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THE INFLUENCE OF MICROFINANCE ON THE EDUCATION DECISIONS OF RURAL HOUSEHOLDS: EVIDENCE FROM BOLIVIA

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Abstract

Increased access to education will be key in any efforts to improve the quality of rural life and the welfare of the next generation in developing countries. Microfinance programs have been among components of strategies for poverty alleviation that have attempted to address this challenge. This essay uses data from three different surveys of households of clients of microfinance organizations (MFOs) in Bolivia to examine several channels through which microfinance may exert an influence on education outcomes. Five channels are identified, designated as income, risk-management, child-labor demand, gender, and information effects.

Based on an econometric specification that explains schooling decisions at the household level, regression models are used to examine determinants of education achievements and to make inferences about the potential influence of microfinance, through these channels, on those achievements.

The results challenge usual assumptions in microfinance programs. In particular, for some ranges of household income and some types of borrowers, access to loans has conflicting effects on school enrollment. On the one hand, loans increase the demand for education as a result of income, risk-management, gender, and information effects. On the other hand, credit-constrained households that cultivate land or operate labor-intensive microenterprises discover new demands for child labor, either for farming, working in the microenterprise, or taking care of siblings while the mothers operate the new or expanded business. Significant program and policy consequences are derived from these paradoxical results.

Key words: microfinance, development, poverty alleviation, education, school enrollment, Bolivia.

JEL classification: C25, D13, G20, I21, J22, J24, O12, O16, O18, O54.

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LA INFLUENCIA DE LAS MICROFINANZAS SOBRE LAS DECISIONES DE EDUCACION EN HOGARES RURALES: EVIDENCIA DE BOLIVIA

Resumen

El mayor acceso a la educación es una herramienta clave en cualquier esfuerzo por mejorar la calidad de vida y el bienestar de las futuras generaciones en los países en desarrollo. Los programas de microfinanzas han estado entre los componentes de las estrategias para aliviar la pobreza que han intentado enfrentar este reto. Este ensayo usa datos de tres encuestas a hogares clientes de organizaciones microfinancieras (OMF) en Bolivia para examinar diferentes canales a través de los cuales las microfinanzas pueden generar impacto sobre el desempeño educativo. En particular, se identifican cinco canales denominados efecto ingreso, efecto manejo de riesgo, efecto demanda por trabajo infantil, efecto género y efecto información.

Con base en un modelo econométrico que explica las decisiones de educación a nivel de hogares se examinan los determinantes de los avances en educación y se hacen inferencias sobre el efecto potencial de las microfinanzas sobre estos avances, a través de los canales identificados.

Los resultados desafían los supuestos usuales acerca de los programas de microfinanzas. En particular, para algunos rangos de ingreso del hogar y algunos tipos de clientes, el acceso a crédito tiene efectos conflictivos con la permanencia de los niños en el sistema educativo. De un lado, el crédito incrementa la demanda por educación como resultado de los efectos ingreso, manejo de riesgo, género e información. Del otro lado, hogares con restricciones en el mercado crediticio, que cultivan o tienen microempresas intensivas en mano de obra, descubren nuevas demandas por trabajo infantil, bien sea para trabajar en el cultivo o en la microempresa o para cuidar niños menores mientras las madres trabajan en las nuevas actividades productivas. De estos resultados paradójicos se derivan significativas consecuencias de política.

Palabras clave: microfinanzas, desarrollo, educación, vinculación escolar, reducción de pobreza, Bolivia.

Clasificación JEL: C25, D13, G20, I21, J22, J24, O12, O16, O18, O54.

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1. Motivation

To alleviate poverty is one of the most significant challenges for developing countries in the current century. Human capital formation has been recognized as an effective tool for reducing poverty in the long run (Schultz, 1961; Bils and Klenow, 2000; Krueger and Lindahl, 2000). Particularly in the rural areas of developing countries, however, access to education is limited (Barro and Jong-Wha, 2000). Some concerned observers highlight supply constraints, due to lack of infrastructure and resources (*e.g.*, roads, schools, teachers and materials). Low schooling achievements may also reflect, however, the consequences, on the demand for education, of severe budget constraints and of a competing demand for the youth's labor.

