption. In the developing world, poor households work under heavy burdens and limitations including lack of employment, or forced underemployment, and little to no access to health care, schools, or savings and credit facilities. In order to evaluate the impact that savings and credit facilities has on impoverished households it is critical to identify the unique set of constraints that they act within, and assess services in respects to their impact on household outcomes. This chapter will identify some of the household level constraints of the less developed world and will describe what impacts savings and credit can have on them.

On the household level, consumption and production are constrained by numerous exogenous and endogenous factors including high unemployment, lack of credit worthiness, and low wages. A series of intertemporal models will be used to evaluate the impact of credit access on consumption across two periods. Later the discussion will be extended to include household level production using a cost minimization model. These models will be adapted to include common household limitations in order to accurately estimate the impact of savings and credit, within the developing world context.

2.2 Household Consumption Choices in a Developed World

Intertemporal Basics

The intertemporal consumption model is an extension of the neo-classical consumption model. The model plots consumption in time period one on the y-axis and consumption in time two on the x-axis. Problematically it assumes perfect information

on the part of the individual across time, as well as instant adjustment of stocks (Deaton, 359). Perfect adjustment of stocks refers to the ability of the household to instantaneously respond to changes in their environment while maintaining the maximum level of utility. Therefore this model tends to overestimate the predictive abilities of the household as well as their ability to adjust resources according to imperfect information. Other key assumptions of the basic model include: 1) present and future income are given two, 2) same interest rate savings and credit facilities are available, and 3) prices of consumption are held constant for both periods. These assumptions will be relaxed later to encompass real-world constraints.

Budget Constraint

The first key feature of an intertemporal consumption model is the budget constraint line. This line is plotted between consumption in time T, on the x-axis, and consumption in T+1, on the y-axis. The budget constraint plots all possible combinations of consumption in both periods dependent on the levels of borrowing and savings in time T. The budget constraint represents the limitations a consumer or a household face as a result of limited incomes, across two periods. In other words, interest or zero-interest bearing savings and loans can be considered a single financial asset A, which is available in negative or positive amounts (Deaton, 98). This asset links both the current and future period with a single asset A. The balance on A must be accounted for in the consumption period after its value was determined (Deaton, 98). The level of consumption chosen in T therefore determines the level consumed in T+1 since A is the only variable. The formula for an intertemporal budget constraint is as follows in equation 2.0.

(2.0) $$BC = P_1 q_1 + P_2 q_2$$

Equation 2.0 shows that the budget constraint is the sum of period 1 and 2's consumption, P_iq_i, where P_1 and Q_1 are the prices and quantity in the first period, and P_2, Q_2 are the prices and quantity in the second period. Prices are assumed constant and quantities are variable. Equation 2.0 does not take into account the effects of savings or borrowing. When a household borrows or saves in the current period, the following period is affected through the impact of the interest rate. Equation 2.1 integrates the effects of interest bearing savings and loans.

(2.1) $BC = P_1q_1 + (P_2 / (1+r_2))* q_2$ (Deaton, 100)
where: $q_1 = f(A, y_1)$

In this new equation (2.1) the price level is affected by the interest rate, where y_1 is the income at the beginning of period one, and borrowing carries a negative interest rate while savings carries a positive interest rate. In the first period although the impact of savings or credit is not directly shown, the financial assets A appears by increasing or decreasing the quantity consumed q_1. In the second period, when interest is due, P_i deflates by one plus the interest rate r. Loans taken in period one with a negative interest rate from borrowing will have decreases in period two consumption since: $(P_2 / (1+r_2)) > P_2$. Savings balances with a positive interest rate in period one will increase consumption in period two since: $(P_2 / (1+r_2)) < P_2$.

The following algebraic manipulations will derive the slope of the budget constraint:

The budget constraint can be rewritten by setting BC = 0

(2.2) $0 = P_1q_1 + (P_2 / (1+r))q_2$

(2.3) $(P_1q_1 / q_2) = -(P_2 / (1+r))$

Solve for the ratio of the quantities of both periods

(2.4) $q_1 / q_2 = -P_2 / ((1+r)P_1)$

The reciprocal is taken to set the independent and dependent variables as desired

(2.5) $q_2 / q_1 = - ((1+r)P_1) / P_2$

Since prices are assumed to be equal to one

(2.6) $\bullet Y / \bullet X = q_2 / q_1 = - (1+r)$

These equations mathematically show the main functions and properties of the intertemporal consumption model. The amount consumed in the current period can be expanded through the use of loans or decreased through use of savings. If assets are interest bearing, the amount borrowed or saved has an exaggerated impact on consumption in the following period. The slope of the budget constraint is negative one times one plus the interest rate, where interest is negative for borrowing and positive for savings.

Using the Intertemporal Model

First, this section will help to accustom the reader to the working of the graphical version of the intertemporal consumption model. Secondly, it will introduce the concept of intertemporal household utility. Figure 2.1 below will help to establish the concept of the visual intertemporal choice.

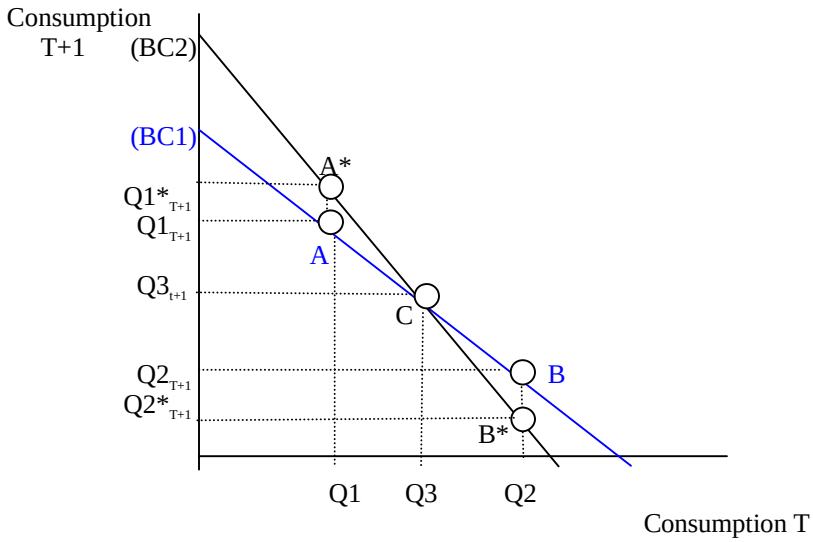

Fig. 2.1 Intertemporal Consumption Choices w/o Credit Constraints

If borrowing / saving is interest bearing, the slope for the budget constraint becomes -(1+r). Where r is the interest rate. The endowment point C at Q3, $Q3_{T+1}$ represents the total consumption quantities available to the household in both periods without saving or borrowing. Any increase in absolute value of r will lead to a steeper slope of the budget constraint rotated around the endowment point C, this demonstrated as BC1 rotates to BC2 in figure 2.1. As absolute interest increases the budget constraint will rotate clockwise around the endowment point because the slope is increasing.

In figure 2.1 the budget constraint BC1 displays a zero-interest-bearing financial service since the slope is equal to negative one. Any point to the left of the endowment C, such as point A, demonstrates a reduction in spending or increases in savings, and will provide positive returns from interest on the residual income. However since r is equal to negative one, consumption in period two will not increases beyond the $Q1_{T+1}$ level. The opposite is true for borrowing.

We will now evaluate the impact of positive interest rates on this model. If the absolute level of interest |r| is increased BC1 will rotate to BC2 around the endowment point C. Starting at point A moving to point A*, the current level of consumption remains Q1 and $Q1_{T+1}$ moves up to $Q1^*_{T+1}$. The increased consumption in period two reflects the gains from interest on savings (initial savings has a value of the difference between Q3 and Q1). For points to the right of the endowment point an interest-bearing loan must be taken in order to increase current consumption. Following point B, as BC1 moves to BC2, $Q2_{T+1}$ moves down to $Q2^*_{T+1}$ at point B*. The decrease in consumption in T+1 reflects the additional costs of interest bearing loans.

Since the interest rate determines the slope of the budget constraint through its interaction with savings and credit, increased interest rates discourages current consumption, while lower rates encourage it. This basic implication will be of critical importance to the development of this theory.

Budget Utility

In respect to consumption, each household or individual has a certain desirable level of utility along his or her budget constraint. The utility level (U_i) is a function of the satisfaction derived by household (i) from a certain intertemporal market basket consumed in the current period through additional future periods (Rubinfield, 673). In the intertemporal model the market baskets are composed of different combinations of current and future consumption that provide the same level of satisfaction across both periods. Since this period's choice to consume a market basket determines the level of consumption in a latter period, the shape of a utility curve suggests the household's preferences between consumption in the current period in comparison to the latter period.

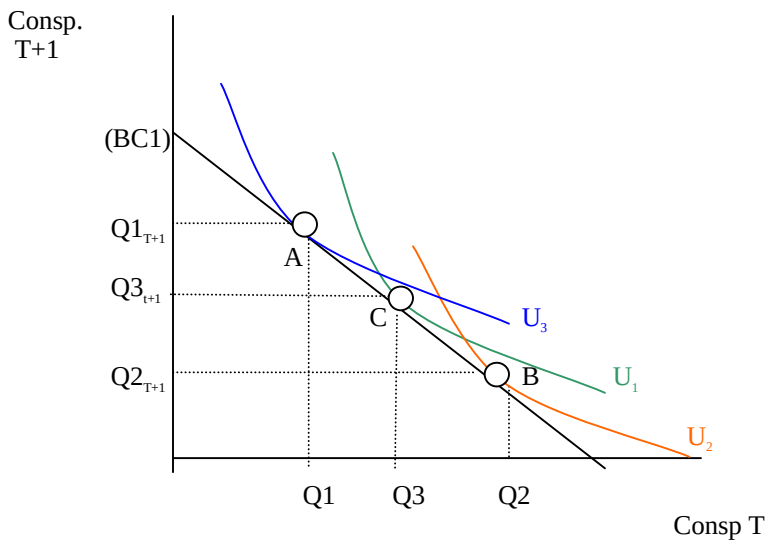

Fig. 2.2 Utility Maximizing Intertemporal Consumption Choices

Figure 2.2 demonstrates a series of different families' utility curves along a similar budget constraint, where |r| is greater than one. A point slope along U_1 demonstrates a certain preference towards or against consumption in T and T+1. Moving left along U_1 past point C the line accelerates at an increasing rate because the household has a growing preference towards current consumption. As the level of current consumption decreases, the household will place increasing importance on it because its marginal utility increases. The opposite is true for the portion right of point C. We can see therefore that both current and future consumption have a decreasing marginal utility.

In figure 2.2 the utility curve (U_1) suggests that both forms of consumption are neither perfect substitutes nor perfect compliments, but instead somewhere between. This means that the household's indifference between current and future consumption is only partially flexible. The concavity of a utility curve demonstrates that the household is risk-adverse. The household prefers an "average" level of consumption in both periods,

as apposed to consuming relatively large amounts in one period versus the other (Varian, 184).

Figure 2.2 also displays a series of three families' utility curves. It will be assumed that all three families have the same incomes in both periods and therefore all share the endowment point C, as well as BC1, but have dissimilar preferences. Each family has a unique utility curve [U_1, U_2, U_3] that is specific to their preferences in respects to consumption. Each household is assumed to be a utility maximizer, meaning that for $U_{1\text{-}3}$ respectively, there is no other utility curve that meets these two conditions: 1) is tangent to the budget constraint, and 2) provides equal or greater levels of total present and future consumption than is available along U_i.

A household with the utility curve of U_3 maximizes at point A. This implies a level of current consumption Q1 and $Q1_{T+1}$ in the following period. This household has reduced their current consumption (saved) in exchange for greater future expenditure. Future expenditure can be increased by the amount saved (Q_3-Q_1) plus the interest accrued on savings [(Q_3-Q_1) *(1+r)]. The utility maximizing household at point C with utility curve U_1 neither savings nor borrows and therefore sees no increases in spending. The maximizing household at point B with utility U_2 increases their current consumption by Q_2-Q_3 by borrowing at the expense of future consumption, leaving them $Q2_{T+1}$. Consequently the household at point B must lower their future spending by the amount of the loan plus interest payments ($Q3_{T+1}$ – $Q2_{T+1}$).

Developed World Conclusions

The conditions described within this section most resemble the conditions facing households in the developed world. There are some key characteristics that were excluded for simplicity within the discussion, but the resemblance is quite striking.

Although developed economies use interest bearing financial services, a relatively *competitive market* helps to determine the interest rate and consumers are able to act on relatively good, if not perfect information. Households in the developed world are therefore are able to make decisions within a relatively fair environment and therefore should be able to maximize their capabilities and therefore standard of living.

Financial services are often used to smooth the consumption of the household, to fuel investments with expected profits or even to act as emergency insurance. The ability to invest with the use of credit is critical to the household for two main reasons: one, early investment; two, increased efficiency. Credit allows a household to invest *early*, increasing their current spending flexibility, and thereby extending the realized profits over a longer period of time. Suppose that the two families of curves U2 and U3 are both able to make an investment with an expected profit. U3 will utilize savings and U2, credit. Assuming that the venture is profitable, and that the rate of return is higher than the interest rate (as would be expected as a short term investment condition), then the credit household U2 will see relatively higher impacts on their current and future incomes than U3. This is due to the fact that the U2 household realizes profits in the second period, while U3 will not realize profits until the third period. On the same note, credit encourages the efficient allocation of assets across time by decreasing waiting period before investment can be made. A family with access to credit will be able to move quickly on a short or long term opportunities, thereby increasing the likelihood of investment and increasing the benefits received from it. Compared to their counterparts in poor countries these highly developed services appear nearly perfect.

2.3 Household Consumption Choices in a World without Credit

A household's needs are far from stable across time. Families have to deal with a large number of exogenous events and a smaller yet important number of investment opportunities. Problems may arise during times of natural disaster, unexpected deaths, or political instability. In the developing world many of these problems must be faced without the assistance of insurance or other modern coping mechanisms. On the positive side, a household has opportunities including investment into businesses, productive assets, and fixed startup and working capital. For instance a family might wish to purchase a cow for milking, and a refrigerator to keep the milk from spoiling. All of these factors increase a household's need for short-term income flexibility in current and or future periods.

Unfortunately we do not operate in a world where everyone has access to effectively functioning economic systems. There are a number of constraints that can impact a household's consumption levels, especially in those countries plagued by underdevelopment. Limitations on access to savings and credit, the powerlessness to gain credit worthiness, high interest rate bearing loans, low income levels, and other external / internal conditions can seriously constrain the capabilities of a household. Unfortunately, these problems are often even more acute within geographically isolated areas. We will now model household consumption choices without access to credit or interest bearing savings.

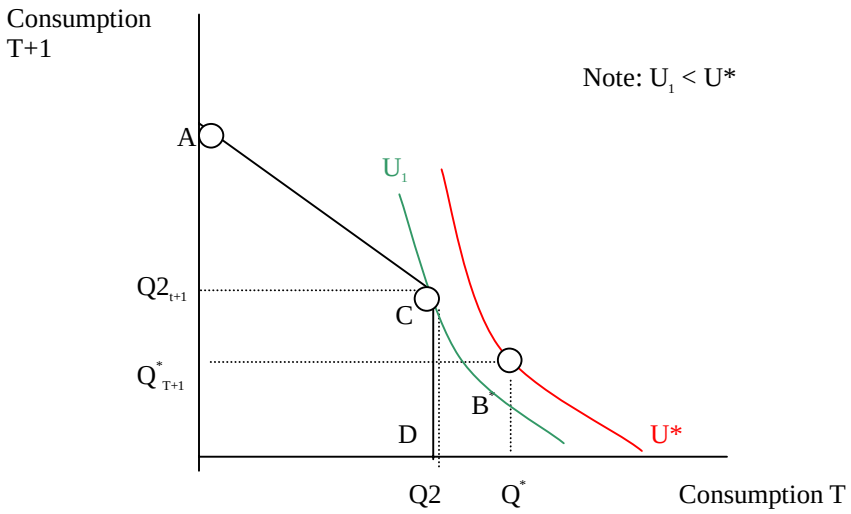

Fig. 2.3 Intertemporal Consumption Choices with income constraints w/o Credit Access

Figure 2.3 displays two significant alterations to the model shown in figure 2.2. In 2.3 the slope of the budget constraint, between points A and C, *is* equal to negative one. This reflects the lack of interest bearing savings accounts for the household. This would be an unrealistic assumption for the developed world, as seen in figure 2.1, but is quite common in the developing world. Without interest bearing accounts savings will have a directly proportional opposite reaction on future consumption. Therefore, there is little incentive to save rather than maximize current consumption. Under this constraint households often revert to the hoarding of perishable or non-perishable goods. In times of economic or humanitarian crisis this practice can lead to the massive inflation of food and asset prices, which often leads to increased instability (Chadha, 46).

Since there are no credit facilities available to the household, present consumption cannot be expanded to the right beyond point C (Q2, $Q2_{T+1}$), the current endowment. This accounts for the vertical portion of the budget constraint C to D. Therefore the budget

constraint is separated into two unique sections to the left and right of the endowment point C. Savings (A – C) is available but unattractive, and credit Q* > Q2 is unavailable. We will now look at how these constraints affect the household's choices.

Two representative problems are demonstrated in figure 2.3. First, a family with a utility curve U_1 is unable to maximize its utility. Although U_1 is goes through the maximum level of current consumption along A-C-D, this level (Q2, $Q2_{T+1}$) does not provide the maximum level of utility because U_1 and A-C-D are not tangents. Therefore the household is forced to consume Q_2 despite its inefficiency. The solution to this problem will be presented in the section 2.4. Next, a family with the utility curve U* finds its optimal level of consumption B* is impossible along their budget constraint A-C-D. We will assume that the family has an immediate need for a high level of consumption to deal with an unexpected problem or an investment opportunity. The total need for extra consumption is equal Q* minus Q2. The desired consumption and utility level is not available without access to a loan if the house's savings are already expended. The household must therefore restructure its variable expenditure along a utility curve similar to U_1, and lower than U*. The current endowment Q2 must be divided to cover both the living expenses of the family, *and* the cost of the problem or opportunity. If the family is already impoverished, the impact of any further reduction in living expenses may be disastrous to their quality of life. In conclusion, if a household business wishes to immediately expand beyond the level currently available to them at endowment C, they must have access to credit or else choose to divide up their current consumption.

2.4 Household Consumption Choices in the World of Microfinance

Microfinance institutions (MFIs) can play a critical role in filling the need for household level credit and savings. Before talking about what specifically MFIs do, it is important to look at what impact credit access can have on the intertemporal consumption model.

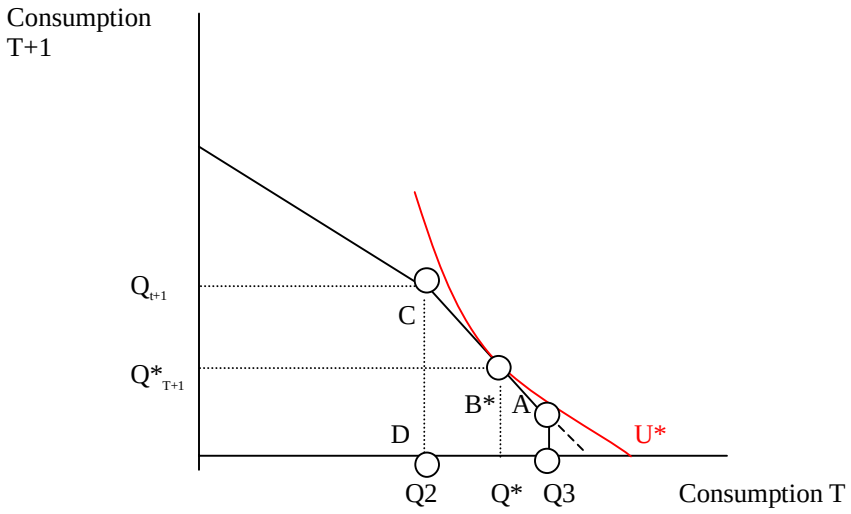

Fig. 2.5 Intertemporal Consumption Utility Problems w/ Credit Access

MFIs are able to provide interest-bearing loans up to a certain credit limit. These loans often amount to little more than a few hundred dollars. Figure 2.5 demonstrates the effects of access to interest bearing credit with restrictive credit limit. Again the slopes of the budget constraint to the left and the right of the endowment C reflect interest due on savings/loaning and borrowing. In this example all loans have a positive interest rate, therefore the slope of the budget constraint to the right of point C is steeper. Interest on savings balances will be assumed to be equal to zero, therefore the slope of section to the left of point C is equal to negative 1. The vertical section of the budget constraint from A

to Q3 demonstrates the effects of a credit limit; beyond Q3 no additional money is available.