In particular, the demand for education depends both on household preferences and on budget constraints that are influenced by income levels. If a sufficiently high marginal value is placed on the education of family members, increases in income will result in higher expenditures in schooling. That is, there is a positive income elasticity of the demand for education. For some ranges of income, this elasticity may be even greater than one, with expenditures in education increasing at a faster rate than income.

In turn, given the labor-supply potential of children, a low household income implies a high opportunity cost of keeping them in school. In particular, the marginal utility of one extra unit of income may be higher for a poor household, in which case this opportunity cost is higher for a poorer than a richer household. Therefore, income levels are expected to positively influence the schooling decisions of poor households, while adverse shocks that reduce income are expected to negatively influence these decisions. At the same time, because the higher productivity of better-educated household members may be rewarded in the labor market with higher incomes, prospects about production and employment opportunities will influence those decisions (Duryea and Pagés, 2002).

Child labor may be demanded either to fulfill the household's basic income-generating requirements or to take care of younger siblings, so as to facilitate the labor efforts of more productive household members. Further, differential schooling outcomes may reflect

cultural factors (e.g., the traditional division of labor and expectations about gender roles as well as differences in male-female preferences).

Financial services (loans, payments instruments, and deposit facilities) allow households to take fuller advantage of their productive opportunities, facilitate consumption smoothing in the presence of unstable and seasonal income flows, and offer tools for risk management when adverse income shocks occur, thereby reducing the vulnerability associated with poverty (Sharma and Zeller, 1999). In turn, higher and particularly more stable income flows positively influence the demand for schooling.

Typically, however, information, incentive, and contract enforcement problems severely constrain the access of poor rural households to formal financial markets (González-Vega, 2003). Moreover, because human capital cannot be seized and transferred to a lender in the event of default, it cannot be used as collateral; consequently, the poor must fund their educational choices out of their past wealth, retained earnings, or abstention from current productive work or consumption. Because they are poor, the marginal cost of doing so may be prohibitively high (Ray, 1998).

The typical shortcomings of credit markets accentuate the joint causation between income and human capital. Combined with increasing returns to investment in education, these shortcomings generate poverty traps (Bardhan and Udry, 1999). Relatively wealthy households, able to invest in human capital, earn high incomes and remain wealthy. In contrast, the poor are unable to invest in human capital, continue to earn low incomes, and remain poor.

Through innovations in cost-effective lending technologies, microfinance organizations (MFOs) have been offering mostly credit and sometimes deposit facilities for savings to segments of the rural population otherwise without access to formal finance (Rodríguez-Meza and González-Vega, 2003; Quirós, Rodríguez-Meza and González-Vega, 2003; Navajas and González-Vega, 2003). These innovations have allowed households without traditional collateral to pledge their reputation in the community and the present value of their relationship with the MFO –based on their future ability to generate income from their microenterprises and on their human capital formation– as a guarantee on their loans.

Some observers have hoped that this might be an important mechanism to influence, directly or indirectly, outcomes about education.

The available literature has identified different channels through which microfinance may influence human capital formation. In this essay, these effects and some new ones are grouped into five categories.

First, it is widely recognized that income levels influence schooling (Behrman and Knowles, 1999). Changes in income modify the ability of households to afford the opportunity costs of education. To the extent to which microfinance may influence the growth of the incomes of poor households, it may influence the demand for schooling (***income effect***).

Second, the vulnerability of rural households to adverse exogenous shocks and the volatility of their incomes not only influence their ability to afford the opportunity costs of education but also force them to engage in risk-coping strategies that may require pooling their children out of school and do not allow sustained enrollment over time. This outcome may be transitory, unless there are poverty traps, either because school expenses can no longer be afforded or because the children are needed to earn extra income indefinitely. The absence of the usual remedies for risk, such as borrowing and insurance benefits results in the adoption of costly income smoothing strategies (Deaton, 1997). In order to cope with risk, poor households frequently adopt diversified production plans and employment and migration strategies, even if these actions entail lower average incomes (Morduch, 1995). In addition, households smooth consumption by using financial savings, selling assets, taking children out of school, and developing informal insurance and credit arrangements (Kanbur and Squire, 2001). Access to loans from MFOs –particularly when emergency loans are offered, such as those from the internal account of village banks– reduce the probability that children will be withdrawn from school when adverse shocks occur.

Jacoby and Skoufias (1997), among others, show how poor households affected by income shocks withdraw their children from school: a ten-percent decline in agricultural income across seasons caused a fall in school attendance of five days in a sample of six Indian villages. Access to microfinance may thus improve a household's ability to

anticipate and cope with income shocks and may thereby positively influence the demand for education (*risk-management effect*).

Third, several studies have hypothesized that, compared to men, women show a stronger preference for educating their children (Thomas, 1990; Behrman and Rosenzweig, 2002; Sallee, 2002). If preferences toward education are gender-related and if microfinance improves access to loans by women and, thereby, changes their power to influence household schooling decisions, the rate of human capital formation may be altered by access to these services (*gender effect*). This approach substitutes a bargaining process within the household for the traditional unitary model of optimization of a single preference set (Haddad, Hoddinott, and Alderman, 1997). The outcome of this bargaining process reflects gender differences both in preference functions and in relative power in influencing household decisions (Phipps and Burton, 1995; McElroy, 1997; Nanda, 1999).

Fourth, given uncertainty about the future, imperfect information about opportunities, and high private discount rates, in large part due to poverty, household choices about education may be shortsighted. These choices may be revised with the acquisition of new knowledge that either modifies intertemporal preferences or changes perceptions about the value of schooling. If access to microfinance changes perceptions about opportunities or allows learning about potential returns, it may have this impact (*information effect*). In effect, higher levels of the education of the parents have been found to positively affect schooling decisions (Lillard and Willis, 1994).

In particular, preferences about schooling may be influenced by adult training programs that highlight education as a tool for income generation or as a determinant of the standards of living. Some MFOs, as is the case of CRECER and Pro Mujer in Bolivia, hold meetings with their borrowers on a regular basis and take advantage of these meetings to disseminate information about healthy reproduction, nutrition, and child education, among others. The influence of these credit-cum-education programs in improving standards of living is subject to great debate (MkNelly and Dunford, 1999; Littlefield, Morduch and Hashemi, 2003).

An additional and important debate questions the optimality, from an organizational perspective, of jointly providing credit and other non-financial services. On the one hand,

there may be economies of scope for both provider and client from this joint provision. On the other hand, the supply of non-financial services may jeopardize the pursuit of financial sustainability by the MFO, through diseconomies from overburdening the organization's management capabilities or from signals that weaken borrower discipline and willingness to repay (González-Vega, 1998; Rhyne and Otero, 1992). The present essay does not address these issues.

The analysis is, in this respect, incomplete, in that it only assesses the marginal value of the supply of credit-cum-education services, but it does not measure the marginal cost of providing these services. These organizations may actually face a trade-off between successfully offering non-financial services and a package of fairly simple (rudimentary but still valuable) financial services versus offering a broader and more diversified menu of just financial services, as other MFOs do (Quirós, Rodríguez-Meza and González-Vega, 2003). Moreover, the cost-benefit evaluation of these approaches must take into account the initial conditions of the target segment of the population and the existing government infrastructure for the delivery of these services.

Fifth, there is a growing literature on the influence of the demand for child labor on schooling outcomes (Psacharopoulos, 1997; Jensen and Nielsen, 1997; Patrinos and Psacharopoulos, 1997; Grootaert and Patrinos, 1999; Trigueros, 2002). Additional productive activities, made possible by access to microfinance, may change household demands for child labor directly, in the newly-created or expanded microenterprises, or indirectly, in child care or in farm and livestock duties, and other household chores (***child-labor demand effect***).