Despite its limitations microfinance credit can provide a useful service to households that need more than Q2 for current consumption. Even loans taken with relatively high interest can effectively meet the needs of the household by extending the budget constraint beyond the vertical line C, D to C, A, Q3. Our family is now able to maximize their utility at point B*, with current consumption of Q* and future of $Q^*_{T+1.}$ However, this loan will reduce consumption in T+1 by the difference between Q_{t+1} and Q^*_{t+1}; this amount is equal to the sum of the loan plus the interest due on it.

Microfinance institutions can help to meet the consumption needs of poor households, depending on the shape of the family's utility curve (which reflects preferences in current and future consumption) and the interest rate of borrowing. Interest rates can be high within microfinance loan provision due to the high monitoring, recovery, and human capital costs associated with it. Nonetheless literature shows that "poor clients will afford to pay full cost recovery interest rates and fees whatever the level" (CEEWA, 20).

The majority of institutions go beyond credit to providing savings accounts, and even non-financial services. This allows members to choose between taking loans, accumulating savings or utilizing other services. This dynamic emphasis expands the number of coping mechanism and entitlements of participant households. All this provides evidence that households might find microfinance intervention advantageous despite the high costs of it employ.

2.5 Household Consumption Choices and its Impact on Household Investment and Production

Within a developed financial system loans may act as a catalyst for risk-taking, and also a backup for exogenously produced income instability. Please note that consumption may include investment into household level production of market and non-market goods. Additionally, risk-taking plays a critical role in capitalist development since it often entails investment into a profitable business or productive assets (Johnson, 3). In the last section we could see that access to credit can help to bridge the gap between a clients income, and minimum level of investment or risk-taking. The lack of access to loans may adversely affect production output. Microfinance loans can therefore improve the efficiency of variable inputs within households business. An adaptation of the isocost model will demonstrate the impact of microfinance institutions on household or personal production. In this case a household business will be treated as a firm.

Building an Isocost Line

This model works under the assumptions that: 1) the only inputs to production are capital and labor; 2) the wage rate of labor (w) and user cost of capital (r) are at constant competitive market outcomes; 3) in the short run only labor is variable. The user cost of capital is defined as the sum of forgone interest rate through alternative investment and the depreciation rate of the capital (Rubinfield, 217).

An isocost line plots all the combinations of inputs at a specified cost (Rubinfield, 217). Since inputs are restricted to capital and labor the equation for the isocost line is as follows in equation 2.7.

(2.7) $TC = wL + rK$ (Rubinfield, 217)

In relation to later figure 2.6, isocost C1 is equal to the sum of 1) the wage rate times the number of labor hours, and 2) the user cost of capital times the number of physical units of capital. We can find the slope of the isocost line and the endpoints by rearranging eq. 2.7 into a typical straight-line equation as shown in equation 2.8.

(2.8) $K = TC/r - (w/r)L$ (Rubinfield, 217)

The y-intercepts are therefore equal to C divided by the user cost of capital, and the x-intercept is the total cost of labor divided by the wage rate of labor. In other words the endpoints on the x or y axis are equal to the total quantity of labor or capital available at the total cost set by isocost C1. As can be seen in the equation above, the slope is equal to negative one times the ratio of the wage rate to the user cost of capital.

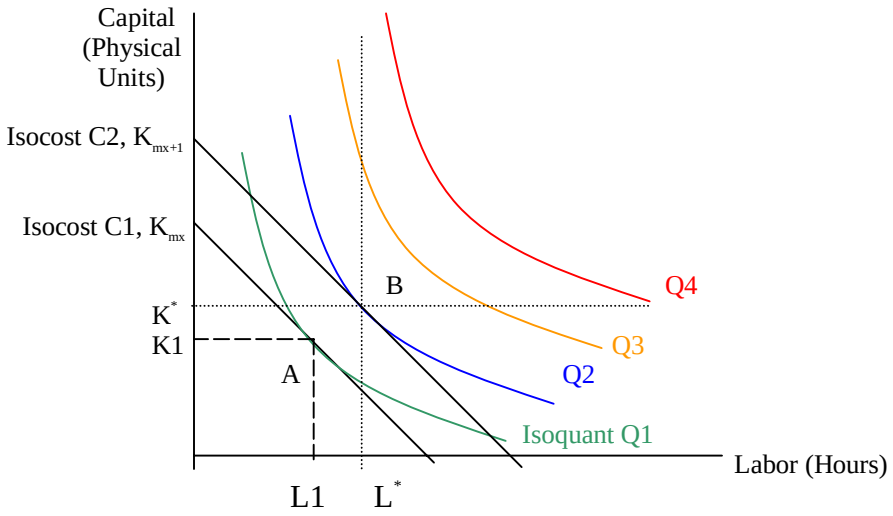

Fig. 2.6 - Basic Isocost with Declining Marginal Productivity

Building an Isoquant Line

The isoquant is similar to the isocost line, however it plots out all possible combinations of inputs that yield a specified level of output. Again the inputs in this case are limited to capital and labor. The isocost is downward sloping because it reflects the fact that both capital and labor have positive marginal products and are substitutes (Rubinfield, 191; Ehrenberg, 97). The concavity of the isoquant relates to the fact that both labor and capital have diminishing marginal products.

The marginal productivity of x is defined as, the amount output increases by a one unit increase in the input x. In other words, as the quantity of labor or capital increases their marginal productivity to output diminishes. In figure 2.6, this is demonstrated with the dotted line at K^*. As the household firm expands holding the level of capital constant at K*, the returns to increased labor decline across Q1 to Q3. This is due to the fact that the amount of labor needed to move to the next output level increases drastically as the amount of labor increases. This example also applies to the line L^* holding labor constant at L*.

Isoquant Details

The following will discuss the working of the isoquant line. The amount of capital decreased due to a unit increase in labor while output is held constant is called the marginal rate of technical substitution (MRTS) (Ehrenberg, 97). The slope of the isoquant at any given point is equal to the MRTS. This will now be described mathematically.

(2.9) *Marginal Rate of Technical Substitution*

$MRTS = \Delta K / \Delta L$ holding Q constant

(2.10) *This can also be expressed as:*

$MRTS = -(\Delta K/\Delta Q) / (\Delta L/\Delta Q) = - (\Delta Q/\Delta L) / (\Delta Q/\Delta K) = -MP_L/MP_k$ (Ehrenberg,101)

The MRTS can therefore be adapted to: negative the marginal product of labor over the marginal product of capital. So the MRTS can be interpreted as a ratio of the productivities of labor and capital.

Minimum Cost

To find equilibrium within this model it is necessary to discover the cost minimizing point. This is of particular importance because it is in the best interest of any household firm to minimize their costs in the long run. The cost minimization point is the point along the isoquant which is tangent with the isocost line. At this point MRTS or ($- MP_L/MP_k$) will be equal to negative one times the ratio of the wage rate to the user cost of capital (-w/r). In other words the ratio of the productivities of labor and capital should be equal to the ratio of labor wages and the user cost of capital; this promotes allocative efficiency since costs are minimized. The equilibrium equation is shown in equation 2.11.

(2.11) $MRTS = -MP_L/MP_k = -w/r$

These cost minimizing points can be traced over increased production levels. In figure 2.6, if a household takes a loan in period one or realizes savings in period two, the isocost line shifts out from C1 by the amount of money invested into inputs ending up at C2. The total amount invested, although maybe not the entire sum of the loan, can be

calculated by finding the difference between K_m and K_{m+1}. The isocost shifts out parallel from isocost C1 by the amount of the increased expenditure. From point A the increase in income (from savings or loans) allows the household firm to purchase higher levels of labor and capital for production. Point B is then realized along C2 and a new isoquant (Q2) is reached, where Q2 > Q1. In sum we have seen how the use of savings and loans can increase the level of household production through shifting out the isocost and iscoquant lines.

Building a Developing Country Isocost Curve

The conventional isocost curve does not take into account a number of real life constraints within the developing world. Although the theories are constantly adapting over time, economists have established differences in the construction of economic models between developed and underdeveloped countries. These differences include: low wage levels of labor, high relative costs of capital and technology, and constraints on current and future spending.

In 1954, Arthur Lewis theorized that within developing countries the marginal productivity of labor was approaching zero since the supply of labor was unlimited. This can be reflected in this model through a low relative cost of wage labor compared to the costs of capital. This can be established with the equilibrium ratio reported in equation 2.11.

The actual cost of physical capital may be higher in developing countries. According to equation 2.11 this wage and rental ratio reflects the marginal productivity of capital and labor in developing countries. Therefore the amount of capital used in these

countries is expected to be low due to its high costs, in spite of its high returns to productivity.

Expansion Path with Savings and Loans

Between figures 2.6 and 2.7 the same total costs in time T will be used. Since the total costs remain the same and the prices of inputs are different, the isocosts in 2.6 will have to rotate counterclockwise in order to exhibit the higher relative cost of capital. This change is reflected below in figure 2.7. Along all isocost lines $C_{1\text{-}3}$, the maximum level of capital used K_{max} is always lower than the number of labor hours used L_{max}. In figure 2.7 the utility maximizing point (A) along isocost C_1 allows for the use of large amounts of labor (L1) and small amounts of capital (K1). The equilibrium levels of labor and capital are L1 and K1, respectively.

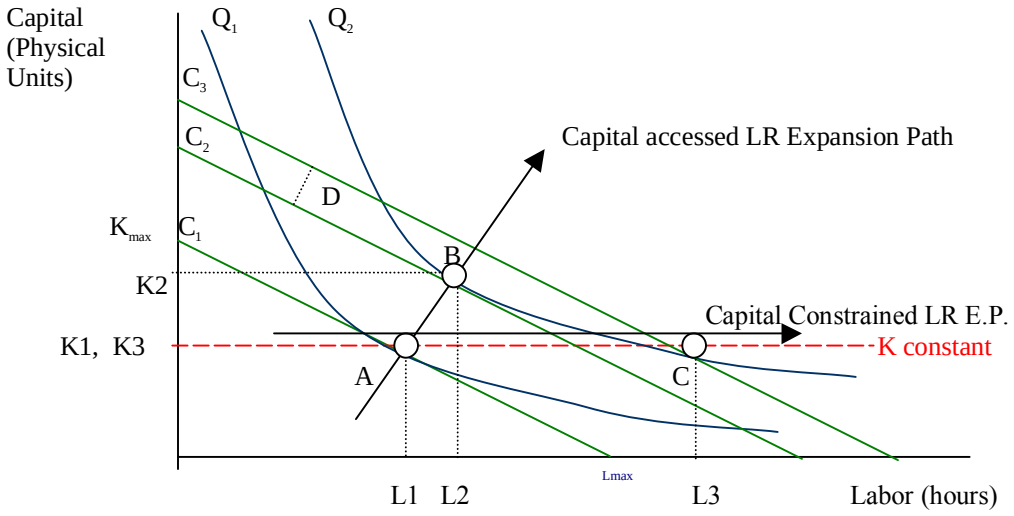

Figure 2.7 - Borrowing effects w/ low productivity of labor & high cost of capital

From the discussion of intertemporal consumption we can see the effects of savings and borrowing on the level of flexible consumption available in both periods. This concept can be applied to the isocost / isoquant model of production since additional

funds for investment can be used to push out the isocost curve in the next time period. Under the specified conditions, we can trace the expansion of production *with the use of savings and borrowing* by the household.

In time period one the household is a utility maximizer at point A, at the tangency point of C1 and Q1. A certain level of savings is then realized or a specified amount of money is the borrowed for investment. This additional amount of money shifts the isocost C1 out to C2, where the total cost of C2 > C1. The household along C1 can increase labor above L1 to L2 and capital levels above K1 to K2. Each input's utility to the household is maximized at point B along the new isoquant Q2. Following this set of events, the expansion path of the household can be traced from point to point, following the path set by A to B in the long run.

Low Income Expansion Path without Savings or Loans

This section will explain how the unavailability of financial services can decrease household production efficiency and lower household well-being. Additionally, if other realistic constraints are placed on the family the LR production expansion path is quite different. This constraint considers the effects of extremely *low levels of income* and *no access to credit or savings* prior to making a household investment. The household may start with a fixed level of physical capital or no capital what so ever. Consider the implications for households with dangerously low-income levels; in this case any reduction of spending could have negative outcomes on the household's ability to survive (Khandker, "Household" 8).

Under these circumstances it is difficult to save and is assumed to be impossible to borrow in the current period. Therefore heavy constraints are placed on the

household's ability to expand production and to increase their income level. Without access to any savings or credit, production can only be increased with the current profits from production. Since micro-enterprises by nature are quite small, the amount of profits may not be high enough to make any substantial investments. However, considering the tight intra and inter household ties within many developing nations, including Uganda, it may be possible to expand production in two ways: 1) through increased levels of labor hours from family members, and 2) through the use of IOUs for labor wages. However possible, it should be considered significantly harder to obtain IOUs large enough to make a productive investment into capital because of its high cost. This type of constrained expansion is also demonstrated in figure 2.7.

Starting at point A under these new limitations, the level of capital available is restricted, in the current period and following periods, to the line K constant. K constant could be equal to a certain minimum level or even zero capital. In order to expand production to Q2, the household must increase the level of labor used along the K constant line to L3 at point C, where Q2 intersects K constant. At this point the household is able to increase output to the levels achieved with capital at point B, *but with much less efficiency*.

It should be clear from figure 2.7 that point C is not a point where Q2 and C2 are tangent. In fact C2 is not even touching Q2 at point C. In order for this family to produce Q_2 they must move beyond isocost C_2 to C_3; *this therefore shows that the family must take on a higher level of costs in order to produce the same amount as families with access to financial services.*

In this specific case the diminishing productivity of labor is influencing the equation; equation 2.11 is not in equilibrium. The wage is greater than the productivity of

the labor since wages are constant and marginal productivity is very low at L3 (look at point slope of Q_2). This lower level of efficiency transfers into a higher total cost. The movement from A to C is the capital constrained, or financial service deficient, long run expansion path.

The distance between the two total cost lines, denoted by line D, is equal to the total cost of inefficiency. By setting a very low-income level, while constraining access to savings and credit, the household may be forced to dramatically increase their total cost level in order to increase their output. The impact of these restrictions on financial services may cause the households to incur other costs, such as decreased caloric intake, increased child mortality, the liquidation of essential assets, or the reduction of other basic expenditures.

Access to credit and savings markets can therefore provide access to critical levels of capital for low-income households. *This is despite the fact that the prices of capital are high relative to labor.* Households with access to credit and savings should be more likely to follow a more efficient expansion path of A to B instead of A to C. This can help to increase the household's production and to minimize their costs. The positive impacts of increased efficiency and access to minimum levels of capital can be transferred into greater household well-being or standard of living.

2.6 Theory Conclusions

This chapter describes the affects of lack of access to savings and credit on households. This was first done using the intertemporal consumption model. This model showed that microfinance savings and loans fill an essential gap in financial services to the poor. It also demonstrated that even interest bearing loans are able to help households maximize their utility for consumption across two periods. A microfinance

institution's financial services may also help to avoid undesired household outcomes by improving coping abilities. The second model, an isocost/quantity model, suggested that the lack of access to savings and credit could have negative impacts on household production by increasing its costs. Without access to minimum levels of capital investment, production can be limited. This then leads to inefficiency through the excess promotion of labor-intensive growth.

Joe Remenyi in "Is there a 'State of the Art' in Microfinance?" identifies five major ways in which Microfinance institutions can facilitate the growth of household investment and accumulation of productive assets by the poor: 1) provision of capital, 2) offering pertinent investment advise, 3) reducing household reliance on asset hoarding, 4) offering insurance and savings, 5) responding to exogenous events and misfortune, and 6) offering money management advise (Remenyi, 36). Importantly this list includes services *beyond* the scope of conventional savings and loans facilities. Education and technical advice may help to compound the effects of financial services, thereby promoting improved household outcomes as described by this chapter.

Chapter 3: Literature Review

3.1 Introduction

This chapter will review six articles, which are pertinent to household credit impact analysis. These articles take a number of different approaches in estimating the impact of credit on borrowers. The selections were used to help establish a clean methodological and theoretical basis upon which further evaluations could be built. The majority of these articles appear in peer reviewed journals while the remainder come from self-evaluations by microfinance sponsors and donors. As you will see the large majority of literature uses datasets from Bangladesh, the country where micro-credit institutions were first established. Each article was squeezed for basic theoretical concepts, variable and equation specifications, and innovative approaches to methodological problems.

A number of estimators were used to evaluate the impact of household and village variables on either total household consumption or other household welfare variable. These estimators included OLS, fixed effects and logit models. Each one will be described throughout the remainder of the chapter.

The first article by Hassan Zaman evaluates the impact of the BRAC microfinance program on households in Bangladesh. He establishes the concept of a loan threshold after which families experience positive returns to the log of total consumption per adult equivalent. Zaman also identifies and treats three major theoretical bottlenecks.

The second article by Brett Coleman evaluates the impact of microfinance services on women's wealth. Coleman gives an in-depth description and evaluation of the common problem of selectivity bias within these models. He introduces an intriguing experimental survey methodology that allows control group members to be self-selected

into, while not benefiting from credit programs at the time of the interview. This technique reduces the impact of supposedly drastic differences between members and non-members by comparing members with members whom have not yet received services. This is the only paper of the six that sees no positive impact from micro-credit institutions. However, I will contend that the negligible credit impact is actually due to a number of methodological and survey problems instead of institutional ones.

The third article written by Andrew Mckay and Harold Coulombe takes on a much more explicit methodology. Unlike other studies these authors evaluate the determinants of poverty within a number of mutually exclusive socioeconomic groups. Instead of solely evaluating the impact of variables on consumption, this paper makes OLS estimates on a standard of living measurement. This specification helps to control for a number of factors that are left out of other papers, most important of which are the differences in prices between villages.

Shahidur R. Khandker, Baqui Khalily, and Zahed Khan for the World Bank write the fourth article. This paper takes a different approach by estimating the determinant of the "dropout rate" for the Grameen Bank in Bangladesh. The dropout rate measures the number of members who withdraw from the bank due to their own personal success or failure. This methodology was undertaken in order to estimate the impact of the bank as a whole, through the viability of the borrower. This article also uses a branch fixed effects method in order to control for differences in services provided at various bank locations.

The fifth paper was written by Manfred Zeller, it evaluated the determinants of supply and demand for NGO credit groups in Bangladesh. This analysis was included because it gives an idea of what types of people need financial services while also

indicating how these services are distributed. The bi-directional approach allows for a clearer specification of household level variables.

The final paper by Mark Pitt, and Shahidur Kahandker studies the impact of three microfinance institutions (MFIs) on the log of per capita expenditure in Bangladesh. They make estimations of the impact of credit on food, non-food and total expenditure. This method gives a clearer picture of how exactly loans are used within the household. The paper also utilizes another complex estimation strategy that will be described later in the review.

These articles span a wide range of estimation strategies and should allow for an insightful and unique household level analysis. Note that this batch of literature portrays the high saturation of microcredit papers pertaining to Bangladesh in the academic world, a selection bias if you will. The following papers will help to create a base for further international research on the impact of microfinance credit services.

3.2 Literature Review of "Assessing the Poverty and Vulnerability Impact of Micro-credit in Bangladesh: A case study of BRAC" -Hassan Zaman

This study assesses the impact of the BRAC credit program on poverty and vulnerability using a multi-variant OLS regression analysis. Zaman uses household consumption data from BRAC active areas in Bangladesh. The paper evaluated the relationship between access to / amount of credit, and poverty / vulnerability reduction while controlling for household characteristics.

This paper finds that credit mitigates numerous factors which contribute to household and personal vulnerability and can reduce poverty past a certain "loan threshold", dependent on the poverty level of the household (Zaman, 1). Zaman also investigates the affects of credit on women's empowerment in times of crisis; this discussion will not be included in this review.

Zaman utilized a large World Bank household consumption and credit survey from Bangladesh in 1995. The sample involved 1072 households including 547 BRAC households and 525 eligible 'control group' non-members.

The author stresses the importance of asset creation and savings for reducing the levels of vulnerability / poverty on a household level (Zaman, 18). Survey results showed that longer BRAC membership induces increases in savings. These savings assets act as personal insurance for times of need, while improving the credit-worthiness of the household. Past literature suggests that early loans are used to "improve household conditions and subsequently build up other productive assets" (Zaman, 18). This asset accumulation is critical to mitigate the possibly negative affects of increased risk through investment. BRAC provides access to the benefits of credit to the poor through the innovative microfinance group credit methodology. Studies including this one have

shown that the incidence of poverty lowers relative to loan size and prolonged access (Zaman, 3).