The purpose of this essay is to evaluate the influence of microfinance on human capital formation by looking at whether children from rural households with access to just credit or to credit-cum-education programs are kept longer in school than children from households with no access to these programs.

2. Methodology

The assessment of impact, which involves attributing specific effects to specific interventions, encounters formidable methodological problems (Ravallion, 2001). Meyer (2002) claims that the measurement and attribution of impacts of microfinance on clients is the most difficult and controversial aspect in the evaluation of the performance of MFOs. To illustrate these problems, following Ravallion (2001), denote P_i as the participation of the household in the program (for instance, the parent of the i th child gains access to microfinance services), where $P_i = 1$ if the child's parent participates and $P_i = 0$ if he/she does not. If the household does not participate, the child's education outcome is S_{0i} . If the household participates, the education outcome for the child is S_{1i} . The gain in education achievement, G_i , due to participation in the microfinance program for a household that does in fact participate is:

$$G_i = S_{1i} - S_{0i} \mid P_i = 1 \quad (1)$$

An unbiased estimate of the true mean gain in education achievement will be:

$$G = E(S_{1i} - S_{0i} \mid P_i = 1) \quad (2)$$

This gain is the average increase in schooling for those households that participate in the microfinance program compared to those that do not. From the available information, however, one is usually not able to calculate G . Instead, information is available on the outcome for children from participating families and for children from non-participating families. To obtain an estimate of the gain, D , one can set:

$$D = E(S_{1i} \mid P_i = 1) - E(S_{0i} \mid P_i = 0) \quad (3)$$

There is a simple identity relating G and D , given by

$$D = G + B \quad (4)$$

where B refers to the bias in the estimate. This bias is given by

$$B = E(S_{0i} \mid P_i = 1) - E(S_{0i} \mid P_i = 0) \quad (5)$$

The bias is the expected difference in outcome (schooling) without treatment (participation in the microfinance program) between households that did in fact participate and those that did not. The bias could be corrected if one knew $E(S_{0i} | P_i = 1)$, but there is no way of having a sample estimate of this magnitude: one cannot observe what the performance would have been for children whose families actually participated in the program, had they not participated. The bias arises if there is a difference in mean outcome between the treatment and non-treatment groups in the absence of the program; that is, if there would have been a difference between the outcome of children from borrowing and children from non-borrowing families in the absence of microfinance services, due to some other unobserved circumstances, such as the parents' drive, or to other reasons.

Therefore, one important dimension of these difficulties, of relevance here, is the possibility of selection bias. Both the selection of clients and program placement are sources of concern. The first concern arises because MFO clients will not likely be randomly selected; rather, they possess characteristics that are systematically different from those of a randomly selected sample and, therefore, also of non-participants.

Self-selection into the program can occur because of systematic differences in preferences among those who choose to participate and those who do not. Moreover, if the lender uses a systematic creditworthiness-screening criterion, borrowers should differ from non-borrowers. Non-participants, therefore, are a non-equivalent comparison group. Ignoring this source of potential endogeneity can lead to biases due to the omission of unobserved relevant variables (Moffitt, 1991).

A second concern arises because MFOs choose to start operations in areas with specific attributes, such as communication and transportation facilities or conglomerates of target clienteles (Pitt and Khandker, 1998). Programs may be developed in localities that are either more dynamic than others are or where the incidence of poverty is greater. Unmeasured locality factors and household attributes may simultaneously affect the demand for program participation, women's empowerment, and the demand for education. This possibility of selection bias implies a difficulty to determine if differences between groups are due to the supply of microfinance services or to non-representative clients and locations.

To face the problem of selection bias, it is desirable to identify what would have happened without participation; that is, we need to use an appropriate comparison group. This group is designed to be representative of the treatment group of participants, with the only difference being that the comparison group did not participate in the program. To accomplish this, different approaches may be available:

- *Randomization.* The selection into the treatment and comparison groups would be random among some well-defined set of people. In this way, the only difference between the two groups would be due to the participation decision. However, given screening and program targeting (e.g., MFOs focusing on certain groups), participation is unlikely to be unbiased.
- *Matching.* The comparison group is matched to the treatment group on the basis of a set of observed characteristics or using the propensity score (that is, the predicted probability of participation, given observed characteristics).
- *Reflexive comparisons.* A baseline survey of participants is undertaken before the intervention, and a follow-up survey is implemented afterwards. The baseline provides the comparison group, and impact is measured by the change in outcome indicators before and after participation.
- *Double difference methods.* Treatment and comparison groups are compared (first difference) before and after a program (second difference).
- *Instrumental variables method.* Variables that matter for participation but not to outcomes given participation are used. These variables, if they exist, identify a source of exogenous variation in outcomes attributable to the program. Instrumental variables are first used to predict program participation, and then an outcome indicator is evaluated as a response to predicted values.

The feasibility of some of these methods may be limited by different circumstances. For instance, they may be too costly, and to obtain the desired information may be too difficult or impossible to accomplish.

Following Ravallion (2001) and Heckman (1997), there is an econometric design that can be useful to capture the differences between groups relevant for the test. Suppose a regression model is estimated, where the dependent variable is the outcome to evaluate

(S_i). The independent variables should include participation in the program (P_i) and control variables (X_i) related to the individual, the family, and the environment. Therefore, the specification would be:

$$S_i = \alpha + \beta P_i + \gamma X_i + \varepsilon_i \quad (6)$$

It is expected that β accounts for the difference due to the program. However, this regression does not allow the impact of the program to vary with X . That is, impact is the same for everyone, which may not be the case if one expects differences between groups beyond actual participation. To face this possibility, let the mean outcome for non-participants be $\alpha_0 + \gamma_0 X_i$ and the mean outcome for participants $\alpha_1 + \gamma_1 X_i$, such that

$$S_i = (\alpha_1 + \gamma_1 X_i + \varepsilon_{i1})P_i + (\alpha_0 + \gamma_0 X_i + \varepsilon_{i0})(1 - P_i) \quad (7)$$

where ε_0 and ε_1 are random errors with mean zero and uncorrelated with X . This equation can be written as

$$S_i = \alpha_0 + (\alpha_1 - \alpha_0)P_i + \gamma_0 X_i + (\gamma_1 - \gamma_0)X_i P_i + \varepsilon_i \quad (8)$$

and the impact of the program for individual i would be

$$\frac{\partial S_i}{\partial P} = (\alpha_1 - \alpha_0) + (\gamma_1 - \gamma_0)X_i \quad (9)$$

This allows computation of the mean program impact for the whole sample. If the right-hand side (RHS) variables are not exogenous, however, OLS estimates of the parameter will be biased even in large samples. That is, the RHS variables must be determined independently of the outcome-decisions choices, so that they are uncorrelated with the error term in the regression.

For the samples analyzed here, due to non-random placement, the estimation results may be biased. The implicit assumption is that ε_i is independent of P_i , but some unobservable characteristics accumulated in ε_i are not independent of participation decisions. To be sure that the results are still valid, the instrumental variables approach must be used. Suppose participation can be expressed as

$$P_i = \phi + \theta Z_i + \eta_i \quad (10)$$

where Z_i is a set of variables that includes all the variables used in targeting clients by the MFO placement decisions. If X includes all the variables in Z that also influence the outcome, and the error term η is uncorrelated with the error term ε , an OLS regression will generate an unbiased estimate of β . This method is called *selection on observables* (Heckman and Robb, 1985). However, it only works if the initial assumptions hold: (i) That there are no unobserved determinants of participation, and (ii) that ε contains variables not available in the survey but that do affect the participation in the program. These variables may be correlated with η , and ε will not have zero mean, given X and P . In the end, there will be correlation between ε and η . Given the threat of self-selection bias before the sample is collected, there is some risk of still obtaining a bias in the estimates.