Three theoretical bottlenecks were observed and evaluated. The first problem is related to selectivity bias in BRAC membership, which creates biased estimations. Any evaluation of a microfinance programs is plagued by the fact that the majority of members are considered to be highly enterprising, of higher social standing, and risk-takers. This creates a condition were OLS accredits the benefits of these personal characteristics to program impact, instead of to the individual. The second problem is correctly controlling for the counterfactual i.e. correctly evaluating the level of household welfare without the influence of other anti-poverty programs (Zaman, 33). There are often multiple anti-poverty initiatives undertaken in one village or district. If these programs change the sample area and are left uncontrolled for, then OLS will attribute the impact of programs to that of microfinance. The final problem is the fungibility of money. Currency as we all know, is easily exchangeable. Therefore it is hard to estimate the impact of savings and loans when the taken funds are easily diverted to other investments such as “bads” or other non-productive expenditure. The chances of this are offset by the monitoring undertaken by peers in the investment groups and by the monitoring by the bank itself.

In this paper the selectivity bias is evaluated with the ‘Mills ratio’ as part of the ‘Heckman’s selectivity model’. This procedure first assesses the significance of an underlying rule that governs the participation within BRAC and second, controls for any bias. The author notes that according to these results, selectivity bias is negligible in this regression. The use of the ‘Heckman’s model’ should be further evaluated.

Two different control groups, eligible non-members and non-borrowing members control for the counterfactual. A discussion of these control groups will be supplied later in this review.

The author believes that the problems with fungibility are controlled for with the law of averages within this extremely large data set. In order for this method to control fungibility, for every person that invests less than the full loan amount there will be another whom invests more. It is illogical to believe that this will properly handle the problem. Zaman notes that other studies suggested that approximately 80% of BRAC funds are used for productive investment instead of other consumption. Despite this, he concludes that the study adequately estimates the impact of loans taken to maximize a household's utility. The impact of the loan can therefore be best observed by evaluating its affect on household consumption while acknowledging the possible bias.

The regression uses natural log of total consumption per adult equivalent as the dependent variable. However, Zaman neglects to define the components of consumption. This variable may be considered to be a standard of living index not controlling for price differences. The specification of the semi-log also suggests that for every one-unit increase in the independent variables there is a B_{hat} times 100 percent change in the dependent variable. The two equations are provided in equation 3.1 and 3.2. The results from analysis are provided in table 3.0. Definitions of all the variables are provided at the end of the review in table 3.1. All of the following tables and equations are provided in Zaman's text.

(3.1) LNCOAD = f(AG1560M, AG1560F, ADEQPR, AGEHHH, AGSQ, EARNER, HHHLBR, LGLAND, OTHNGO, PRIMHHH, SECHHH, SXHHH, VIL2 – 10, BRVO, MLOADUM 1 – 3, ULOADUM 1-3, MEMLEN 1-4, MILLS-RATIO)

(3.2) LNCOAD = f(EQUATION 3.1. MINUS MILLS-RATIO)

Table 3.0 - Estimated coefficients of the 'BRAC variables' in poverty models (n=1072)

	Identification on functional form with village dummies (eq. 3.1)	OLS with village Dummies (eq. 3.2)
BRVO	-0.83 (p= 0.05)	-0.05 (p= 0.37)
MLOADUM1	0.07 (p= 0.41)	0.08 (p= 0.38)
MLOADUM2	-0.01 (p= 0.91)	-0.01 (p= 0.95)
MLOADUM3	0.17 (p= 0.05)	0.18 (p= 0.06)
ULOADUM1	0.01 (p= 0.91)	0.02 (p= 0.88)
ULOADUM2	0.05 (p= 0.56)	0.06 (p= 0.55)
ULOADUM3	0.14 (p= 0.12)	0.14 (p= 0.13)
MEMLENG1	0.13 (p= 0.08)	0.13 (p= 0.11)
MEMLENG2	0.09 (p= 0.20)	0.09 (p= 0.23)
MEMLENG3	0.04 (p= 0.59)	0.04 (p= 0.26)
MEMLENG4	0.09 (p= 0.21)	0.09 (p= 0.26)
Lambda (Mills Ratio)	0.47 (p= 0.06)	

Notice that for both regressions the dummy variable for BRAC member is negative and in equation 3.1's case it is also significant. MLOADUM3 however, is both positive and significant on the 10% level (Zaman, 13). The estimates of MLOADUM suggest that families with more than 10 decimals of land and have taken loans over 10,000 taka, have consumption levels 18% higher than their counterparts. This helps to verify the author's claim that there is a loan threshold that families must break in order to

see a significantly positive impact on their consumption. This is further supported by the results, suggesting that those persons borrowing more than 10,000 taka are significantly more likely to spend on non-land 'productive assets'[1] (Zaman, 14).

Interestingly, little case can be made for the assumption that the moderately poor would benefit more from program taking loans than would the ultra-poor (Zaman, 14). Comparing the estimates from ULOADUM1-3 and MLOADUM1-3 we can see that the moderately poor only benefit more than the ultra-poor when the 10,000 taka threshold is broken. This may be because these families are more likely to invest in non-land productive assets at this loan level compared to the "ultra-poor", due to different risk taking capabilities.

The most interesting results from these regressions are not entirely included in the author's tables. For instance when the BRAC membership dummies 'base category' was changed from 'non-borrowing member' to 'eligible non-member' the results changed significantly. The 'eligible non-member' regression results suggested that member households taking loans over 10,000 taka were 48% worse off compared to 'non-members' (Zaman, 13). This then contradicts with the outcomes of using 'non-borrowing members' as the base category, which suggested that households of the same loan size were 13.8% better off than 'non-members'. The correct base category must then be derived either from further theoretical analysis or past literature. According to Zaman, past literature shows that the amount borrowed is most likely a function of membership length not initial endowments so therefore the "socio-economic differences between

[1] "The expenditure per head during the year prior to the survey on 'productive assets' was taka 368, 542, 438, 768 for 'no loan', 'less than 5000 taka', '5000-10000 taka' and 'greater than 10000 taka' categories" (Zaman, 14).

borrowers and non-borrowing members are minimal" (13) He then concludes that this suggests that the 'non-borrowing members' are a better base category (14).

Despite the use of a large sample size and its rather comprehensive methodology, this study still has theoretical and methodological shortcomings. First, the author omits a great deal of information from his results, such as F-statistics which would give insight into the accurateness of the equation as a whole, he also failed to show complete results for both forms of the BRAC dummy variable. Instead the author makes numerous references to omitted formulas and calculations. Second, the author chooses to skip any discussion of variables with unexpected signs, such as BRVO from eq. 3.1. Unexpected signs may be an indication of an omitted variable.

The BRAC dummy variable (BRVO) is a critical point of concern especially when evaluating the differences in results between base categories. The author even fails to acknowledge the theoretical definitions of categories themselves. The first category to discuss here is 'eligible non-members.' This group is most likely to be comprised of people that find the costs of joining BRAC for savings or investment to be too high. This means that either the services are not needed or the transaction costs are too high. Critically, there may be other informal, formal or traditional practices that can replace BRAC's product, which 'eligible non members' may be utilizing. These institutions are unobserved in this regression analysis. The second specification of BRVO (non-borrowing member) may also have some inherit biases since "A savings facility is an extremely valuable service in its own right, which often attracts many more clients than a credit program, particularly from among the poorest" (Mosley, 147) If the poorest comprise a comparatively high percentage of non-borrowing members the results for

borrowing members may be overestimated or skewed. This predicament should be examined further.

Zaman also fails to mention or control for seasonal variations of economic welfare within Bangladesh. Manfred Zeller finds significant differences in the level of impact across the three agricultural seasons in Bangladesh. Each season has different demands for labor and varying levels of access to resources.

Conclusions

The results from this study seem to be questionable on some levels. The lack of disclosure undermines the conclusions of the study. Some methodological and theoretical items of great importance were also overlooked or avoided. On other levels this study provides a look at a large sample of data often unavailable. However, since the specification seems relatively appropriate the results may be of great overall significance.

Table 3.1 - Variables definitions for 'poverty models'

Variable	*Variable Definition*
LGCOAD	Log of total consumption per adult equivalent
LGLAND	quantity of land owned (log)
AGHHH	age of the household head in years
AGHSQ	age of the household head squared
AG1560M	number of adult males in the household (aged 15-60)
AG1560F	number of adult females in the household (aged 15-60)
OTHNGO 1	if household member of other NGO, 0 if not
HHHLBR 1	if household head is a manual laborer, 0 if not
ADEQPR	ratio of the number of adult equivalents to household size
DEPEND	number aged under ten plus those over sixty, divided by total members
EARNER	ratio of earners to household size
HHHLBR	1 if household head is a manual laborer, zero if not
HLTHHH	1 if household head is in good health, zero if not
PRIMHHH	1 if household head attended primary school; zero if not
SECHHH	1 if household head attended secondary school, zero if not
SXHHH	1 if household head is male, zero if female
BRVO	1 if household is BRAC member, 0 if not
MLOADUM1	1 if household has more than ten decimals of land and has borrowed less than 5000 taka, 0 if not
MLOADUM2	1 if household has more than ten decimals of land and has borrowed between 5000-10,000 taka, 0 if not
MLOADUM3	1 if household has more than ten decimals of land and has borrowed more than 10000 taka, 0 if not
ULOADUM1	1 if household has less than ten decimals of land and has borrowed less than 5000 taka, 0 if not
ULOADUM2	1 if household has less than ten decimals of land and has borrowed between 5000-1000 taka, 0 if not
ULOADUM3	1 if household has less than ten decimals of land and has borrowed more than 10000 taka, 0 if not
MEMLEN1	1 if membership length between 1-10 months, 0 if not
MEMLEN2	1 if membership length between 11-20 months, 0 if not
MEMLEN3	1 if membership length between 21-30 months, 0 if not
MEMLEN4	1 if membership length between 31-40 months, 0 if not
IEMBNK	1 if village is inside embankment, 0 if not
MARKET	Distance from market in Km.
TGHH92	Number of eligible households in village in 1992
VIL1 - VL10	Village Dummies
LAMBDA	Mills ratio term

3.3 Literature Review of "The impact of group lending in Northeast Thailand" - Brett E. Coleman

This study focuses on the impact of microfinance services on a number of household outcomes in Thailand. These outcomes range from consumption and caloric intake, to employment and non-land farm assets. The objective was to add depth to the interpretation of microfinance success, which often hinges around loan repayment rates instead of detailed household outcomes (Coleman, 105). Methodologically the author hoped to control for problems with self-selection, and endogenous program placement, primarily through the use of a creative control group specification. These problems will be discussed further in this and other reviews. Coleman also compares outcomes from naïve and fixed effects methods. This study presents an interesting contrast to the often-optimistic microfinance econometric literature.

The survey involved 445 households in 14 villages throughout the rural northeast of Thailand (Coleman, 110). Each household was interviewed 4 times in 1995. The survey timing was arbitrarily planned. As originally proposed by Pitt and Khandker, the authors utilized a "quasi-experimental" survey form, while drastically altering the traditional specification of this type of model.

Before discussing anything else, there were numerous problems inherit in the sampling method for this study. Coleman reported that the average survey household wealth was 529,586 baht (Coleman, 111). This means that average wealth was 21,183.44 dollars (at the reported exchange rate). Controlling for average household size, ages 5 and up, per person wealth is $5350.70. Although Coleman refuses to do this bit of algebra it should be clear that these families by no means fall under most definitions of poverty. More importantly they may not even fall under the category of poor in their own

country. According to the UNDP, real per capital GDP for Thailand was $5,950 in 1995 and the per capita GNP was $1,840 (UNDP, 158). That means that each family member possess on average, just below the per capita GDP. It is possible that the observed financial institutions may be at fault for not properly filtering out non-poor clients and or not providing appropriately sized loans, relative to high household income. Considering that the maximum loan size is $300 it is now clear what is implied by his observation that household wealth "dwarfs village bank loan size" (Coleman, 111). This data bias may severely lower the estimated impacts and brings into question whether these results can be generalized across countries.

Along side this the author mentions that the Thai government runs a highly pervasive microfinance bank, The Bank for Agriculture and Agriculture Cooperatives (BAAC) (Coleman, 111). The BAAC provides a substantial amount of group based loans throughout the country and considers " 84.5% of rural households as its clients" (Coleman, 111). Coleman identified that 63% of surveyed households were currently members of BRAAC (Coleman, 111). Unfortunately, the impact (either positive or negative) of BRAAC participation is left uncontrolled for within the regressions. This will significantly affect the estimates of this study since the majority of members (including the control group) have already benefited from microfinance products including education, savings and credit facilities.

The characteristics of the particular financial institution are also critical in nature. With this controlled for poor institutional quality could be properly attributed to low manager wages or low educational expenditure, instead of denigrating the importance of credit and other financial services.

Despite these potentially grievous errors within the data and specification other methods of this paper should be considered on the basis of their theoretical ingenuity and possible effectiveness. The results however should be examined critically and should be considered biased.

The standard model for the estimation of loan impact on the household level is as follows in equation 3.3:

(3.3) $$Y = X + V + B + \mu$$

Where

$$B = X + V + \varepsilon$$

Y is the dependent variable to observe credit impact, X is a vector of household characteristics, V is a vector of village characteristics, and B is the amount borrowed by the household. ε and μ are errors derived from unobserved village and household characteristics (Coleman, 112).

ε and μ are likely to be similar because the same village and household characteristics are likely to determine both: whether a house participates and how much. In this model the correlation between ε and μ will create biased estimations (Coleman, 112). The author presents arguments against the three standard corrections for such endogeniety including the use of: 1) instrumental variables, 2) panel data, and 3) an assumed error distribution (Coleman, 113). These arguments are very similar to those of Pitt and Khandker.

Another problem in this standard model is the fact that clients are able to self-select. This may introduce bias because these members may have certain personality attributes, often assumed to include higher levels of talent, ingenuity, and determination. This sample characteristic will force OLS to overestimate the impact of credit on the population since loan takers may be more competent. Coleman, in congruence with Pitt

and Khandker, utilized the fixed effects method to remove endogeniety in program placement (this will be discussed more thoroughly in the review of Pitt and Khandker). The problem with selection bias however was treated very differently.

A new estimation model was created in order to remove the self-selection bias. A control group was created to include the self-selection process and nonaffiliated non-members. This model is as follows in equation 3.4.

(3.4) $$Y = X + V + M + VBMOS + \mu$$

Where M is a dummy variable for self-selection. M is equal to one if the member has pre-selected himself or herself into the village bank that will not be operating for one year after the interview, and 0 otherwise (Coleman, 115). In other words these members have pre-registered for a forthcoming village bank, and have therefore self-selected but have *not* received any benefits of membership. This group helps to control for personal motivation, attitudes "favorable to gender equality", the stigma which prevent the rich from joining, and other unobservable characteristics (Coleman, 112). These pre-members make up the backbone of the control group along with nonmember households from treatment and non-treatment villages (Coleman, 136).

There is one problem with this specification; it is quite possible that people who can and will self-select might also have higher income levels. Such an early show of support might be akin to the "here today gone tomorrow" support of celebrities or politicians in the United States. This is backed up by David Hulme's finding that early members tend to be wealthier while late members tend to be poorer (Hulme, 16). This bias should be considered when reviewing the results of this study.

The variable VBMOS is "the number of months, for participants, that the village bank has been operating in the village" (Coleman, 115). Coleman explains that this variable acts as a proxy for program availability. He claims that this variable was more in line with the "project implementers" concern, since it considers the impact of providing services for another month as apposed to "the impact per baht borrowed" (Coleman, 116). This model is therefore estimating the impact of an additional month of service availability on household outcomes.

Other literature makes little use of this type of credit variable. Since it only controls for the length of participation, it may miss other important factors such as the level or type of services utilized. Considering the relatively high household wealth of respondents and the small size of loans, it is possible that the village bank is primarily used as a savings facility. If this service is non-interest bearing, it would have almost no impact on women's and or household wealth. In fact, if the level of savings was not controlled for this model might suggest negative outcomes from participation. This possibility should have been better controlled for within the regression, and the results from this variable should be considered questionable.

Since the author identifies that bank participation will most likely affect the wealth of women members, this review will focus on these specific estimates. The fixed effects method includes village dummies whereas the non-fixed effects use a vector of village characteristics to weed out the differences between them. The results of this regression are as follows in table 3.2.

Table 3.2 - Selected Estimates from: Impact of village bank on women's wealth (Fixed effects and non-fixed effects models)

Independent Variables	Fixed effects coefficients	Nonfixed effects coefficients

Months as VB member	240 (475)	77.7 (339)
Sex of household head (fem =1)	67,010 (17,595)***	64,470 (17,444)***
Household member village chief or assistant? (0 / 1)	43,926 (24,243)*	43,558 (43,119)*
Does hh have village bank member?	2245 (14,778)	5116 (12,649)
Prob > F	0.000	0.000
R^2	0.9787	0.9784
* Significant at 0.10 level. ** Significant at 0.05 level *** Significant at 0.01 level *Standard errors in parentheses*		

The dependent variable for this regression, female-owned wealth in the household, is left undefined. Simply, it could be considered a sum of household women's personal assets and current income, it is not clear if other financial assets such as cash, savings or loan amounts are included in this calculation. This variable both benefits and suffers from its aggregated state. Since the variable potentially includes a large number of economic status indicators, the model estimation could have unusually high level of significance as seen by the R^2 or F-statistic. It is hurt however, by its reliance on the effectiveness of the control group to factor for the characteristics of "favorable to gender equality" as discussed earlier (Coleman, 112). If gender equality is not properly controlled for, the estimation may be biased by affects of household gender attitudes, especially if these beliefs are systematic or correlated with regressors. With these two critiques in mind the results obtained from this regression should *again* be doubted. Months of village bank participation act as the regression's primary credit indicator.

A positive aspect of this model relates to the results of sex of household head. As expected, female's posses significantly more wealth when the household head is a woman. These results were significant at the 1% level. These results however also bring out the irony in this model as a whole. According to these results women may actually benefit from lacking a spouse, since they are now the owners of all HH property.

However, it is clear that female lead households often suffer under enormous constraints on resources and are typically impoverished. This regression therefore is estimating little about the status poverty and instead serves to estimate the economic self-determination of Thai women. This is because women's wealth is not necessarily correlated with their well-being and is more likely to be related to the level of control (either beneficial or detrimental) they have on the household level. Therefore this regression is not inline with the stated goals of this project, but may be relevant on a more humanistic level.

A very interesting and important inclusion was the dummy variable for household political power. This variable suggests that political power has a significantly positive effect on women's wealth. This maybe related to a number of factors including household income (left uncontrolled for), required gender awareness of political leaders (uncontrolled for), and other unobserved socio-economic systems.

The interpretation of the dummy for village bank participation is also shaky. Although it controls for participation and non-participation, it is not explicitly defined whether this variable is for *current or past* participation. Meanwhile hinging on its definition, it may be highly correlated with the duration of participation variable. The inclusion of this variable may reduce the descriptive power of regression and more importantly, a key impact estimation. No correlation matrix or reference to one was reported. The results suggest that household membership does not have a significantly positive correlation with women's wealth or possibly more accurately with women's economic self-determination.

Female-owned land value five years ago, acts as a "proxy for initial household wealth" (Coleman, 129). This is a key control because it removes predefined levels of wealth from the estimation. As expected this variable shows positive and highly

significant (1%) results. Some of the characteristics of this variable will be discussed in the conclusion of this paper.

The three estimations of overall model significance are all uncommonly high. The R^2s for both fixed effects and non-fixed effects estimates indicate that approximately 97% of the movements in the dependent variable can be described by the independent variables. These results are unusually high for this type of regression.

It is also important to compare the fixed and non-fixed effects estimates. Through a visual inspection it is clear that there are differences in the coefficients and standard errors. However the differences are often minimal and produce estimates with the same signs and do not interfere much with levels of significance. This may indicate that a vector of village characteristics, included in the non-fixed effects estimation, is effective at controlling for differences between them. This vector was composed of "a provincial dummy variable, the number of paved roads in the village, a school dummy variable, the daily harvest wage, and the distance to the provincial capital" (Coleman, 129). A series of robustness tests showed at the 5% level that the fixed effects estimates were correlated with village characteristics, therefore non-fixed effects methods may be appropriate.

In his conclusion Coleman makes reference to the fact that his previous study found "that village bank members tend to be wealthier in the first place" (Coleman, 130). It seems equally possible that participant women own more land not because they are richer but because they are *single parents* and therefore own the land and assets. Coleman also noted that women tend to spend their money for consumption purposes (Coleman, 132). This may also gives weight to the theory that women household heads under high constraints may be forced to use village bank products for consumption instead of investment. Also it may suggest the ineffectiveness of the village bank itself,

as it might not be providing inadequate support or client tracking. Client tracking despite its high costs is considered to be a critical function of group loaning systems because it promotes productive investment.

Conclusions

Although throughout his conclusion Coleman points to the fact that these results might be specific to this sample and sampling area, he fails to acknowledge some major theoretical problems with his model and its specification. On the other hand he does identify an important new control variable, which might help to alleviate the problems associated with self-selection. However the problems with this technique should be weighted seriously. Otherwise Coleman's study is riddled with a number of interesting theoretical concerns. This paper's methods may help to evaluate and expose the potential dangers of credit access, and to discourage the all too common conclusion of overwhelming microfinance success.

3.4 Literature review of "Modeling Determinants of Poverty in Mauritania" - Harold Coulombe, Andrew Mckay

This study identifies and describes components of household poverty in Mauritania and uses regression analysis to estimate the factors affecting local living standards (Coulombe, 1015). Although this paper does not directly deal with the impact of microfinance institution products, it does evaluate the affects of credit and savings on the household level. Most importantly Coulombe employs an unusual approach, modeling determinants of poverty within socioeconomic categories. The disaggregated state could help to identify the variables that have the greatest impact on different groups of people. These topics will be discussed throughout this review.

A set of household data was collected in Mauritania, in 1990 using the Living Standards Measurement Study methodology. Data was collected four times according to seasonal variations and included approximately 1520 households.

In hopes to provide a clearer picture of the "nature and determinants of poverty" than is provided in typical poverty evaluations, the household data was separated into a total of four mutually exclusive socioeconomic groups (Coulombe, 1015). These sample sets were composed of: non-working, wage employees, agricultural, and non-farm self-employment. The socio-economic classification was assigned according to the employment type of the household head. Each category was estimated separately for both the rural and urban environments. These groups were controlled for because each job type and economic environment has a unique coefficient associated with every independent variable. It should be clear that, relative to living standards, an urban self-employed household would not consider a plantain seed as important as a rural agricultural household. Regressions failing to control for these economic differences

may loose descriptive power because they disregard important theoretical components. This review will focus on the results obtained from non-working households in both urban and rural areas since these regressions specifically control for the affects of borrowing and or savings.

All regressions used the log of total household expenditure per capita in constant prices as the dependant variable (Coulombe, 1030). The specification is as follows, household expenditure is composed of a sum of: total market cost of food and non-food purchases, total household agricultural and non-agricultural output, sum of all expended remittances and or transfers [in case and in kind], and the consumption of in kind wages (Coulombe, 1017). This variable is put into constant prices per capita by deflating it by a regional cost of living index and household size (Coulombe, 1017). Johnson, McKay and Round describe this method further. This specification is a proxy for a standard of living because it estimates the level of services and goods available to every household member, controlling for price differences.

The semi-log specification insinuates certain relationships between the dependent and independent variables. The semi-log allows the results to be interpreted as follows: as the independent variable increases by one unit the dependent variable will change in percentage terms (Studenmund, 208). The dependent variable changes by 100 times the estimated coefficient.

The independent variables include a series of household location variables, household demographics, household head characteristics, seasonal variables, and savings and loans indicators. In all socioeconomic categories, the affects of savings and credit are only estimated for non-working households. Regrettably, Coulombe neglects to explain this category was the exception. It does however clearly introduce a specification

bias since credit and or savings impacts may be exaggerated. Theoretically, savings and loans should have greater affects on households *without* positive earning than those *with* them. Further problems arise because participants in microfinance institutions are unlikely to be classified under the category of "non-working." However, if this bias is kept in mind the specification and results may provide greater detail on the variables affecting household standard of living.

Table 3.3 – Model of the determinant s of living standards OLS results

Dependent variable: Logarithm of standard of living		
Variables	Rural Non-working (A)	Urban Non-working (B)
Constant	10.259 (0.000)	9.98667 (0.000)
Eastern Region	-0.7247 (0.006)	---
Central Village/city	-0.3033 (0.245)	0.4271 (0.007)
Koranic	0.6656 (0.001)	0.0621 (0.607)
Primary	0.2361 (0.039)	0.0969 (0.727)
Secondary	-0.0709 (0.543)	0.5914 (0.022)
Age	0.0441 (0.188)	0.0387 (0.089)
Age squared	-0.0005 (0.083)	-0.0005 (0.066)
Feb-mar-apr	-0.4916 (0.109)	-0.0354 (0.888)
Aug-sep-oct	-0.8735 (0.000)	-0.0486 (0.823)
Nov-dec-jan	-0.2527 (0.267)	-0.2992 (0.194)
Married	0.4635 (0.094)	0.0201 (0.903)
% children	-0.8707 (0.045)	-0.1466 (0.565)
% old age	-0.2361 (0.585)	0.9605 (0.067)
HH size	-0.0564 (0.356)	-0.0489 (0.118)
Unemployed	-0.1104 (0.596)	0.1822 (0.144)
Transfers	0.0000 (0.964)	0.0001 (0.004)
Loans	0.4199 (0.037)	-0.0233 (0.859)
Savings	----	0.8159 (0.004)
R^2	0.34	0.303
* P-values are provided in parenthesis		

In both regressions presented in table 3.3, the author includes variables describing the location of the household on both the regional and village/city level. In the rural regression (A), a dummy variable controls for residency within the "poorer" eastern rural region. Through comparison this variable shows that eastern households have significantly lower standards of living, on the 1% level. In regression B, city level location of the household is significant at the 1% level. Therefore non-working

households residing in main urban cores have significantly higher standards of living in comparison to similar households in other urban areas. These results may that most resources are localized around dominant centers, possibly at the expense of the periphery within Mauritania. Overall, we can see that it is also critical to control for location because it influences the average level of income, and geographical position characteristics.

The results of the education variables seem equally important. Primary and traditional education is shown to have significantly positive impacts on the standard of living in rural areas, but not in urban areas. Interestingly, secondary education is shown to have opposite affect in respect to location. These results support the obvious conclusion that the usefulness of certain levels of education depends greatly on the economic environment in which they must be used.

The exclusion of a gender of household head (HHH) dummy is quite surprising. At all levels of literature and analysis average female-headed households are considered to have significantly lower levels of well-being than there male headed counterparts. This appears to be a grievous omission. Interestingly, married HHHs see a positive and significant increase in standard of living but only in rural areas. This also seems puzzling. The unexpected result might be attributed to the exclusion of the gender of HHH dummy or other relevant household variables.

In rural areas, the ratio of children less than 15 years old to household size (% children) has a significantly negative impact on household living standards. The estimate for urban areas however is negative and insignificant. This may suggest that rural households have fewer coping strategies at their disposal and are therefore less able to deal with dependency. The authors conclude, “size of household does not appear to

influence significantly the standards of living … composition does" (Coulombe, 1026). Although other literature seems to discount this conclusion, the significance of household composition should be considered in any evaluation of household welfare.

The contradictory result of the unemployment variable is also problematic. These results suggest that for urban non-working families, unemployment comes close to significantly [15% level] increasing their standard of living. Theory however would suggest that unemployment for non-working families would promote negative outcomes. It is possible that these contradictory results are due to the existence of an omitted variable, a misspecification or an absent theoretical discussion such as illicit markets.

Savings and loans are also shown to have significant impacts on household standard of living. Interestingly, rural savings was exempt from this analysis. It is possible that rural participant areas lacked access to formal or informal savings accounts and the variable was therefore omitted. Urban savings however was shown to have a positive impact at the 1% level. Savings may act as an important buffer for periods of unemployment or lack of expendable income. Informal and formal loans in rural areas are shown to have a positive and highly significant impact (5%) upon the household. In urban areas, loan impact is negative yet insignificant. This insignificant result might be attributed to "loans" provided by loan sharks or lenders that do not adhere to the relatively fair practices of commercial and microfinance banks, all of which are included in Coulombe's definition of loans. Since the impacts of these exploitative loans are included, the credit coefficient should be biased downward. Remember that these results are estimating the impact of savings and loans on non-working households; therefore the results are likely to overestimate the importance of access and or levels of participation. What is clear is that savings or credit can act as an important addition to liquid income

either for consumption or possibly even for investment, especially within non-working households. For working families, financial services may play a similar role acting as a buffer for crisis but also as a stimulant for productive investment.

The results varied between urban and rural non-working households. A fairly large number of estimations displayed the expected signs and were significant. A few unexpected signs and an unanticipated high significance undermined these otherwise excellent results. Unfortunately, at the fault of the authors discussions of any shortcomings were left out. The few unexpected results contradicted by the relatively high R2 of .34. When considering the paper's ambitiously explicit analytical goals, these results appear quite significant.

Conclusions

In summary this paper takes large steps towards evaluating the factors which effect poverty at the household level. Due to the distinct differences in household types, the use of socio-economic categories plays a major role in this report by properly modeling the nature of material poverty. Although the regressions suffered from the *lack* of commonly used aggregated variables (causing lower t-stats and R^2s), these models are relevant to creating an explicit credit impact model. Great weight should be placed on the experiments presented within this analysis since they provide a level of insight and detail not existent within other literature.

3.5 Literature Review of "Grameen Bank: Performance and Sustainability" - Shahidur R. Khandker, Baqui Khalily, Zahed Khan

This study evaluated the performance and sustainability of the Grameen bank. The primary objective was to develop a methodology that estimated the costs and benefits of group based credit programs on the household level. Therefore, the evaluation included an identification of program affects on individual and household level outcomes. Analysis was done on a largely thematic basis; little discussion was included with the use of econometric results.

The main indicator, determinants of drop out rate was used to evaluate what factors promote members to quit or to remain within a group. The dropout rate is, the percentage of members that for one reason or another are forced to or voluntarily leave the credit program; this voluntary action may include "graduation" whereupon members are able to cross the credit divide to larger commercial bank loans. According to the authors, this assessment will help to determine bank performance and sustainability in respect to the *viability of the borrower*. However in this review, the assessment of borrower viability can be seen as a model of the program's costs and benefits to a borrower; these are the key to understanding what constraints households and individuals face when considering the affects of microfinance services. This study also draws some important theoretical conclusions that may be relevant to a credit impact analysis.

Very little information was given on the characteristics of the sample or specifics of the data. The authors mentioned that the data is cross-sectional at the branch level. The number of observations for this specific model was 357.

Although the Grameen Bank only experienced very low drop out rates (around 5%), this sliver acts as an important indicator of borrower viability (81). This regression

will focus on the factors that influence an individual to discontinue MFI participation. The results are shown in table 3.3.

Table 3.3 – Determinants of dropout rates (Fixed effects estimates)

Variables	Member dropout	First year dropout	Second year dropout	Third year dropout	Fourth year dropout
Age	0.47	.001	.006	.009	.006
	(5.377)	(0.369)	(1.839)	(2.118)	(1.100)
Age Squared	-0.002	-0.000	-0.001	-0.001	.000
	(-1.880)	(-0.780)	(-1.890)	(-2.205)	(0.582)
Log of predicted	-0.183	.007	-0.040	-0.003	-0.066
managers wage	(-3.941)	(0.486)	(-2.126)	(-0.117)	(-2.354)
Average training costs	-0.000	.000	.000	.000	-0.000
	(-1.213)	(0.744)	(0.301)	(0.217)	(-0.053)
Women-only Branches	.011	.033	.015	-0.008	-0.011
	(0.880)	(0.727)	(2.941)	(-1.484)	(-1.458)
Branches with	.017	-0.002	.006	.008	.007
technology loans	(1.127)	(-0.509)	(1.021)	(1.124)	(0.810)
Electrification per km^2	.239	.015	.016	-0.002	.001
	(3.527)	(0.721)	(0.578)	(-0.056)	(0.032)
Road-length per km^2	.042	.021	-0.017	.035	.018
	(0.264)	(0.426)	(-0.262)	(0.478)	(0.192)
Secondary schools per	-1.641	-0.072	-0.243	-0.516	-0.610
km^2	(-1.714)	(-0.246)	(-0.632)	(-1.157)	(-1.059)
Primary schools per	.202	.151	.012	.162	.200
km^2	(0.484)	(1.192)	(0.069)	(0.835)	(0.796)
Average rainfall	-0.000	-0.000	-0.000	.000	.000
	(-0.123)	(-0.226)	(-0.229)	(-0.087)	(1.045)
Dispersion of rainfall	-0.000	-0.000	.000	-0.000	-0.000
from its mean	(-1.220)	(-0.644)	(0.439)	(-0.501)	(-1.311)
Commercial and	-0.074	-0.074	.221	.526	.138
	(-0.136)	(-0.449)	(1.013)	(2.072)	(0.422)
Krishi Banks per km^2	1.637	-0.159	.347	-0.020	.512
	(3.202)	(-1.027)	(1.690)	(-0.085)	(1.665)
R^2	0.819	0.792	0.605	0.408	-0.640

Note: Figures in parentheses are t-statistics Source: Grameen Bank Branch Survey, 1991
* Village dummy estimations are not included in these results

The dependent variable for the regression in Table 3.3 is the drop out rate of clients from sample branches. The dependent variable is broken into five sub-categories: total dropout rate, first year-, second year-, third year- and fourth year dropout rates. The disaggregation of the dependent variable separates the impact of each variable individual's propensity to dropout at different periods of participation. The use of a fixed

effect estimator implies the use of numerous branch-level dummy variables. The impacts of this type of estimation are discussed further in the review of World Bank Discussion Paper 320. For simplicity this discussion will focus on total dropout rate and only include interesting results from the other categories.

The category of benefits is broken into key elements that must be controlled for. Benefits are derived from access to formal-sector loan rates, access to formal training and other "organizational inputs", and psychic benefits (Khandker, "Performance" 73). Training and "organizational inputs" are composed of "social intermediation inputs that encourage social and financial discipline" (Khandker, "Performance" 74). Some key benefits appear to left out of this discussion, 1) expected remunerative benefits of loan taking, 2) increased income flexibility, 3) access to voluntary and required savings[2]. If some proxies for these benefits are not included in the specification, coefficients may be biased, and unexpected signs or poor fits may occur in the results. Further evaluation of this potential weakness will be discussed later.

Although not discussed, two variables are used to control for the benefits discussed above. In table 3.3, average training costs by individual branches controlled for training and "organizational inputs". This variable is not specific to the real costs of training to the individual and therefore the results are impaired by the reliance on aggregation. By applying the branch mean expenditure to the individual, the actual and productive use of training is assumed to the same for each member. The problems with this assumption are obvious as individuals may or may not choose to participate in or actively use training. As expected, average training costs has a negative impact on dropout rates. The results however are insignificant. The inconsistency might be

[2] The total amount of any previously required savings is retrievable upon a client's departure. Assuming that the client has no negative balance with the institution.

explained by the problems with aggregation of the variable or the infectivity of training to address the problems facing Grameen clients. The second variable controlling for benefits is a dummy variable for branches give technology loans. This variable again suffers because it is not specific to the survey households but to the branch. All results from this variable are statistically insignificant. The authors of this study have obviously overlooked the affects of loans, which are expected to be beneficial. Credit variables could include credit limit, total loan value or number of loans taken in a certain time period. The failure to control for this key indicator will bias the results because amount of credit/debt is highly likely to affect a member's propensity to drop out of the program.

Another interesting inclusion is a dummy variable for women-only branch. This variable again is specific to impact at the branch level. This specification may be valid because training and products should be particularly well suited at addressing the needs of female clients. This variable therefore controls for a specific type of 'organizational input'. The results from this variable may be tainted by the fact that women are placed under much greater social and cultural restraints than their male counterparts. Women's only branches have a two-part affect on the overall dropout rate. In the early stages of participation (to the second year) the branches increase the dropout rate (significantly so in the second year). In the later stages these branches reduce dropout rates but not significantly. They also have a positive yet insignificant affect on total dropout rates. The results might indicated that the branches are more effective at addressing the needs of female clients if these clients are able to overcome external constraints which greatly impact the early years of participation.

The costs of participation are two part, first opportunity costs and second psychic costs. The authors further describe opportunity costs as being losses from "alternative

wage-earning opportunities" or lost household production time. Household production time is composed of activities that must be performed for a household function properly. Psychic costs for women may be caused by anything from: male-dominated social norms, to bank related travel costs.

The authors identify three main variables that may pick up on opportunity costs hinged on program participation. Some opportunity costs can theoretically be related to infrastructure improvements, including electrification and road construction. Infrastructure improvements may be an indicator of access to alternative forms of earnings. Another cost can be related to alternative program participation. These two variables are measured in absolute terms so each additional observation per km^2 is directly related to the dropout rate. The authors correctly recognize that these variables also present alternative directions for credit-based investment (Khandker, "Performance" 75). Access to new investments may promote program graduation [movement from group-based lending to commercial loans] (Khandker, "Performance" 75). This possibility may increase the dropout rate even further. In table 3.3, the electrification variable significantly increases total dropout rates. All other results for this variable and for road length were insignificant, and usually positive. The authors also make some attempt at controlling for alternative program choices by including the number of bank per km^2 in the branch area. As expected, this variable has a significantly positive influence on third year dropout rates. This may suggest the possibility of graduation, especially in the third year. The authors note that further household level analysis is needed to further verify these results.

There are a number of other costs that have not been directly controlled for in this equation. For instance there are real costs associated with the distance between the client

and institution. These costs are incurred regularly for participation in training and weekly meetings. Another less tangible cost may be the increased household risk as result of debt or unsure investment. It is assumed that no variable for loan interest rate is included because it remains constant across the sample.

In table 3.3, log of predicted manager's pay affects include both benefits and real cost. This variable is a cost because of the direct relation between employee wages and the cost clearing interest rate. It is also a benefit because managers have been shown to work more effectively as their wages increase. Depending on which relationship dominates, manager wages may have a positive or negative impact on the dropout rate. This relationship may be adequately specified because the log is taken. Therefore the impact of manager's wage on dropout rates increases at a decreasing rate. The results bolster this argument because three out of five estimations are negative and significant. On the institutional level, wage increases should help bank sustainability, on the household level however, the interpretation is more ambiguous.

Another series of variables is included in order to control for externalities. These include controls for branch age [age, age^2], access to education [primary and secondary] and rainfall characteristics. The use of age and age^2 suggests a quadratic relation between dropout rates and branch age. Since the estimations from age tend to be positive while age^2 are negative, these variables have an increasing impact on the dependent to a certain optimal [highest dropout rates] level of age, and then decrease in effect past this branch age. Six out of ten of the age variables are significant. Education is expected to decrease the levels of dropout since educated clients are expected to perform better. Again however control may also increase the numbers of "graduating" clients. It is difficult to determine which of these relationships dominates using these results. The results suggest

that secondary education may have a slightly significant (on the 10% level) negative relationship with the total dropout rate. The results on primary schools are confusing because all estimations have a positive relationship yet insignificant relationship with dropout rates. Both the average rainfall and the dispersion of rainfall from the mean variables are insignificant.

Overall the R^2 statistic suggests a high level of fit to the observations. 81.9% of the changes observed in the dependent variable are explained by changes in the independent variable. These results are unusually high compared to household level regression and may be result of the high level of aggregation of the variables. Also according to Khandker's later literature, a large sample size is required to negate potential side effects of the fixed effects method; it is not clear in this case if this is a creditable concern (56).

This article also included some influential theoretical discussions. The most significant is the discussion of Grameen's branch placement. The authors assume in this case that placement is random. The authors determine this by estimating the correlation between bank location and the agroclimate conditions prominent in these areas (Khandker, "Performance" 56). The authors found no correlation between these variables "…provided that input allocation is not correlated with other regressors" (Khandker, "Performance" 56). The year subsequent to this study, Khandker himself and his peers explain that programs are often placed in "poorer and more flood-prone areas" (14). It seems naïve of this study to consider weather patterns as the sole determinant of branch placement. This assumption may bias the results.

Conclusion

Overall, this paper provides a relatively simple yet influential model of the determinants of branch level dropout rates in respects to time. Critically, this model can be broken into two key parts, the costs and benefits of program participation on the individual. On the supply side, these factors help to determine the viability of the borrower, and on the demand side help to model the vulnerabilities of a borrower. This paper falls short in the discussion of: modeling / specification, literature review and the subsequent results, yet provides some help with the determination of variables significant on the branch and household level.

3.6 Literature Review of "Group-based Financial institutions for the rural poor in Bangladesh: An institutional- and household-level analysis." -Manfred Zeller

This study answers a number of questions on the formation, outreach and affects of participation in group-based credit institutions in Bangladesh. The two main regressions utilized binomial probit estimators. The study uses a household level survey from 1994 that included 128 credit groups, and 350 households. The households were interviewed in three rounds, each round for a particular crop season. These regressions dealt specifically with three microfinance institutions: The Association for Social Advancement (ASA), the Bangladesh Rural Advancement Committee (BRAC), and Rangpur-Dinjajpur Rural Services (RDRS).

The regression uses a binomial probit model, with a maximum likelihood estimator to evaluate both the demand and supply of membership in these organizations. The author evaluates group credit in this manner because membership and participation are a function of both supply and demand for the institutions services (Zeller, 53). Since both sides are determined through this type of analysis, these regressions estimate both the benefits and costs of credit supply and demand.