The use of instrumental variables, which is the classic solution for the problem of an endogenous regressor, is based on the inclusion of some observable source of exogenous variation in program participation. That is, this source of variation is correlated with P but it is not already in the regression for the outcome and it is not correlated with the error term ε . This implies that one needs at least one variable in Z that is not in X and that is not correlated with ε . Then, the instrumental variables estimate of the program's impact is obtained by replacing P by its predicted value, conditional on Z . Since the predicted values depend only on the exogenous variation due to the instrumental variable as well as on the other exogenous variables, the unobservable variables are no longer a problem, since they will be uncorrelated with the error term in the regression for the outcome.

Because the source of bias in the estimate of impact is the correlation between the error term in the outcome equation and the error term in the participation equation, a common practice is to add the residuals from the first-stage equation for participation to the equation for outcome. In this way, the actual participation variable is in the outcome regression and, because the error term estimate has been added to the outcome regression, participation can be treated as exogenous and OLS can be used (Ravallion, 2001).

Given severe information constraints, this essay modestly attempts to minimize potential selection problems. The issues were addressed by using a cohort approach in the sampling process, with results similar to those from reflexive comparisons. Participants were controlled according to their seniority; that is, their length of permanence as clients of the MFO. From this perspective, they were separated into *old* clients, with more than one year in the program, for whom benefits (such as education impacts) would have already accrued, and *new* clients, with one year or less of participation, who have successfully passed the credit screening mechanism but for whom benefits would not have yet accrued. Therefore, the key assumption is that those who have been members of the program for a short period (*i.e.*, less than a year) have not had enough time to increase their incomes or change their attitudes toward schooling and the expected results will not be observed. They are a control group for comparison to households with members who have received credit and non-formal education for longer periods. Self-selection may still be present, nevertheless, if older participants possess unobserved features that differ in degree from those of more recent participants. This could be the case, for example, if the organization's screening criteria have changed in ways that influence non-observed variables.

When dividing the sample into *old* clients (more than one year of permanence as a client) and *new* clients, I control for those variables that are unobservable but that induce participants to become clients, with the advantage that new clients have not yet been exposed to the benefits of the microfinance program, while old clients have. In this way, the inference that schooling differences between the children of old and new clients –after controlling for demographic and environmental variables– are the effect of the program is a reasonable inference as is the expectation that these estimates are unbiased. These results cannot be compared, however, with the performance of non participants, as there is no information about them in the surveys.

3. The Model

Based on Schultz (1993), Lardé de Palomo and Argüello de Morera (2000) recognize that in developing countries, the late incorporation of children to the schooling system and their early withdrawal are mostly due to demand factors. When parents decide about their children's schooling, they choose to allocate a fraction of household income to education, according to the profitability of schooling that they perceive. This perception depends, in turn, on the parents' own level of education and on features of the economic environment. Credit-cum-education programs may influence these perceptions. Behrman, Pollack, and Taubman (1986) further argue that resources for education are split according to the number of children, their gender, and their age, given household composition and the severity of the budget constraint.

In the rural areas of developing countries, moreover, the demand for schooling is influenced by determinants of other forms of human capital that may substitute for or complement education and that are influenced by microfinance-cum-education programs (such as health and nutrition), by productivity gains and the diversification of the sources of labor income (also influenced by access to microfinance), by flows of non-labor income, such as subsidies and remittances, and by the ownership of assets that can be used as collateral for loans. Khandker (1998) found that, in Bangladesh, microloans had a significant impact on the children's schooling, especially for boys. This finding would imply that the child's gender may also matter. Indeed, for all low-income countries, Ray (1998) notes that, in 1995, there were almost twice as many female as there were male illiterates.

For the analysis of this essay, it is assumed that parents make decisions about sending their children to school from the perspective of a long-run investment. Several authors have modeled schooling as an investment decision that generates a flow of benefits and costs over time (Becker, 1993; Glick and Sahn, 2000). Given a household rate of time discount and other particular characteristics, each household perceives an expected net present value from the decision about educating their children.

Let us start by assuming a simple household, whose members can be divided into three groups: adults who work, children that can either work or attend school, and younger children that cannot work. For the simplest case, assume that the adults are uneducated.