The dependent variable for the demand side is a dummy variable, where D* is equal to one if the household decides to apply for membership (Zeller, 53). The supply side regression uses a dummy variable S, where S* is equal to one if the institution and the lending group decide to accept this applicant. The estimates within the binomial probit model specification can be interpreted as the "coefficients that maximize the likelihood of the sample data being observed" (Studenmund, 444). The probit model also has the advantage of being based on a normal distribution, which therefore properly estimates independent variables that are normally distributed. Also the probit picks up on

the marginal benefits that extend beyond the financial returns of membership (Zeller, 53). This paper therefore evaluates, on the demand side, the likelihood of a household to apply for group-credit services, and on the supply side, the determinants of access to these programs.

Zeller's regressions are quite different from the majority used in this chapter. The majority of estimations deal directly with the impact of credit on household outcomes such as consumption. In contrast these estimates are not explicit to household outcomes, however they are implicit to them. This method is relevant to household outcomes because it deals with the costs and benefits for both the household itself and the institutions that it interacts with. This type of analysis allows variables such as the gender of the household head on the *supply side* to be observable. The two estimated equations are presented in equation 3.5 and 3.6 and the results are shown in table 3.4. Variable definitions are available in Table 3.5.

(3.5) *Determinants of Demand of NGO credit groups*

D = f(LAND, HHSIZE, HHSIZE2, MALEEDU, FEMEDU, ADMALE, ADFEMALE, GENDERHH, HPDIST, SPDIST, VILLAGE 1-6)

(3.6) *Determinants of Supply of NGO credit groups*

S = f(LAND, HHSIZE, HHSIZE2, MALEEDU, FEMEDU, ADMALE, ADFEMALE, GENDERHH, HPDIST, SPDIST, ELIGIBILITY, VILLAGE 1-6)

Table 3.4 – Select Results from Determinants of membership in NGO credit groups

	Demand Side		Supply Side	
Variables	Coefficients	t-values	Coefficients	t-values
LAND	-0.016**	-2.707	0.010	1.429
HHSIZE	0.954**	2.950	0.025	0.302
$HHSIZE^2$	-0.038	-1.090	0.033	-0.829
ADMALE	-0.715**	-2.464	0.201	0.547
ADFEMALE	-0.146	-0.457	0.138	0.418
GENDERHH	0.417	0.787	-5.012**	-2.564
HPDIST	-0.885**	-2.242	1.230	1.370
SPDIST	0.310	1.073	0.508	1.440
ELIGIBILITY	- - -	- - -	2.997**	3.045
N = 350		* = significance at the 10% level		
Log likelihood = -151.246		** = significance at the 5% level		
Chi-squared = 152.551				

Table 3.5 – Variable Definitions

Variable	Definition	Variable	Definition
LAND	Land owned ten years ago	ADFEMALE	Number of adult females in household
HHSIZE	Household size	GENDERHH	Gender of household head: male = 1
$HHSIZE^2$	Household size squared	HPDIST	Distance to home of parents of household head
MALEDU	Highest education of male in household	SPDIST	Distance to home of parents of spouse of household head
FEMEDU	Highest education of female in household	VILLAGE 1-6	Village dummies
ADMALE	Number of adult males in household	ELIGIBILITY	Dummy variable that equals 1 if household is eligible 0 otherwise

On the demand side, the likelihood of application significantly decreases as land size ten years ago increases. This suggests that large amounts of land may discourage families from applying due to MFI eligibility restrictions on the amount of land owned, and also possibly increases the households access to other financial services, all while simultaneously reducing their need for credit (Zeller, 55). On the supply side larger land sizes increase the chances of being accepted into an institution, however the result is insignificant. This may suggest a bias within group / institutional-selection towards people with greater wealth, thereby decreasing the likelihood of default or other costly problems. This variable's insignificance may indicate that the maximum land eligibility rule may be effectively enforced (Zeller, 56).

Household size was specified as a quadratic by including both the absolute level and the squared level. This implies that there is a certain optimal household size relative to the supply and demand of microfinance services. The only significant result was for absolute household size on the demand side, implying that larger households tend to be poorer and would therefore derive more benefit from the services provided.

ADMALE and ADFEMALE acted as indicators of the supply of labor available to the household (Zeller, 54). All estimates were positive on the demand side and all were negative for the supply side. This might indicate that both females and male contribute positively to the well-being of the household thereby reducing the need for credit services, while increasing the likelihood of being supplied it. The only significant result was for the demand side ADMALE. This result implies that increased numbers of adult men *significantly* decrease the need for financial services, and is likely to be tied to the fact that men have disproportionately higher levels of income than women (Zeller, 56).

The result of gender of household head, suggests that men are significantly, at the 1% level, less likely to be offered group-based credit services. This undoubtedly reflects the female-oriented nature of group-based credit supply. Also other literature has suggested that males have higher default rates than women, therefore the costs of selecting a male may be higher than those for selecting a woman. Interestingly the results also show that male headed households have a higher likelihood of applying for services, this outcome however is insignificant.

HPDIST and SPDIST reflect the impact of distance from parents on the supply and demand of credit. In this way they act as proxies for two common unobservables: first for, the length of residency (the household is more likely to have migrated if the

parents are far away), and secondly for the "ease" of participating in economic, social and other transactions. As the number of these transactions increases, the less likely it is that they also need credit facilities yet the more likely they will be supplied the opportunity to participate in these programs (Zeller, 54). The results do not seem to support the theories of either of these variables; HPDIST decreases the demand for services significantly while the supply significantly increases. This seems in opposition to theory because households displaced from family connections should have shorter lengths of residency and decreased ease of transactions. These results might be a reflection of a selectivity bias within the variable, for instance wealthier households with certain, internally beneficial and externally attractive characteristics (for instance greater aptitude), might be more likely to emigrate within this sample. This sample may also be a misrepresentation because the 350 observations are small compared to the population of the country.

The final variable to be discussed is ELIGIBIILTY which is only included on the supply side. The results indicate that eligible households are significantly more likely, at the 5% level, to receive micro-credit services. This shows that the eligibility requirements are adequately enforced. The maximum amount of land allowed varies by institution ranging between 0.5 acres and 1.5.

Conclusion

This estimation is unique in the fact that it attempts to observe the costs and benefits of both the supply and demand of microfinance services. Proxies controlling for household expectations could provide more depth to the analysis, these proxies however

may be hard to find. Overall, these results appear to be highly significant and reflect little indication of bias or misspecification.

3.7 Literature Review of "Household and Intrahousehold Impact of the Grameen Bank and Similar Targeted Credit Programs in Bangladesh"
-Mark M. Pitt, Shahidur R. Khandker

This study evaluated the affects of three microfinance institutions in Bangladesh including the Grameen, BRAC, and BRDB banks on two household level indicators. The first of which is a measurement of household well-being and the second, the distribution of resources between households (Khandker, "Household" 1). Citing the failure of commercial credit institutions to provide rural credit, the authors undergo an analysis of some of the determinants of targeted credit program participation (Khandker, "Household" 11). The affect of program participation on these indicators helps to evaluate the effectiveness and impact of the credit program. This review will focus on the estimations of credit impact on household per capita expenditure. Pitt also compares three different estimation techniques in order to evaluate and correct possible problems that "plague earlier attempts" (Khandker, "Household" 2). He compares naïve weighted / unweighted OLS estimates and Weighted Exogenous Sampling Maximum Likelihood limited information maximum likelihood /fixed effects. Particular focus will be placed on the impact of a fixed effects methodology.

For this study the World Bank utilized a quasi-experimental household survey. Data was collected from program and non-program areas, and involved 87 villages from 29 sub-districts. Programs had to be in operation for over three years in order to be included. On the household level 1,798 participant and non-participant households were interviewed in three rounds, one for each main crop season.

Methodological Problems

Within a stocastic model of household participation affects, it is critical that all exogenous and endogenous elements are appropriately controlled for. Exogenous variables are those which are "determined independently" of the model, where as endogenous variables can be considered to be determined by a corresponding set of exogenous variables (Malinvaud, 52, 57). The expenditure model used has problems with uncontrolled endogeniety that must be controlled for in order to avoid bias.

The authors break up the expenditure model into two equations: first, the reduced form for the level of participation in a credit program and the second a demand for a certain household outcome "conditional on the level of program participation" (Khandker, "Household" 13). The first equation has an error term comprised to the stochastic error term and error related to unobserved village and household effects (Khandker, "Household" 13). The problem arises when this equation is brought into the second equation which has its own *hypothetically*, uncorrelated, error term. If the unobserved error coefficients from the first equation are then correlated with those of the second, then problems arise. Explicitly, the unobserved error from household and village characteristics within the level of participation equation may be related to those exact error components from the conditional demand equation this would violate OLS classical assumption number five. In other words, if the error term is related to any included or omitted variable then the error term will no longer have a constant variance and the estimations will suffer from heteroskedasticity. For a mathematic interpretation of this analysis please refer to the study.

The author suggests three ways in which this endogeniety may be introduced into the equation. The first is the non-random placement of microfinance institutions. Their research suggests that programs tend to be placed in poorer and more vulnerable villages,

sometimes even at the request of it's needy inhabitants. The effects of this will be to underestimate projected coefficients. More significantly, if the placement is treated as random, a comparison between control and survey villages may encourage the conclusion that MFIs have had no, or even negative impact on their targets. This is due to the fact that nonrandom placement of treatment villages will produce lower than average means of the indicative variables. Also, this selection bias may effect the error terms of both of the previously discussed equations, leading to problems in estimation.

The second source of endogeniety may arise from a series of other unobserved village components of *demand* for credit and certain household outcomes. These variables are left unobserved due to the complicated nature of obtaining realistic data. The authors provide this list of possible effectors, "… prices, infrastructure, village attitudes, and the nature of the environment…" (Khandker, "Household" 14). These unobserved characteristics or omitted variables will most likely effect the error terms of both equations and may therefore bias the outcomes. The third source of possible endogeniety may be unobserved characteristics on the household level. These include current health, innate ability, or preferences (Khandker, "Household" 14).

Instead of using an instrumental variable the authors suggest the use of a village fixed effects estimator methodology to control for endogeniety. They believe that this estimation technique will control for village-specific error. The fixed effects method treats village error as a "parameter to be estimated," through the use of village intercept dummies (Khandker, "Household" 16). By controlling for the village error, the results should be minimally biased according to this theory. Since individual village characteristics are observed, the estimation can properly utilize the control village data.

The authors also discuss some problems with the fixed effects method, which they believe will be negligible due to the large sample size.

The benefits of this method are further reinforced by one of the methodological components of the survey. The survey includes as part of the control group households that cannot participate within the programs due to the exogenously determined requirement of less than .50 acres of land. This inclusion will help to control for household level unobservable factors because the outcomes include houses "with program choice and those without it" (Khandker, "Household" 17). The rule for eligibility is exogenously decided but allows two types of poor households characteristics to be compared, eligible and non-eligible. These characteristics may include those discussed earlier as being problematic to observe.

Weighted Exogenous Sampling Maximum Likelihood and the limited information maximum likelihood is a "choice-based" model and was used to estimate the results. The WESML method as described by Steven Cosslett is quite similar to a log likelihood estimator for a random sample (Cosslett, 1289). He explained that in a large random sample it is unlikely that more than one person will make the same choice. In this model, the choice being estimated would have a large number of alternatives, for example if one asked, "What bank do you use?" Obviously estimating within such broad parameters would be difficult if only one answer was relevant to the study. However the parameters of the question can be limited to one possibility, "did you choose to take or not to take microfinance credit?" This type of model is "choice-based". Typically with this type of model estimated coefficients represent the maximum likelihood of that choice being made. Cosslett however contends that this maximum likelihood method is asymptotically biased when applied to the type of choice-based model used in

Khandker's study. The WESML method was created in order to avoid this type of bias. For a mathematical interpretation of this please refer to Cosslett's paper.

Of particular interest is the estimation of MFI impact on per capita expenditure. Although the method of calculation was not discussed, this increased expenditure purchases household goods, as well as capital investments. The regression is specified as seen in equation 3.6. Selected results are presented in table 3.7.

(3.6)
Log per Capita Expenditure = f (dummy variables for relationship to land owner for both spouses, Log HH land assets in acres, Highest grade completed by HHH, Sex of HHH (male = 1), Age of HHH, Highest grade completed by adult female in HH, Highest grade comp by adult male in HH, No adult male in HH, No adult female in HH, No spouse present in HH, Round Dummies 2 and 3, Amount borrowed by Female / Male from BRAC, Amount borrowed by female / male from BRDB, Amount borrowed by female / male from GB)

Table 3.7 - WESML-LIML-FE Estimates of the Impact of Credit by Gender on Log per Capita Expenditure

Explanatory Variables	Food		Non-Food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Log HH land assets in decimals	.005	1.026	.055	4.528	.015	2.431
Highest grade completed by HHH	-0.002	-0.426	-0.024	-1.746	-0.007	-0.853
Highest grade completed by adult female in HH	.015	3.736	.065	5.996	.029	5.149
Highest grade comp by adult male in HH	.009	1.773	.060	4.528	.019	2.437
No adult male in HH	-0.020	-0.293	-0.176	-1.117	-0.014	-0.167
No adult female in HH	.158	2.090	.132	.910	.159	2.038
No spouse present in HH	.122	4.195	.188	2.483	.141	4.283
Amount borrowed by Female from BRAC	.026	4.032	.019	.471	.038	3.702
Amount borrowed by Male from BRAC	.012	1.343	.041	1.680	.018	1.615
Amount borrowed by female from BRDB	.032	4.491	.017	.395	.041	3.620
Amount borrowed by male from BRDB	.021	2.531	.050	2.228	.024	2.341
Amount borrowed by female from GB	.032	4.926	.022	.518	.044	3.899
Amount borrowed by male from GB.016	.016	1.752	.029	1.231	.018	1.660
Participated but did not take credit	.056	1.868	.015	.196	.059	1.714
Lof likelihood	-5090.877		-8712.608		-5784.156	
No. of observations	4567		4567		4567	

The dependent variable is the log of per capita expenditure. This specification sets up a semi-log function, this type of function implies that a one unit increase in the independent variable will create a percentage change in the dependent (Studenmund, 208). Unfortunately, the authors give no clues to why they choose this functional form for the equation or for any of the individual variables. Since no clear guidelines were established for interpreting the variable coefficients from the WESML estimator, the discussion will revolve solely around significance instead of the level of impact.

The set of explanatory variables is composed of five main elements: household characteristics of land ownership, household head (HHH) descriptors, and program specific credit / savings variables. The regressions are broken into three sub-categories of expenditure: food, non-food and total expenditure.

The first variable is the log of household land assets. This variable creates a double-log form. The double-log specification implies that a 1% increase in household land assets will create a percentage change in household per capita expenditure. The author notes that land holdings may be the best proxy of household income or the level of poverty. The estimates suggest that this variable has a significantly positive impact on non-food and total expenditure (main non-food expenditure). Both of these estimates are significant on the 5% level. These results might also pickup on the affects of increased levels of collateral for credit due to size of land assets. Therefore this variable may serve to partially control for the effects of commercial or preferred credit for eligible households.

The next series of variables describes the characteristics of the household head and caretakers. The first variable set describes the level of education. This includes two variables: one controlling for the HHH's highest grade level, and the highest grade level of the family disaggregated by gender. These types of variables may pick up on some of characteristics of innate ability to provide for the family, and or village access to education and other household/village characteristics. The results show that as the grade level of the household head increases it has a negative (and in the case of non-food expenditure, significant) impact on expenditure. This may suggest that savings is increasingly preferred as the education of the household head increases. The disaggregated education variables- male/ female highest grade completed in the

household give a different perspective of education's impact on expenditure. These variables are both positive and highly significant.

The lack of an adult male in the household had a negative but insignificant affect on per capita expenditure. These results might emphasize the difficulty that women have within a patriarchal society. The lack of an adult female appears to have a positive and significant effect on total and food expenditure. This may indicate a preference of males towards current period consumption, as opposed to saving. Non-present spouses have positive and significant effects on all forms of expenditure. The increase may be a result of remunerations from emigrated spouses.

The final and most relevant set of variables controls for the amount of credit taken from individual institutions as well as the use of non-credit MFI services, both disaggregated for gender. This specification is quite important because it controls for variations that a borrowing dummy for instance could not observe. These variations may include the impact of the absolute level of credit, and unobserved costs and benefits between different levels of borrowing.

The results show that for females a one-unit increase in amount borrowed leads to a significantly positive percentage change on food expenditure. Male credit variables have significantly positive effects but also hold lower coefficients, suggesting lower absolute increases in expenditure. In regards to non-food expenditure, loans to women showed insignificant yet positive impacts. Also notable, two out of three MFIs significantly increased the non-food expenditure of males. The impact on total expenditure for both sexes was positive and significant. The final variable, participation without borrowing, controls for households that take advantage of non-credit related benefits of MFI participation. This may include the effects of institutional training

courses, business advice or more importantly, access to savings. The results of these variables suggest that savings and other benefits significantly increase the level of food expenditure and total expenditure. The estimation of non-food expenditure demonstrates that the absolute level of savings and other possible benefits *may not be large enough* to promote asset acquisition or non-food related investment across the population. Some literature suggests that access to savings may be more critical to the "ultra poor" than the relatively less poor (Johnson, 3). These results might take this into account since the ultra poor may be less inclined to bear additional risks inherit in investment, therefore having less impact on non-food expenditure.

Conclusions

This study takes a number of important steps in identifying and controlling for methodological problems present in any evaluation of credit impact on the household level. The authors suggest that a fixed effects estimator is critical for the accurate estimation of the explanatory variables. This particular strategy appears to be extremely significant. The results demonstrate the consistently positive and sometimes significant affects of microfinance services.

3.8 Literature Review Conclusions

This review of literature introduced a number of important physical as well as conceptual issues involved in microfinance impact analysis on the household level. As you have seen the selection of literature was not restricted to standard household models but included a number of different methodologies including an analysis of the supply- and demand-side issues, and the viability of the borrower him or herself. The integration

of various methodological findings should help to broaden the scope of this study as well as to improve the soundness of the model created.

The majority of literature including Zaman, Zeller, Khandker, and Coulombe looked at the impact of microfinance on certain household outcomes, and more often then not, on the impact on consumption levels. From these studies we can imply that the level of consumption is the standard measure of household well-being. This finding will have a large impact on the direction of this study and will be discussed at greater lengths in the model chapter.

In addition these studies have helped to establish the need of specific types of control groups, and other methodologies to prevent certain statistical problems. The six identified problems were selectivity bias, the counter factual, survey timing, common unobservable variables, non-random branch placement, and fungibility.

The issue of selectivity bias was dealt with in a number of ways. Most commonly, a self-selection variable was created in order to tease out the differences between those whom apply and those whom don't. Brett Coleman approached this by including self-selected members who have not and will not receive microfinance services until a year after the study ends.

The counterfactual occurs when researchers incorrectly identify the impact of microfinance services because the impact of other social services has not been controlled for. This problem was handled in a number of ways. Khandker included variables controlling for the distance from the household to alternative social services, while Zaman asked if any household member was receiving other NGO services. A control group technique was also widely utilized for this problem. Samples from different studies intentionally included any combination of non-eligible households, eligible non-

members, borrowing members, non-borrowing members, and even households from villages without access to alternate services. This helps by providing OLS a base group upon which it can compare the differences between microfinance and non-microfinance households. Interestingly enough no study controlled for the impact of other, non-microfinance loans.

Problems can also be associated with the timing of surveys. Specifically, if household outcomes are evaluated during glut seasons the results will be biased upwards, on the other hand if households are questioned during lean seasons the results will be biased down wards. Surveying the household between 2 to 3 times during a given year, and including seasonal dummy variables solved this problem.

A few variables that are commonly left unobserved were identified and specified. Most notable of which were variables controlling for the "ease" of local transactions, or networking variables. These ranged from the number of years a household has lived in an area, to Zeller's distance from parents' house variables. Other often-missed variables might relate to the specific characteristics and events in a village or district. These differences can be controlled for with the used of village dummy variables or even village descriptives. The most prevalent method appears to be the village dummy variables, i.e. fixed effects method.

The placement of MFI branches was also an important factor. Shahidur Khandker of the World Bank found contradictory results in relation to this problem. In his first paper published in 1995 he stated that branch placement was found to be random since there was little to no correlation between key climatic and geographical characteristics and the location of microfinance banks. In his paper the follow year he

felt that banks would be likely to be placed non-randomly. To handle his most recent finding he adopted a village fixed effects method.

The final problem, that of the fungibility of money, is more difficult to resolve. Manfred Zeller concluded that the rule of averages in a large sample should alleviate the problem. As discussed earlier this might not hold true. The ability for households to divert money seems more endemic than Zeller realizes. However this problem may not be a problem at all. Households would be expected to maximize their utility through decision making. If a household decides that they would receive more benefit from a radio than they would from a shovel, then they have just maximized their personal well-being. As a researcher no line can or should be drawn between the types of investments households choose to make.

These household outcome studies also disaggregated impacts and households in few different ways. Impacts included food, non-food, and total consumption expenditure. Households were broken up into different comparative categories: rural vs. urban, farming vs. unemployed etc.

Two alternate studies helped to establish a number of other guiding factors for an analysis. Manfred Zeller's study helped to establish the set of costs and benefits for the supply and demand of microfinance services; meanwhile Khandker's first study evaluated the impact of these components on the graduation and dropout rate. Some of the identified factors include: alternative services, alternative opportunities, HHH age, and social transaction "ease" variables, i.e. local networking variables.

In all this diverse group of literature provides a set of innovative, as well as essential techniques and structures. With any luck these reviews will help this study

break from the standard conventions of household impact analysis and move into a greater level of insight.

Chapter 4 – Model Chapter

4.1 Introduction

Two models will be specified in this chapter based upon the finding from the theory chapter and the literature reviews. Microfinance credit services are hypothesized to have a positive and significant impact on household level consumption expenditure as well as on the value of household and enterprise assets. Both of these variables will be adapted slightly in order to proxy household well-being. The large majority of literature supports this hypothesis, however the populations were primarily restricted to Asia, or more specifically to Bangladesh.

Since Bangladesh was the first country to use microfinance style banking it has also been the benefactor of the mass of impact studies. These studies have helped to establish the importance and significance of this type of banking, yet they have failed to evaluate the Microfinance clones that have sprung up throughout the world. This paper will help to establish a broader range of impact analyses. Without such a study Microfinance banking would be left largely unsubstantiated in the host country as well as in most of the African continent.

This ordinary least squares model will be used to estimate the impact of microfinance credit services on household level of expenditure and value of assets in Uganda.

4.2 Sampling Procedure and Data Description

This paper uses the cross-sectional data reported by the Uganda National Household Survey, which was conducted by The Uganda Bureau of Statistics of the Ministry of Finance, Planning and Economic Development in 1999 to 2000. This

datasets is quite extensive. Four districts of the country, Kitgum, Gulu, Kasese and Bundibugio, were not included in the sample presumably because of rebel activity in these areas. In all, the survey included approximately 10,700 households.

The national survey used a two stage stratified method. The majority of data was collected using two-stages where the enumeration areas frames were available. In this case the first stage sample unit was the 1991 populations census by district, the second stage was the household. When the enumeration area framework was not available the data used three stages: the parish, the village, and the household. This study will focus on the impact of microfinance banks on the household level.

Within the constraints of the dataset, these models integrate the most innovative and effective estimation techniques used in literature. For both estimations, the sample group will be restricted to families living in *rural areas* throughout Uganda. Rural households are targeted because of the World Bank's accusation that lenders fail to provide rural credit (Khandker, "Household" 11). The sample size has been reduced in order to lower N from over ten thousand participants to 2070 rural participants. This sub sample of 2070 households was selected randomly from the original dataset. The only exception was the removal of one outlier family that had a MFI loan size well outside of three standard deviations from the mean. No other major adjustments were made to data.

4.3 Estimation Strategy

Fixed effects ordinary least squares

4.4 Regression Equations

(4.1) LNEXP or LNOLNDAS = CONSTANT + S2Q6 + AGE – AGESQR + MARRIED + HIGHED + S81Q1 + S81Q2 + S10AQ6 + S11Q145 + S11Q16 + DEPENDCY + - S10BQ2 + LNLOAN + MFIDUMMY + MFISPD2 + - DIS103 + - DIS104 + - DIS105 + - DIS106 + - DIS107 + - DIS108 + - DIS109 + - DIS110 + - DIS111 + - DIS201 + - DIS202 + - DIS203 + - DIS204 + - DIS205 + - DIS206 + - DIS207 + - DIS208 + - DIS209 + - DIS210 + - DIS211 + - DIS212 + - DIS301 + - DIS302 + - DIS303 + - DIS306 + - DIS307 + - DIS308 + - DIS309 + - DIS310 + - DIS402 + - DIS403 + - DIS404 + - DIS405 + - DIS407 + - DIS408 + - DIS409 + - DIS410 + - DIS411 + - DIS412

4.5 Dependent Variables

In both models the dependent variables are proxies for the household standard of living or household well-being. The first dependent variable is the natural log of total household consumption expenditure per adult equivalent.

Ln(EXP)

In the first regression a standard of living index was created using the guidelines from the literature review of Harold Coulombe, Andrew Mckay. However the variable was not deflated by a price basket because of this model's fixed effects methodology that should adequately control for district level differences such as prices. The use of a fixed effects method will be discussed later. Throughout the remainder of paper this regression will be referred to a Ln(EXP).

Based on Colombe's specification, yearly total household consumption expenditure variable is composed of the sum of the total market value of food, non-food, semi-durables and durables purchases, value of consumption out of home produce, and all current transfers and benefits, either cash or kind. As one would expect, the total value of consumption expenditure will be correlated to the size of the household. For this reason the dependent variable will be deflated by the number of adult equivalents. As it stands now the variable will describe the average consumption per adult. The natural log

of this variable is then taken and a log-lin relationship established with the majority of the equation. This non-linear relationship exhibits the following property: a one-unit change in x will create a percent change in y. This functional form was also adopted because three of four pieces of literature using expenditure as a dependent established this non-linear relationship. The deflation and the natural log also helps to avoid problems with heteroskedasticity by minimizing the variance across the sample.

It should be noted that the expenditure regression would be able to pick up on expenditure into household enterprise certain types of capital (a typical example might be the purchasing of vegetables for resale in local markets). This sort of small investment is typically the emphasis of microfinance loans, not necessarily investment into assets.

Ln(ASSET)

In David Hulme's evaluation of Microfinance impact analyses, he noted that the use of consumption expenditure as a welfare indicator could distort the estimate results (83). He observed that total consumption could fluctuate wildly throughout the year; additionally the calculations might be biased or deceiving because they are based on estimates from the interviewee.

Another problem arises with the use of expenditure within this particular dataset. The questionnaire estimates food, beverages and tobacco expenditure from seven days before the interview. This loose estimate then acts as a proxy for average weekly income. However the key variables, the credit variables, are estimates on a twelve-month basis. So this expenditure average must be multiplied by the number of weeks in a year to arrive at yearly expenditure. Problematically, the data collection was associated with a particular time of the year usually after one of the two main crop seasons, as is the case

with this survey. Please note that the survey failed to create seasonal control variables. Now clearly the use of expenditure would introduce an upward bias on the estimates since expenditure at these times are at their highest. As you will see later this is not the case for household assets.

David Hulme's research suggested the use of an estimate of asset value as a replacement dependent variable (83). Again this variable is deflated to control for household size. This may act as a better indicator of household standard of living because its levels are likely to be relatively stable over a twelve-month period, even after a main crop season; furthermore the number and value of these items are much easier to discern. Again according to the specification of other standard of living estimates, this variable will be put into log form. For the remainder of the paper this second model will be referred to as Ln(ASSET).

The asset dependent variable may not work perfectly for this dataset because the amount of savings cannot be properly controlled for. Households with high levels of savings are therefore likely to have their standard of living underestimated because wealth would be held as a deposit instead of as an asset. This bias will be partially controlled for with a dummy variable for participation in a savings club. However, it should be recognized as a significant problem since the level of savings may be more important than the existence of savings. Another positive attribute of total assets is it explicitly includes recent investment into household enterprises assets. This higher level of investment may be left unobserved in the expenditure-based analysis.

The comparison of both standard of living measures will provide insight into the impact of microfinance on the household and the effectiveness of different model specifications. Specifically, the Ln(EXP) should be able to pickup on investment into

small working capital, while Ln(ASSET) will estimate the impact on the larger physical capital. The next section will specify the independent variables for both models.

4.6 Independent Variables

The independent variables can be broken into four descriptive categories: household characteristics, household head characteristics, financial services variables, and village dummy variables. The variables within these categories will be used to explain the differences between household expenditure and assets. The following models are based largely on the specification of reviewed literature. The Ln(EXP) and Ln(ASSET) models will be discussed in unison because both use household standard of living as the dependent variable [with different specifications] and are therefore identical. The expected signs of all independent variables are reported in table 4.1.

Table 4.1 - Expected Signs

Independent Variables	Expected Sign(s)
HHH Age [AGE]	(+)
HHH Age^2 [AGESQR]	(-)
HHH gender (male =1) [S2Q6]	(+)
HHH Marital Status (Married = 1 Other = 0) [MARRIED]	(+)
HHH Years of Schooling [HIGHED]	(+)
Does household have a crop farming enterprise? (Yes = 1) [S81Q1]	(+)
Does household have any other enterprise? (Yes = 1) [S81Q2]	(+)
Total land quantity 12 months ago in acres [S10AQ6]	(+)
Household member of savings group (Yes = 1) [S11Q145]	(+)
Number of people that family could ask for money in emergency [S11Q16]	(+)
Dependency Ratio [DEPENDCY]	(+)
Household member applied for credit in the last 12 months (Yes = 1) [S10BQ2]	(+)(-)
Ln(Amount of credit received last 12 months) [LNLOAN]	(+)
MFI loan source? (MFI =1, other =0) [MFIDUMMY]	(+)
Microfinance Slope Dummy [MFISPD2]	(+)
District dummy variables [DIS X]	(+)(-)

HHH Characteristics

The characteristics of the household head can have a large impact on household welfare. Please note that the estimation of characteristics for the household head is somewhat inaccurate. If the real household head is not present at the time of the interview then spouse or eldest son may be put down as the household head in exchange for the adult male.

(i) Education

Education can play a key role in the improvement of household well-being even at low levels. Education (HIGHED) will be specified as the number of years of education achieved by the household head. Theoretically every additional year of schooling by the HHH should create some percentage increase in the household's standard of living,

inferring a log-lin relationship. In opposition to the common theory, the returns of higher education in might not be limited for rural families. Although the literal value of training in chemistry might have decreasing returns for a farmer, this may be counteracted by other benefits, such as prestige. HIGHED will therefore be linear because higher education should have relatively constant returns for rural households. Since this variable is positively related to human capital, it is expected to have a positive sign.

(ii) Age Age^2

Older and more establish heads would have had more time to acquire assets or obtain steady or gainful employment than their younger counterparts. Literature tends to specify both age and age squared, suggesting the existence of an optimal age level. Clearly the number and total value of assets of a household would be directly related with the age of the most prominent member of the group. However as the age of the HHH increases beyond some point the amount of spending on assets may decrease, additionally as children grow older they will tend to move from the house along with their own personal assets [note that the age of the household head should also be highly correlated with that of their children]. The same type of argument can be made for expenditure. As younger households grow older they will gain better employment, which leads to increased income and expenditure. However past some point, age will only serve to reduce output and thereby reduce expenditure.

(iii) Gender and Marriage

The gender (s2q6) and marital status (MARRIED) of the HHH will also have an impact on household welfare. For instance single female-headed households would be expected to have significantly lower standards of living than houses headed by married males. For the gender variable (s2q6), male HHH will be equal to 1 and female 0. For the marriage variable (MARRIED) married is equal to 1 and other 0. Both the gender variable and the marriage variable are expected to have a positive sign. It should be noted that the results from both of these variables might be distorted by: one, a social circumstance in Uganda and two, a methodological problem with the survey that was discussed at the beginning of the section. Demographically Uganda is composed of approximately on third Muslims. In these households it is relatively common, if not pervasive to take more than one wife. For this reason the results from the variables MARRIED and s2q6 may have downward bias, since a male may be spreading his resources across a number of female headed households. Secondly, since in the survey spouses might be identified as the household head in the survey, the estimates might also be biased downwards.

Household Characteristics

Household characteristics will include controls for wealth, savings, child dependency, enterprise ownership and coping mechanisms. Please keep in mind that the number of adult equivalents is used to deflate both of the dependent variables.

(i) Wealth

Household wealth will be controlled for with a land acres *one year ago* (s10aq6) estimate. The quantity of land owned by a household should be a good indicator of

household wealth especially within the rural areas of an agriculturally focused economy. Households are likely to hold wealth in the form of land assets since they can provide positive returns from cultivation. This specification is a slight departure from literature. Khandaker 1996, uses *current* total land acres in his specification. The use of current land estimates might undermine the impact of credit for investment into land holdings. Manfred Zeller on the other hand uses a land estimate from ten years prior. Land acres one year ago should be a better estimate of household wealth because it represents a base level of wealth before any target loans were taken. The wealth variable is expected to have a positive sign. Notice that land value is not included in the specification of the ln(ASSET) dependent variable in order to avoid a high non-descriptive correlation with dependent variable.

Contrary to the precedence set by Khanhker and in favor of that of Zeller, the land variable (s10aq6) will be kept in a linear form. In the *developed world*, as household wealth increases the percentage of expenditure on basic needs (consumption expenditure or into basic assets) decreases. This might suggest the use of a log form since the impact of wealth on expenditure and asset value increases at a decreasing rate. For this paper the relationship is expected to be different.

The components of expenditure in the Uganda survey includes increases in semi-durable / durable goods, as well as expenditure into common services such as private education costs. Also consider that the incomes of families in rural Uganda are quite limited compared to those of the developed world. Therefore increased wealth is expected to be spent on durables / semi-durables and common services at much higher rate within Uganda than in the developed world. Therefore a linear relationship for the wealth proxy (s10aq6) is expected. In the Ln(ASSET) regression the reasoning is a bit

different. Consider the impact of asset hoarding on the wealth to asset value relationship. If a family hoards assets (as is common) then increases in wealth should either be invested into land or other assets included in the total value of assets variable. Therefore this relationship is also expected to be linear.

(ii) Savings

Since the dataset lacks any direct measure of household savings, it will be controlled for using a dummy variable (s11q145). The variable will equal 1 if a household member participates in a savings group and 0 otherwise. This savings dummy will miss a large portion of household savings, however it might be a good indicator of the *intent* to hold savings. This variable will be expected to be positive.

(iii) Dependency

A child (under 18 years) per adult (over 18 years) ratio will describe the level of dependency (DEPENDNCY) in the household. The child dependency ratio was included in the papers of Harold Coulombe and Hassan Zaman. As this ratio increases, working adults will have more children to take care of. Additionally children in rural areas will provide a source of labor for the household. As the number of children increases so does the amount of expenditure on all goods, including assets. In addition, children might provide more income to the household through their own output. Therefore this variable is expected to have a positive sign for both regressions.

(iv) Enterprise

The existence of a household run enterprise could also impact a family's level of welfare. Surely we can guess that families with enterprises will have higher levels of assets and expenses. Two dummy variables check for the ownership of a crop-farming enterprise (s81q1) and any other enterprise (s81q2). The inclusion of this variable should help to tweak out the actual impact of credit on the household not just on the business that the loans where intended for. In other words, with the ownership of an enterprise held constant the loan variables will no longer be correlated with the ownership of a business and will be a better estimator of household well-being. This technique, however unusual, should also help to separate the differences between socio-economic groups as was suggested by Harold Coulombe. Both of these variables are expected to carry a positive sign.

(v) Number of people to ask for help

The final household variable helps to control for a family's ability to cope with detrimental exogenous events, as discussed in the theory chapter. Manfred Zeller discussed the necessity of observing the number of support systems the family possesses or the 'ease' of social / economic transactions. He used a series of variables controlling for the distance in kilometers between the participant house and that of their relatives. The innovative approach of the Ugandan survey provides a superior alternative.

Households were asked to count the number of people in the community they could ask if they were in need of money. This answer is a measure of coping mechanisms because it should be correlated with the number of years the household has lived in an area, the proximity of family members, and may even be correlated with

personality traits such as social adeptness, and local reputation. This variable is expected to carry a positive sign.

In conclusion, these variables should adequately describe the household demographics, resources, and coping mechanisms of families while tweaking out a number of commonly unobserved characteristics. All five of these variables should have positive returns to household welfare and therefore are expected to have a positive sign.

Credit Services

The specification of the credit variable was the most highly disputed section in literature. A few different methods were established in order to control for a self-selection bias, wherein people possessing certain advantageous attributes would be more likely to take loans thereby putting upward pressure on impact of these loans. With the exception of Coleman's study, most corrections for self-selection seemed inadequate. Coleman's method included the use of an inventive control group that included persons whom signed up for, but had not *yet* received any loans. However, as discussed in his review this method is problematic since early joiners tend to be richer than latecomers. This paper will attempt to include the same type of self-selection correction within the limits of the survey, while avoiding this bias. This section will also spell out the specification of the remaining credit variables.

(i) Self-Selection

The first credit variable will be a self-selection style dummy variable (s10bq2). If a member of the household applied for a loan within the last twelve months the dummy is equal to one and zero otherwise. This variable therefore teases out the differences

between non-affiliated non-members, self-selected members, and importantly, self-selected members whom have not received any loans. This specification should entirely avoid the bias of early vs. late self-selectors because their loan application is not correlated with the establishment of a new bank. The sign of this variable may be hard to discern theoretically. Typically, as theory indicates, self-selectors are expected to carry certain valuable traits, suggesting a positive value for s10bq2. However, assuming that an applicant's level of education, coping strategies, social network, and wealth are properly controlled for, self-selection might be solely an indication of need. For this reason the self-selection variable will be tested for being significantly different from zero in both directions.

(ii) Loan Size

The second variable is the total loan amount received by the household in the past twelve months from any source (LnLoan). This credit indicator is quite different from the one used by Coleman because it observes the absolute level of credit received, instead of a variable correlated with the loan amount. Interestingly most literature pieces do not control for loans from any other source besides microfinance banks, and instead include some loose proxy such as the distance to the nearest bank. This new variable will allow the additional costs and benefits from extra units of credit to be estimated no matter what their source. This variable will be placed in a non-linear log form, a technical discussion is provided in Appendix A. In addition to the argument presented there, the non-linear form should make the variable more useful to policymakers because the estimates refer to a percent change in loan size instead of a unit increase. This variable is expected to carry a positive sign.

(iii) MFI dummy

Since the main focus of this paper is on the impact of microfinance loans, a microfinance dummy variable will be included (MFIDUMMY). This variable is equal to 1 if the loan was received from a *non-governmental organization* (NGO) and 0 otherwise. Non-governmental organization loans are used as a proxy for MFI credit because the survey did not explicitly ask about MFI loans. This problem may bias the variable's estimation. However the summary from the Uganda Statistics Bureau also seemed to consider this variable as a proxy for MFI loans (Uganda: Report on the Socio-Economic, 62). According to the summary statistics 66% of NGO loans have security requirement that fall under the category of "none" or "other". This leads me to believe that the majority of these NGO loans at least follow the group-based lending technique, which usually requires no security or "other" i.e. peer, security. Although this is not a perfect indicator of MFI impact, it is the only technique provided by the format of the survey. This variable is expected to carry a positive sign but should be considered biased.

(iv) MFI Slope Dummy

The final variable, a MFI (or NGO) slope dummy (MFISLOPE) is included because loans from these institutions are expected to have a greater impact than other types of loans on the two dependent variables. In other words the slopes associated with MFI loans are expected to be different from that of other loans, primarily because of the extra requisite services provided to compliment these loans. The services include training on anything from market identification to household hygiene. These additional services are expected to have a positive impact both models' dependent variables. Again this variable may be biased because it includes the impact of other non-MFI loans.

District Dummies

District characteristics will be described using the district level fixed effects method. In other words, all districts with the exception of one comparison district are assigned a dummy variable with a parameter to be estimated. Each household will then be arranged under these variables. The majority of literature seemed to utilize the FE method or suggest its use primarily because descriptive variables may overlook the impact of key attributes or local events. However two out of three times this technique was specific to the village instead of district level. These village level dummy variables were not included in this study because their detrimental impact on OLS degrees of freedom. If included they would introduce over 400 variables into the model, with as little as one observation per village. Therefore the use of village dummies was rejected as problematic.

District level dummy variables should adequately control for differences between districts. These differences might include price levels, local events, climate conditions,

and economic conditions. These estimations will assume that all villages within a district are relatively similar; problems with this assumption should be expected. However, the differences between villages within one district should be minimal, and any substantial changes in one village should impact the whole district. Please note that regional dummies where not included because a single region is perfectly correlated with the districts it encompasses. These variables will be in comparison to an omitted rural district.

Literature also discussed problems with random and non-random placement of bank branches at the village level. Specifically if branches are placed non-randomly in poorer areas, then the estimates would be biased downwards. According to literature any non-random placement can be controlled for with the use of a fixed effects estimator.

Chapter 5 - Results

5.1 Introduction

In this chapter the significance and validity of both the Ln(ASSET) and Ln(EXP) models will be tested. The estimations and outcomes of multiple tests for econometric problems in both models will be discussed simultaneously. The following results are the estimated using a district level fixed effects ordinary least squares estimator. This regression technique estimates the coefficients by minimizing the sum of square errors. The following sections will demonstrate and discuss the results of tests for statistical problems. This will be followed with a discussion of the results of both estimates and a comparative discussion of the two proxies for household well-being. Finally, a test for the existence of a statistical break between the well-being of male and female headed households (HHH) will be undertaken.