This assumption could be relaxed as an extension of the model but it is kept here for the sake of simplicity and without loss of generality.

In the first period ($t=0$) of a simple two-period model, the household invests in the education of its children. In the second period ($t=1$), the children grow up and the household reaps the benefits. In addition to spending on education for each child in school (E), the household consumes goods and services, during both periods, (C_0 and C_1).

The sources of income are earnings from household labor (L), supplied by adults (who are uneducated) and children able to work. Labor can be sold at a wage rate w for non-educated household members. Here, the assumption is that the unskilled-labor wage rate is the same for adults and for children able to work (teenagers). This assumption might not be true for some activities and it matters, as the opportunity cost of educating them will be less if the teenager wage rate is lower. It could also be relaxed as an extension of the model.

If the household decides to educate some of the potentially-working children, a proportion of the labor force, α , will not be available to generate income in period $t=0$. In period $t=1$, however, this educated portion of the labor force will earn a higher wage rate w' ($w' > w$). Therefore, in period $t=0$, income will be equal to $[(1-\alpha) w L]$; in period $t=1$, income will be $[(1-\alpha) w L + \alpha w' L]$. Assuming a composite good C , with price $p=1$, expenditures in period $t=0$ will be $[C_0 + \alpha E]$ and in period $t=1$ they will be $[C_1]$. Consumption is the result of the sum of consumption of the three-groups: adults, children able to work (teenagers), and young children. The model could be extended to deal with the shares of consumption for each group and with per capita consumption. In this way, dependence issues could be addressed.

During period $t=0$, either if income is low or if education expenditures are high, a small proportion of the children will go to school. At the same time, however, low income due to low wage rates reduces the opportunity cost of sending children to school, increasing their likelihood of being educated.

Assume that the household gains access to a loan B , to be repaid in the second period, given an interest rate and borrower transaction costs. It is assumed that the loan has no

productive impact and that its usefulness comes from its ability to facilitate the household's inter-temporal allocation of resources. Credit used to face exogenous shocks is not included in this model either. Define r as the sum of the interest rate and *per peso* transaction costs.

Thus, the cash flow constraint for period $t=0$ becomes $[(1-\alpha)wL + B]$, and expenditures for period $t=1$ become $[C_1 + (1+r)B]$.

Utility comes only from consumption (C_0, C_1). The problem for the household is to choose the level of consumption for each period, C_t , the rate of schooling of the children α , and the optimal loan size B , in order to

$$\begin{aligned} \text{Max}_{C_0, C_1, \alpha, B} U(C_0, \rho C_1) \quad \text{s.t.} \quad & (1-\alpha)wL + B = C_0 + \alpha E; \\ & (1-\alpha)wL + \alpha w' L = C_1 + (1+r)B \end{aligned} \quad (11)$$

Here ρ is the intertemporal discount factor, given by $(1/(1+\delta))$, and δ is the time discount rate for the household. Solving for C_0 and C_1 in the budget restrictions and substituting into the utility function, the problem becomes

$$\max_{\alpha, B} U\{(1-\alpha)wL + B - \alpha E, \rho[(1-\alpha)wL + \alpha w' L - (1+r)B]\} \quad (12)$$

The first-order conditions for an optimum are given by

$$\frac{dU}{dC_0}(wL + E) = \rho \frac{dU}{dC_1} L(w' - w) \quad (13)$$

$$\frac{dU}{dC_0} = \rho \frac{dU}{dC_1} (1+r) \quad (14)$$

The first condition indicates that the marginal utility of current consumption, weighted by the sum of education expenses per child in school and forgone income from the last unit of labor used (LHS), which can be interpreted as the marginal cost of devoting a proportion α of the household's labor force to an investment in education, should equal the discounted marginal utility of future consumption, weighted by the difference between earnings from

wage rates for skilled and unskilled labor for the last unit of labor used (RHS), which can be interpreted as the discounted marginal benefit of educating a proportion α of the household's labor force. Calculating the intertemporal marginal rate of substitution,

$$\frac{\frac{\partial U(.)}{\partial C_0}}{\frac{\partial U(.)}{\partial C_1}} = \rho \frac{L(w'-w)}{wL + E} \cong \frac{\Delta C_1}{\Delta C_0} \quad (15)$$