5.2 Econometric Problems

Colinearity Test

Colinearity becomes problematic when two explanatory variables are nearly perfect or perfect linear functions of each other. Classic assumption number five for OLS regressions requires that no two variables are perfectly collinear with any other. In the case of perfect colinearity, OLS will be unable to differentiate between the two variables. A PCOR correlation matrix is provided to evaluate this possibility. All correlations greater than 40% or .40 will be considered to be *relatively* significant collinearity.

Table 5.1 - Combined Correlation Matrix of Variables

```
LNOLNDAS   1.0000
S2Q6     -0.32844E-01    1.0000
AGE       0.88610E-01  -0.94244E-01    1.0000
AGESQR    0.71909E-01  -0.91246E-01   0.98310        1.0000
MARRIED   0.74473E-01   0.54403      -0.97500E-01  -0.10395       1.0000
HIGHED    0.24537       0.20417      -0.27239      -0.27699      0.15274
          1.0000
          LNOLNDAS     S2Q6          AGE            AGESQR       MARRIED
          HIGHED


S81Q1     0.11992       0.41318E-01   0.12751       0.10888       0.14249
         -0.43426E-01    1.0000
S81Q2     0.26545       0.36201E-01  -0.94224E-01  -0.97196E-01   0.64074E-01
          0.14266      -0.44114E-01    1.0000
S10AQ6    0.14792       0.34254E-01   0.83552E-01   0.77644E-01   0.31200E-01
          0.12310E-01   0.50295E-01   0.74058E-01    1.0000
S11Q145   0.11591       0.25983E-01   0.76992E-02  -0.26681E-02   0.82388E-01
          0.77541E-01   0.22287E-01   0.56015E-01  -0.63342E-02    1.0000
S11Q16    0.80745E-01   0.55501E-01  -0.70540E-01  -0.67252E-01   0.82198E-01
          0.66075E-01   0.27743E-01   0.32624E-01   0.22636E-01   0.81451E-01
           1.0000
          LNOLNDAS      S2Q6          AGE           AGESQR        MARRIED
          HIGHED        S81Q1         S81Q2         S10AQ6        S11Q145
          S11Q16


DEPENDCY  0.25197      -0.15810      -0.55338E-01  -0.91867E-01   0.10645
          0.21657E-01   0.14558       0.67894E-01   0.16865E-01   0.26415E-01
          0.17595E-01    1.0000
S10BQ2    0.96288E-01   0.38697E-01  -0.48980E-01  -0.49728E-01   0.67266E-01
          0.68044E-01   0.27290E-01   0.97119E-01   0.84741E-02   0.16841
          0.92287E-01   0.46978E-01    1.0000
LNLOAN    0.12390       0.31543E-01  -0.38294E-01  -0.38452E-01   0.66236E-01
          0.60097E-01   0.23453E-01   0.10249       0.24323E-01   0.17245
          0.87036E-01   0.59698E-01   0.89371        1.0000
MFIDUMMY  0.84227E-01  -0.10921E-01   0.31624E-01   0.22625E-01   0.46520E-02
          0.93919E-01  -0.10352E-01   0.95413E-01   0.15805E-01   0.14078
          0.43848E-02   0.84815E-02   0.31475       0.22118        1.0000
MFISPD2   0.97086E-01  -0.26590E-02   0.28714E-01   0.25542E-01   0.27396E-02
          0.65913E-01  -0.19137E-02   0.77171E-01   0.35661E-01   0.94829E-01
          0.12263E-01   0.23613E-01   0.18365       0.24749       0.58348
           1.0000
             LNOLNDAS     S2Q6          AGE           AGESQR       MARRIED
             HIGHED       S81Q1         S81Q2         S10AQ6       S11Q145
             S11Q16       DEPENDCY      S10BQ2        LNLOAN       MFIDUMMY
              MFISPD2
```

As you can see in table 5.1 these regressions have four instances where PCOR values are greater than .4, a low-end cutoff level for colinearity. This however, does not prove high colinearity. According to some econometricians correlations are not considered severe until they are equal to or greater than .80. In this case AGE and AGE^2 show a severe correlation, this correlation is expected because of the x and x^2 specification, and will be included unchanged on a theoretical basis. The only other

extreme case of colinearity arises with the LNLOAN variable, with 89.371% correlation between itself and s10bq2 (did household member apply for a loan in the last twelve months). In this case alternatives for s10bq2 are limited by the focus of the survey. Since the survey was not specifically designed to deal with the intricacies of the self-selection process, no alternatives seem theoretically valid. This may indicate the existence of high to severe colinearity, however these variables are of critical importance to the regression. These last two collinear variables should now be more likely to be insignificant if the problem is severe; this is yet to be seen. However it should be kept in mind that if they are significant, these variables should remain as reliable as any other in the model.

Auxiliary R^2 Tests

This method tests the independent variables for the existence of multicolinearity by individually setting each independent variable as a function of all other explanatory variables. If any variable is a near perfect function of the other explanatory variables, the model will suffer from inflated variances and OLS will find it difficult to distinguish the impact of multiconlinear variables. If these problems are not dealt with, they could inflate the standard error and estimates.

The auxiliary R^2 values for each of these estimates are given below. Estimates from district dummies will be excluded for brevity and because they are theoretically expected to be multicolinear. All variables showing the possibility of high multicolinearity are highlighted.

Table 5.2 - Auxiliary R^2 Test Results

```
R-SQUARE OF S2Q6     ON OTHER INDEPENDENT VARIABLES =   0.3755
R-SQUARE OF AGE      ON OTHER INDEPENDENT VARIABLES =   0.9688
R-SQUARE OF AGESQR   ON OTHER INDEPENDENT VARIABLES =   0.9689
R-SQUARE OF MARRIED  ON OTHER INDEPENDENT VARIABLES =   0.4026
R-SQUARE OF HIGHED   ON OTHER INDEPENDENT VARIABLES =   0.1608
R-SQUARE OF S81Q1    ON OTHER INDEPENDENT VARIABLES =   0.1161
R-SQUARE OF S81Q2    ON OTHER INDEPENDENT VARIABLES =   0.1049
R-SQUARE OF S10AQ6   ON OTHER INDEPENDENT VARIABLES =   0.0572
R-SQUARE OF S11Q145  ON OTHER INDEPENDENT VARIABLES =   0.0993
R-SQUARE OF S11Q16   ON OTHER INDEPENDENT VARIABLES =   0.0836
R-SQUARE OF DEPENDCY ON OTHER INDEPENDENT VARIABLES =   0.1601
R-SQUARE OF S10BQ2   ON OTHER INDEPENDENT VARIABLES =   0.8355
R-SQUARE OF LNLOAN   ON OTHER INDEPENDENT VARIABLES =   0.8330
R-SQUARE OF MFIDUMMY ON OTHER INDEPENDENT VARIABLES =   0.4841
R-SQUARE OF MFISPD2  ON OTHER INDEPENDENT VARIABLES =   0.4235
```

Variance Inflation Factors (VIFs)

The variance inflation factors in table 5.2 can be used to evaluate the possibility of high multicolinearity. The VIF help to evaluate multicolinearity via exaggerating the effects of multicolinearity by dividing one by one minus a variable's auxiliary R^2 (1/(1-Aux. R^2)). Therefore as the level of multicolinearity increases the VIF will move from one to infinity. VIF outcomes are reported below.

Table 5.3 - Variance Inflation Factors (VIFs)

```
VIF OF AGE      ON OTHER INDEPENDENT VARIABLES =   32.051
VIF OF AGESQR   ON OTHER INDEPENDENT VARIABLES =   32.154
VIF OF S10BQ2   ON OTHER INDEPENDENT VARIABLES =   6.079
VIF OF LNLOAN   ON OTHER INDEPENDENT VARIABLES =   5.988
VIF OF MFIDUMMY ON OTHER INDEPENDENT VARIABLES =   1.938
VIF OF MFISPD2  ON OTHER INDEPENDENT VARIABLES =   1.734
```

According to Studenmund, VIF ≥ 5 is a common cutoff point for significant multicolinearity (258). The above values show clear cases of severe multicolinearity for the variables AGE and AGE^2. Since these variables are similar [correlated to themselves] this result was not unexpected. They will be left in the model specifications due to their theoretical significance. There are two more problems present in the VIF values. Both the applied for loan dummy (s10bq2) and the ln of loan size variable (LNLOAN) could

be considered severely multicolinear. However due to the critical nature of the variables, the apparent lack of valid alternatives and the minimally problematic VIF values, both the LNLOAN and MFIDUMMY will be used without correction. The results from these variables should be carefully evaluated later for significance or unexpected signs.

Heteroskedasticity Tests

Heteroskedasticity is the violation of classical assumption number five, which assumes that the error term has constant variance for an estimate (Studenmund, 85). If the error terms from variables are not constant then OLS will create imprecise estimates. A hypothetical example can be created for the Ln(ASSET) equation; if additional acres of land were met with increases in the error term, this estimated would suffer from heteroskedasticity. This increased error could be correlated with some other variable, called the z-proportionality factor. Z, in this case could be any number of things including the increased difficulty in estimating larger land holdings. The following section tests for heteroskedasticity in the Ln(ASSET) and Ln(EXP) regressions.

(i) Heteroskedasticity Tests on Ln (total value of non-land assets per adult equivalent)

Table 5.4 – Critical Values for $\chi 2$ and T Distributions

	10%	5%	DF	TESTS
χ^2	63.1671	67.5048	50	HAR, BPG
T	1.282	1.960	∞	PARK

Table 5.5 – Heteroskedasticity Tests

	CHI-SQUARE TEST STATISTIC	D.F.	P-VALUE
LOG(E**2) ON X (HARVEY) TEST:	113.204	54	0.00000
E**2 ON X TEST: B-P-G (SSR) :	183.291	54	0.00000

Table 5.6 - Park Test on X_I

X_I	TEST STATISTIC
S11Q16	-1.963046
DEPENDCY	-1.419164
AGE	-0.4953143
HIGHED	0.7209891E-01
S10AQ6	1.012417
LNLOAN	-0.6024521

(ii) Test Results on Ln (total value of non-land assets per adult equivalent)

Both the Harvey and the B-P-G tests detect the presence of heteroskedasticity above the 5 percent level since the test statistics were above the critical values. Therefore the null hypothesis of no heteroskedasticity can be rejected. A series of Park tests were undertaken to help identify the source of the problem.

The Park test evaluates individual variables for the existence of heteroskedasticity by making the error variance a function of a single explanatory variable, x. If the test statistic is significantly different than zero, then it can be shown that x (the possible z proportionality factor) has impacted the value of the squared residuals. The functional form of the test is shown below.

(5.1) $\ln(\varepsilon_t^2) = \propto_0 + \propto_1 \ln(Z) + u_t$

The estimations from this test on the Ln(ASSET) function shows signs for heteroskedasticity on the 5% level for the variable s11q16 [the number of people you could ask for monetary help during an emergency]. Unfortunately there is no way, upholding theory, in which this variable can be transformed acceptably. It should be

noted that an attempt to use Weighted Least Squares, using s11q16 as the proportionality factor failed to correct for the problem.

Since all three tests show the probable existence of heteroskedasticity this regression will be estimated using a heteroskedasticity consistent covariance matrix. This will lessen the harms associated with the variable s11q16 by minimizing the effects of heteroskedasticity on the SE(B)s. The standard errors will still remain biased but should be significantly more accurate than the uncorrected errors (Studenmund, 366). However since the sample size for this regression is relatively large the bias should remain minimal (Studenmund, 366).

(iii) Heteroskedasticity Tests on Ln (total consumption expenditure per adult equivalent)

Table 5.7 - Heteroskedasticity Tests

	CHI-SQUARE TEST STATISTIC	D.F.	P-VALUE
LOG(E**2) ON X (HARVEY) TEST:	65.464	54	0.13641
E**2 ON X TEST: B-P-G (SSR) :	140.731	54	0.00000

Table 5.8 - - Park Test on X_I

X_I	TEST STATISTIC
S11Q16	-1.101968
DEPENDCY	-0.8322299
AGE	2.320493
HIGHED	-1.141721
S10AQ6	2.017749
LNLOAN	-0.8408922

(iv) Test Results on Ln (total consumption expenditure per adult equivalent)

The results of the heteroskedasticity tests for the Ln(EXP) regression are quite different than those of the previous one. First we can see that the Harvey test statistic is not larger than the critical value at the 5% level, but is greater than it at the 10% level. Therefore the Harvey test show signs of heteroskedasticity at the 10% level. The B-P-G test on the other hand shows a clear sign of heteroskedasticity. The test statistic for the Chi-squared distribution is higher than the critical value at the 5% level. Therefore this test also shows signs of heteroskedasticity. These test were followed up by the Park test in order to identify potential sources of the problem. On the 5% level we can see that both the variable AGE and s10aq6 [quantity of land available last year] show signs of heteroskedasticity.

A case can be made to adapt the s10aq6 [quantity of land available last year] in ln(s10aq6). The linear specification of this variable was discussed thoroughly in the model chapter. Additionally, since the variable age would be difficult if not impossible to adapt, the heteroskedasticity corrected estimations will also be run for this regression. The SE are expected to be slightly biased, again the bias should be minimal due to the large sample size.

5.3 - Regression Results

Determining the "Goodness of Fit"

The adjusted R^2 value is the ratio of the explained sum of squares minus (N – K – 1) and the total sum of squares minus (N – 1). The adjusted R^2 is used to estimate the overall fit of the equation in the sample data controlling for the degrees of freedom in the equation (Studenmund, 51).

TABLE 5.9 - OLS ESTIMATION Ln(ASSET) R^2

```
   USING HETEROSKEDASTICITY-CONSISTENT COVARIANCE MATRIX

    R-SQUARE =   0.3212     R-SQUARE ADJUSTED =   0.3030
   VARIANCE OF THE ESTIMATE-SIGMA**2 =   1.1814
   STANDARD ERROR OF THE ESTIMATE-SIGMA =   1.0869
   SUM OF SQUARED ERRORS-SSE=   2380.5
   MEAN OF DEPENDENT VARIABLE =   12.224
      LOG OF THE LIKELIHOOD FUNCTION = -3081.88
```

TABLE 5.10 - OLS ESTIMATION Ln(EXP) R^2

```
   USING HETEROSKEDASTICITY-CONSISTENT COVARIANCE MATRIX

    R-SQUARE =   0.3807     R-SQUARE ADJUSTED =   0.3641
   VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.24750
   STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.49749
   SUM OF SQUARED ERRORS-SSE=   498.71
   MEAN OF DEPENDENT VARIABLE =   13.235
      LOG OF THE LIKELIHOOD FUNCTION = -1464.11
```

The adjust R^2 value in the Ln(ASSET) regression, indicates that 30.3% of the changes in the dependent variable can be explained by changes in the independent variables. For the Ln(EXP) equation this level of fit increases to 36.41%. Keep in mind that the adjusted R^2 values control for the impact of degrees of freedom, by penalizing for the additional variables.

Significance of the Equation: F- Tests

The F-test can be used to test the significance of the equation as a whole. The following section will step through the hypothesis test.

Table 5.11 - Analysis of Variance – from Mean Ln(ASSET)

	SS	DF	MS	F
REGRESSION	1126.3	54.	20.858	17.655
ERROR	2380.5	2015.	1.1814	P-VALUE
TOTAL	3506.9	2069.	1.6950	0.000

Table 5.12 - Analysis of Variance – from Mean Ln(EXP)

	SS	DF	MS	F
REGRESSION	306.62	54.	5.6782	22.942
ERROR	498.71	2015.	0.24750	P-VALUE
TOTAL	805.33	2069.	0.38924	0.000

Hypothesis

Null: $B_1 = B_1 = B_1 = \ldots = B_k = 0$

Alter: Null is not true. Equation is statistically significant.

Test Statistic

Ln (total value of non-land assets per adult equivalent)

$F\text{-stat}_{asset} = 17.655$

Ln (total consumption expenditure per adult equivalent)

$F\text{-stat}_{expend} = 22.942$

Critical Value: DFNum = 40 DFDenom = ∞

5% level = 1.39

1% level = 1.59

Outcomes

$F\text{-stat}_{asset}$ > 1% level > 5% level

$F\text{-stat}_{expend}$ > 1% level > 5% level

This test shows that the estimated coefficients for Ln (total value of non-land assets per adult equivalent) and Ln (total consumption expenditure per adult equivalent)

are statistically different from zero above the 5% level. In other words both equations are statistically significant at the 95% level of confidence.

Significance of the Independent Variables: T-Test and Estimation Results

The following section will show the results from first the Ln(ASSET) model and second, the Ln(EXP) model. Both estimations are calculated using the heteroskedasticity-consistent covariance matrix or HETCOV command in Shazam. Please keep in mind that the definitions of household well-being are different for both estimations. In the Ln(ASSET) regression household well-being is defined as the total value of non-land assets per adult equivalent, and in the Ln(EXP) regression it is defined as the total consumption expenditure per adult equivalent. These estimates are expected to reflect the outcomes just after one of the two main crop seasons, because households were interviewed at these times.

Table 5.13 – Critical Values for T-Tests

Critical T Value:	5%	1%	DF = 2015 using ∞
One sided:	1.645	2.326	
Two sided:	1.96	2.576	

Table 5.1 - T Test for Ln (total value of non-land assets per adult equivalent)

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2015 DF	PARTIAL P-VALUE	STANDARDIZED COEFFICIENT
S2Q6	-0.34393	0.8308E-01	-4.140	0.000	-0.1009
AGE	0.19657E-01	0.9312E-02	2.111	0.035	0.2385
AGESQR	-0.68340E-04	0.9476E-04	-0.7212	0.471	-0.0834
MARRIED	0.24517	0.7770E-01	3.155	0.002	0.0801
HIGHED	0.72164E-01	0.6053E-02	11.92	0.000	0.2519
S81Q1	0.45586	0.1279	3.564	0.000	0.0865
S81Q2	0.55264	0.5114E-01	10.81	0.000	0.2112
S10AQ6	0.69309E-02	0.3520E-02	1.969	0.049	0.1011
S11Q145	0.19507	0.9611E-01	2.030	0.043	0.0346
S11Q16	0.26822E-01	0.8669E-02	3.094	0.002	0.0548
DEPENDCY	0.18990	0.2050E-01	9.263	0.000	0.1840
S10BQ2	-0.16417	0.1208	-1.359	0.174	-0.0501
LNLOAN	0.24514E-01	0.1265E-01	1.938	0.053	0.0757
MFIDUMMY	0.21839	0.2007	1.088	0.277	0.0255
MFISPD2	0.58115E-06	0.5601E-06	1.038	0.300	0.0172

* Results from the District dummy variables are shown in Appendix B.
* Estimations are calculated using the heteroskedasticity- consistent covariance matrix

Table 5.1 summarizes the results for the Ln(ASSET) regression and the t-tests for all independent variables except for the village dummies. In all, there are five insignificant variables in these results. The rest of the t-statistics show statistical significance on at least the 5% level. The gender variable S2q6 was the only variable with an unexpected sign and is also significant. This may be attributed to a survey methodology that is discussed further during an investigation for a statistical break. The following section will interpret the results of the estimation. Note: for every estimated variable, all other variables are held constant.

From s2q6 we can see that male-headed households have 34.39% lower household well-being, as estimated by total non-land assets value per adult. This result is significantly different from zero in the unexpected direction on the 5% level. These unusual results might be an indication of a significant error in the specification, but most likely indicates a problem with data. If there is an error with data, the gender of the

household head will still be controlled for. In that case however the interpretations would be opposite.

Age and Age^2 estimations are both in the expected direction, but only Age is significantly different from zero in the expected direction on the 5% level. As the age of the household head increases by one year, household well-being is increased by 1.9657%. Although Age^2 was not significant it still may be important to control for the theoretical relationship.

The marriage variable (MARRIED) is significant on the 5% level. Households with married household heads have a 24.517% higher level of well-being. This result demonstrates the expected increase in assets through the inclusion of both male and female owned assets.

The household enterprise dummies were both significant on the 5% level. A household owning a crop-farming enterprise (s81q1) is expected to have a 45% higher level of well-being than the omitted group, non-enterprise households. Along the same lines, families owning other enterprises (s81q2) are expected to have a 55.254% higher level of household well-being compared to non-enterprise houses.

The household wealth variable (s10aq6), as estimated by land holdings last year, is significant on the 5% level. As household holdings one year ago increases by one acre, household well-being increases by 0.69309%. Although this variable is significant, the coefficient shows that it has a minimal impact on the dependent variable. Therefore this might be an indication that house land holdings last year might not be an effective proxy for household wealth. This is due to the fact that wealth should be a highly correlated with well-being. However other variables including s81q1-2 might pick up on the level of household wealth. This would explain the lack of impact of s10aq6 on household

well-being. The latter explanation seems most likely since 46% of rural households reported owning a crop-farming enterprise (Uganda: Report on the Socio-Economic, 50).

Households with members in a savings group (s11q145) have 19.507% greater levels of household well-being than households without participants. This variable is significant on the 5% level.

The variable controlling for household coping mechanisms (s11q16) is significant on the 5% level. As the number of people the household head can ask for money in case of emergency increases by one, household well-being increases by 2.6822%.

The education variable (HIGHED) is significant on the 5% level. As a household head's education level increases by one year, household well-being increases by 7.2164%. Considering its extremely high t-score, this variable may also be picking up on the impact of higher levels of wealth. Since education beyond the primary level is largely privatized in Uganda, the years of education of a household head might be correlated to his or her family's wealth.

The dependency variable (DEPENDCY) is significant on the 5% level. As the number of children per adult increases, household well-being as described by total value of non-land assets increases by 18.99%. It should be clear that the dependency ratio is of critical importance to control for, however the magnitude of its impact in this estimation was unexpected. Again it seems possible that the proxy for household wealth might not be effective. If the number of children has a positive relationship with wealth in rural areas and wealth is not controlled for, then this variable could be picking up on the positive correlation. In other words, some of the characteristics of greater wealth could be picked up in the dependency variable. On the positive side of problem, the variable

DEPENDCY should now help to control for some of the beneficial effects of higher income, therefore wealth might be adequately control for.

Although the dummy variable controlling for loan application (s10bq2) is not significant in a two-tailed test, it is still important to discuss its results. Since the value of this variable is negative, it suggests that the self-selection bias may have been properly controlled for with the use of variables for coping mechanisms, education, social networking, and wealth. It can be assumed that the previously mentioned variables have been able to tease out the key differences between applicants and non-applicants in the Ugandan context. This specification can now be used as a starting block for removing the self-selection bias for further econometric studies on microfinance impact. The variable s10bq2 is now thought to control for a households need for a loan. In other words, households in need of loans would be expected to have slightly lower levels of household well-being.

The variable for size of loan received (LNLOAN) is significant on the 5% level using ∞ degrees of freedom. However notice that the partial p-value in table 5.1 shows it is just short of significance with 2015 degrees of freedom. Therefore this result will be considered significant on the 10% level. An increase in loan size of 1% leads to an increase in household well-being by .024514%. This might indicate that the original assets purchased with loans provided negative returns to the household within in a twelve-month period. The relatively small estimated coefficient however, indicates that an increase in general loan size has a minimal impact on household.

The microfinance dummy variable and the microfinance slope dummy variable were both insignificant on the 5% level. This shows that there is no statistically significant difference between the MFI loans and other loans. Additionally from slope

dummy we can see there is no difference in the impact of loan size on well-being between MFI loans and other loans.

The results from both microfinance credit variables are slightly deceiving at first glance. Despite the fact that they are insignificant, they both have positive signs and the MFI dummy variable has a large estimated coefficient. Before assuming that MFI loans have little to no impact on household well-being, *as defined by this dependent variable*, it should be considered that this variable is specified in comparison to all other types of loans. The variable is essentially asking if MFI loans have a significantly greater impact on household well-being than do commercial loans, loans from family and friends, or other loans (controlling for their absolute size but not interest rate). Considering the high interest rates on and intended use of MFI loans, it is no wonder that they have less of an impact on well-being than low interest or unrestricted loans. It should also be noted that MFI loans are often not targeted towards the purchase of physical assets, this too undermines their impact in this model.

Table 5.2 - T Test for Ln (total consumption expenditure per adult equivalent)

VARIABLE NAME	ESTIMATED COEFFICIENT	STANDARD ERROR	T-RATIO 2015 DF	PARTIAL P-VALUE	STANDARDIZED COEFFICIENT
S2Q6	-0.75259E-01	0.3973E-01	-1.894	0.058	-0.0461
AGE	0.31854E-02	0.4300E-02	0.7408	0.459	0.0807
AGESQR	-0.38442E-04	0.4374E-04	-0.8790	0.380	-0.0979
MARRIED	-0.57323E-01	0.3691E-01	-1.553	0.121	-0.0391
HIGHED	0.28710E-01	0.2704E-02	10.62	0.000	0.2091
S81Q1	-0.12583	0.5483E-01	-2.295	0.022	-0.0498
S81Q2	0.11063	0.2311E-01	4.787	0.000	0.0882
S10AQ6	0.11028E-02	0.9502E-03	1.161	0.246	0.0336
S11Q145	0.14651	0.5241E-01	2.795	0.005	0.0542
S11Q16	0.13332E-01	0.4552E-02	2.929	0.003	0.0569
DEPENDCY	0.18490	0.9712E-02	19.04	0.000	0.3739
S10BQ2	-0.95908E-01	0.6116E-01	-1.568	0.117	-0.0611
LNLOAN	0.16215E-01	0.6083E-02	2.665	0.008	0.1045
MFIDUMMY	0.19538	0.7494E-01	2.607	0.009	0.0476
MFISPD2	0.10082E-06	0.2024E-06	0.4980	0.619	0.0062

* Results from the District dummy variables are shown in Appendix B.
* Estimations are calculated using the heteroskedasticity- consistent covariance matrix

Table 5.2 summarizes the results for the Ln(EXP) regression and the t-tests for all independent variables except for the village dummies. In all, there are seven insignificant variables in these results. The rest of the t-statistics show statistical significance on 5% level. The gender variable (s2q6), the statistically insignificant marriage variable (MARRIED), and the crop-farming enterprise variable (s81q1) all have unexpected signs. The following section will interpret *selected* results from the estimation. Note: for every estimated coefficient, all other variables are held constant.

The unexpected sign of the marriage variable (MARRIED) may indicate an omitted variable which would help to describe the spending habits of married families or could possibly just be a characteristic of this particular sample. Note that this variable is not significant on either the 5% or 10% level.

The crop-farming dummy variable (s81q1) is significant on 5% level in the unexpected direction. These results show that crop farmers have significantly lower levels of well-being as described by total consumption expenditure per adult.

Specifically, crop-farming families have 12.583% less expenditure (or lower well-being) than the omitted non-enterprise families. The recent global decline in cash-crop prices might explain this lower level of expenditure. This contrary result demonstrates a key difference between this Ln(EXP) and Ln(ASSET) regressions. Lower expenditure by crop farmers should be expected in future literature.

The "other enterprise" dummy variable (s81q2) is significant on the 5% level in the expected direction. Households owning "other" enterprises have a 11.063% greater level of well-being, as described in the Ln(EXP) regression.

The wealth variable (s10aq6) is not significant on the 5% level. This again points to a misspecification of a wealth proxy. Other alternatives should be explored. However keep in mind those variables such as HIGHED, DEPENDCY, s11q145, s81q1-2 should all help to control for some of the impacts of wealth.

The savings dummy (s11q145) indicates that households with savings group members have 14.651% greater levels of well-being that houses without members on the 5% level.

The loans size variable (LNLOAN) in this model is significant on the 5% level. As the size of the loan increases by 1%, household well-being increases by .016215%. This variable again demonstrates negative twelve-month investment returns from loans received within the last year.

The microfinance dummy variable results (MFIDUMMY) indicate that if the loan is taken from a microfinance bank, household well-being is 19.538% higher compared to loans from other sources. This variable is statistically significant on the 5% level. Please keep in mind that MFIDUMMY is only a proxy for microfinance loans, and is most accurately described as non-governmental organization loans.

Again the microfinance slope dummy (MFISPD2) shows no differential impact of loan size on well-being between MFI loans, and other sources.

5.4 A Comparative Discussion

From the results chapter we can see that there are a number of differences between the results of the Ln(ASSET) and Ln(EXP) regressions despite the identical specification of independent variables. This is due to the fact that household well-being, or standard of living, are calculated differently for the two estimates. The following few paragraphs will discuss some of the differences from the results, attempt to explain these, and make suggestions accordingly.

The first major difference appears in the results of the crop-farming dummy variable (s81q1). In the Ln(ASSET) regression this variable was positive and significant, and in the Ln(EXP) estimation it was negative and significant. It should be clear that neither result is the outcome of bias so much as differences in theory. In Ln(ASSET), crop-farming households have higher levels of well-being because they own additional assets in order to maintain their enterprise. In the Ln(EXP) estimates, crop-farming families may have less consumption expenditure per person most likely because of the declining profitability of crop-farming. *In this case total consumption expenditure might be a better indicator of a household's overall well-being because it observes the decline in expenditure on any combination of food, clothing and education.* The Ln(ASSET) estimation of s81q1 overestimates crop-farmers' current level of well-being by basing the proxy for well-being on the acquisition of non-land assets, which most likely includes items such as hoes, simple plows, and other agricultural equipment. *The Ln(ASSET) estimations may however be a better indicator of long run well-being since productive*

assets could increase efficiency and help increase enterprise output. Both regressions can be evaluated within this new context.

The most important difference between the two regressions involves the key variable of the models, the microfinance dummy variable (MFIDUMMY) which also includes the impact of other NGO loans. As we saw in the results chapter the MFI dummy was significant only for the Ln(EXP) regression. At a glance this might indicate that loan recipients are more likely to use MFI loans for basic consumption than other loans. On the other hand this seems unlikely for two reasons: first, microfinance institutions utilize social pressure as well as formal loan tracking in order to ensure the proper use of their loans, secondly, many MFI loans are explicitly intended for investment into items that are included in the calculation of consumption expenditure; for instance working capital used for an agricultural market stand. As a side note my own personal experience with MFIs in Uganda is limited to the urban areas of the Kampala and Mbarrara districts. I am unsure if the use of MFI loans for working capital is as prevalent in rural areas as it is in urban ones. Nonetheless, the point can be made that the impact of these loans within the two regressions is relative to the intended purpose of the loans.

Although biased, my own experience compels me to believe that MFI loans will tend to focus on items included under consumption expenditure instead of non-land asset value. This would suggest that again Ln(EXP) might be a better indicator of the impact of MFI loans and of household well-being in general, especially since it includes expenditure into education; without which it might be considered a shortsighted indicator. Both estimates however may be useful if their relative merits are thoroughly considered in the evaluation.

5.5 The Chow Test

This chow test is used to check for a structural difference between mutually exclusive household types within the sample. First it will be tested whether or not there is a statistically significant difference between the total non-land assets of female and male headed households. Next the same test will be done on the household expenditure regression.

Is there a statistical break between male and female household head?

```
*TOTAL ESTIMATE Ln(ASSETS)
   OLS ESTIMATION
   2070 OBSERVATIONS     DEPENDENT VARIABLE= LNOLNDAS
   ...NOTE..SAMPLE RANGE SET TO:      1,   2070

    R-SQUARE =   0.3212     R-SQUARE ADJUSTED =   0.3030
   VARIANCE OF THE ESTIMATE-SIGMA**2 =   1.1814
   STANDARD ERROR OF THE ESTIMATE-SIGMA =   1.0869
   SUM OF SQUARED ERRORS-SSE=   2380.5
   MEAN OF DEPENDENT VARIABLE =   12.224
   LOG OF THE LIKELIHOOD FUNCTION = -3081.88


*FEMALE ESTIMATE Ln(ASSETS)
   OLS ESTIMATION
   367 OBSERVATIONS     DEPENDENT VARIABLE= LNOLNDAS
   ...NOTE..SAMPLE RANGE SET TO:      1,    367

    R-SQUARE =   0.3695     R-SQUARE ADJUSTED =   0.2698
   VARIANCE OF THE ESTIMATE-SIGMA**2 =   1.2731
   STANDARD ERROR OF THE ESTIMATE-SIGMA =   1.1283
   SUM OF SQUARED ERRORS-SSE=   402.30
   MEAN OF DEPENDENT VARIABLE =   12.316
   LOG OF THE LIKELIHOOD FUNCTION = -537.600
```

*MALE ESTIMATE Ln(ASSETS)

```
   OLS ESTIMATION
   1703 OBSERVATIONS     DEPENDENT VARIABLE= LNOLNDAS
   ...NOTE..SAMPLE RANGE SET TO:    368,   2070

    R-SQUARE =   0.3423     R-SQUARE ADJUSTED =   0.3215
   VARIANCE OF THE ESTIMATE-SIGMA**2 =   1.1421
   STANDARD ERROR OF THE ESTIMATE-SIGMA =   1.0687
   SUM OF SQUARED ERRORS-SSE=   1884.4
   MEAN OF DEPENDENT VARIABLE =   12.204
   LOG OF THE LIKELIHOOD FUNCTION = -2502.63
```

Hypothesis:

Null: Coefficients are equivalent

Alt: Null is not true, coefficients are not equivalent

Test Statistic:

F-stat = 1.490

Critical Value: DFNum = 40 DFDenom = ∞

5% level = 1.39

1% level = 1.59

Outcome

5% level < F-stat < 1% level

Conclusions – Ln(ASSET)

For the Ln(ASSET) regression the test statistic is greater that the critical value at the 5% but not at the 1% level. Therefore there is a statistical break between male and female headed households ln(total non-land assets per adult equivalent) at the 5% confidence level. This means that, in the Ln(ASSET) regression, there is a statistical difference between the level of well-being for male and female headed households.

*TOTAL ESTIMATE Ln(EXP)

```
   OLS ESTIMATION
   2070 OBSERVATIONS     DEPENDENT VARIABLE= LNEXP
```

```
   ...NOTE..SAMPLE RANGE SET TO:      1,   2070

    R-SQUARE =   0.3807     R-SQUARE ADJUSTED =   0.3641
   VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.24750
   STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.49749
   SUM OF SQUARED ERRORS-SSE=   498.71
   MEAN OF DEPENDENT VARIABLE =   13.235
   LOG OF THE LIKELIHOOD FUNCTION = -1464.11
```

*FEMALE ESTIMATE Ln(EXP)

```
   OLS ESTIMATION
   367 OBSERVATIONS     DEPENDENT VARIABLE= LNEXP
   ...NOTE..SAMPLE RANGE SET TO:      1,    367

    R-SQUARE =   0.4589     R-SQUARE ADJUSTED =   0.3733
   VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.26585
   STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.51561
   SUM OF SQUARED ERRORS-SSE=   84.010
   MEAN OF DEPENDENT VARIABLE =   13.349
   LOG OF THE LIKELIHOOD FUNCTION = -250.193
```

*MALE ESTIMATE Ln(EXP)

```
   OLS ESTIMATION
   1703 OBSERVATIONS     DEPENDENT VARIABLE= LNEXP
   ...NOTE..SAMPLE RANGE SET TO:    368,   2070

    R-SQUARE =   0.3795     R-SQUARE ADJUSTED =   0.3600
   VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.24228
   STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.49222
   SUM OF SQUARED ERRORS-SSE=   399.77
   MEAN OF DEPENDENT VARIABLE =   13.211
   LOG OF THE LIKELIHOOD FUNCTION = -1182.40
```

Test Statistic:

F-stat = 1.21

Critical Value: DFNum = 40 DFDenom = ∞

5% level = 1.39

1% level = 1.59

Outcome

F-stat < 5% level

Conclusions – Ln(EXP)

The test statistic for the Ln(EXP) regression is less that both critical values at the 5% and the 1% levels. Therefore there is *no* statistical break between male and female headed households ln(total non-consumption expenditure per adult equivalent) at the 5% confidence level. This result is unexpected and may indicate the existence of some unexplained variable or possibly some error in data collection.

It should be noted that the significance of this estimate (as well as the past one) might have a downward bias due to the format of the household survey. If the male head is not present at the time of the interview then the female spouse may be interviewed in his absence (Uganda: Manual of Instructions, 18). In this case under the restrictions of the survey, this family is assumed to be female-headed. This will put upward pressure on the value of assets and expenditure in female-headed households, and therefore undermine the differences in between the two household types. This could possibly explain why there is no statistical break in the Ln(EXP) regression.

In addition there are a number of polygamous households in Uganda. This would put downward pressure on the value of assets and consumption expenditure in male-headed households since the male's income and assets are spread across different families. This cultural incidence would also narrow the gap between male- and female-headed households, thereby decreasing the significance of the chow test statistic.

Chapter 6: Conclusions

Intensive econometric microfinance impact assessments for Sub-Saharan Africa appear to be almost non-existent within the greater body of literature. This paper should help to fill this large gap in academia. This section will sum up the results of the paper, make suggestions for further research, and construct policy recommendations. For the most part this study corroborates with the majority of the selected literature, finding a positive impact from microfinance loans on households in Uganda.

Two different calculations of household standard of living or household well-being were constructed for this paper. In the Ln(EXP) regression well-being was defined as the total household consumption expenditure per adult equivalent, and in the Ln(ASSET) regression was defined as the total value of non-land assets per adult equivalent. The results are expected to be biased upwards, yet more significantly in Ln(EXP), since households were interviewed just after one of the two main crop seasons.

The models have high levels of significance for both the models themselves, and the independent variables. Tests indicated the existence of heteroskedasticity, which was corrected with the use of a heteroskedasticity corrected covariance matrix. This technique largely removes the effects of heteroskedasticity, but leaves the standard errors with a minimal bias.

The self-selection bias is a common issue in microfinance impact literature. Self-selection bias is the idea that persons whom apply for MFI loans are considered to have certain beneficial characteristics; these might include intelligence, gumption, or know-how. In this paper the self-selection process is controlled for with the use of a self-selection dummy variable. This variable then teases out the differences between those

whom do apply and do not apply for a loan. The results from this variable suggest that self-selection may have already been properly controlled for with the use of a few innovative variables, these most likely include: the savings dummy (s11q145), the networking / coping mechanism variable (s11q16), the education variable (HIGHED), and thus may be considered for removal in future works. These self-selection descriptive variables should be considered for inclusion in future literature in order to remove the effects of self-selection.

The relative merits of both estimations are discussed thoroughly in the "A Comparative Discussion" section of the fifth chapter. This section had concluded that Ln(EXP) might be a better overall model, and Ln(ASSET) a better long run model.

Within this context, the results indicate that NGO loans used as a proxy for MFI loans can have a positive and significant impact on household well-being in the Ln(EXP) regression and a positive but insignificant impact in the longer run Ln(ASSET) regression. The results from the Ln(EXP) estimates are consistent with those in other literature; no literature using assets as the dependent variable was located in time for this paper. These results indicate that microfinance loans *are* a viable and potentially powerful tool for poverty alleviation in Uganda.

Another influential result was that of the dummy variable for participation in a savings group (s11q145). This variable was positive and significant for *both* estimations. Additionally the relative size of the estimated coefficients were quite high. In fact, the impact of savings groups on household well-being was nearly that of microfinance loans and greater than the returns from an additional year of education for the household head. All together this indicates that the promotion of savings or savings groups may be another extremely powerful tool for poverty alleviation within the Ugandan rural context.

The recent efforts by President Museveni to bring free Universal Primary Education (UPE) to his country are supported by the highly positive returns to an additional year of education for the household head. At the upper bound, each additional year of education to current and future household heads could increase household well-being by 7.4% on average.

The results of the Chow test suggested that there was a statistically significant break between the level of male- and female-headed household well-being in the Ln(ASSET) regression and not in the Ln(EXP) regression. In other words male-headed households have higher levels of well-being, as it is defined in the Ln(ASSET) model; This is not the case with the Ln(EXP) model. The lack of significance in the Ln(EXP) model can be attributed to a number of factors, ranging from technical problems with the survey or model, and the effects of polygamy.

This paper intentionally pushed the boundaries of conventional microfinance analysis; hopefully these models will help create a better, more innovative knowledge base for future evaluations. Since there were a number of atypical variables and usual variable specifications, this paper should be thoroughly examined before making decisions based on its results. The degree of generality from these results should be related to the reader's confidence in the methods and specification used.

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Table of Variables

Independent Variables	Definitions
[AGE]	HHH Age
[AGESQR]	HHH Age^2
[S2Q6]	HHH gender (male =1)
[MARRIED]	HHH Marital Status (Married = 1 Other = 0)
[HIGHED]	HHH Years of Schooling
[S81Q1]	Does household have a crop farming enterprise? (Yes = 1)
[S81Q2]	Does household have any other enterprise? (Yes = 1)
[S10AQ6]	Total land quantity 12 months ago in acres
[S11Q145]	Household member of savings group (Yes = 1)
[S11Q16]	Number of people that family could ask for money in emergency
[DEPENDCY]	Dependency Ratio (# Children / # Adults)
[S10BQ2]	Household member applied for credit in the last 12 months (Yes = 1)
[LNLOAN]	Ln(Amount of credit received last 12 months)
[MFIDUMMY]	MFI loan source? (MFI =1, other =0)
[MFISPD2]	Microfinance Slope Dummy
[DIS X]	District dummy variables