The household would be more willing to give up current consumption for the sake of future consumption, the greater the salary gap between educated and non-educated workers (that is, the marginal rate of return on education), the lower the opportunity cost of sending one person to school (that is, the wage rate for non-educated workers), and the lower the expenses needed for school attendance. The propensity to send children to school (α) will be increasing in salary differentials ($w'-w$) and decreasing in the salaries of the non-educated (w) and the costs of attendance per pupil (E).

The second condition implies that the marginal utility of the additional purchasing power from the consumption-and-education loan in the initial period (LHS) should equal the discounted marginal disutility of the corresponding loan repayment, given borrower transaction costs and interest rates (RHS).

In order to incorporate *gender effects* in the model, assume that the household's utility can be written as a Cobb-Douglas function, where the shares correspond to weights for females and males in the household involved in making decisions about the households' levels of consumption. If γ represents the proportion of women decision makers in the household and $(1-\gamma)$ the proportion of men, the household's utility function can be written as:

$$U(.) = U_F^\gamma U_M^{1-\gamma} \quad (16)$$

This specification makes it possible to include differential preferences between women and men within the family. Assuming that women have a stronger preference than men about schooling, when women gain access to decision-making within the household, these

preferences will be reflected in the consumption patterns as well as in the investment in education.

The model accounts for the expected effects of microfinance on schooling decisions. The household's labor supply $(1-\alpha)L$ and the wage levels for skilled and unskilled workers (w and w') determine levels of income as well as marginal returns on education, while α accounts for the demand for child labor. Note that household size can play an important role in this framework. With a greater share of adults generating income from labor, children will be more likely to be educated. In the same way, the greater the number of children able to work, the more likely for some of them to be educated, and the higher the share of them sent to school.

In this context, the presence of B in the budget constraint accounts for a consumption reallocation effect (as the loan facilitates an intertemporal reallocation of resources) and for investment in human capital formation. So far, the model does not say anything about the impact of credit on the household's productivity (income smoothing) or the use of credit to overcome shocks (consumption smoothing). Another limitation of this simple model is that it does not include credit rationing as a usual binding constraint for poor households. These issues can be addressed in posterior studies. Finally, the shares γ and $(1-\gamma)$ in the utility function account for the gender effect, while the specific functional form can capture the information effect on preferences about education.

Using the implicit function theorem, the first-order conditions imply that optimal demand functions for education and credit exist, namely

$$\alpha = \alpha(w, w', E, r; L, \gamma, \rho) \quad (17)$$

$$B = B(w, w', E, r; L, \gamma, \rho) \quad (18)$$

The outcome of this decision-making process determines the optimal proportion of the household's potential labor force to be kept out of work and into education and the optimal size of loan to be demanded, as functions of the opportunity cost of education (wage-earning activities), expected future income, education expenses, and the cost of credit,

given parameters about household size, the importance of women in the decision-making exercise, and the time discount rate.

4. Econometric Approach

From the conceptual analysis, several key variables considered by households when making decisions about sending their children to school are identified. With this framework –and taking into account the identification and attribution issues that may emerge– an econometric specification is necessary to test empirically for the evaluation of impact on schooling of access to microfinance services.

From the derived demand for education, we observe that the household decides on the amount of education by looking at the current marginal costs and (expected) future marginal benefits of education. The household's decision is, however, taken on an individual basis. The household will decide to educate a particular child –able to work– if the present value of (expected) net benefits that he/she will accrue is positive. Otherwise, he/she will work.

The net expected utility from education may be expressed as a function of a vector of household and child characteristics (\mathbf{z}), observed by the researcher, and of a stochastic component of preferences, known to the household but not observed by the researcher (ε). Then, the expected net present value of schooling for a given child in the household (denoted by i) can be written as

$$ENPV_i = f(\mathbf{z}_i, \varepsilon_i) \quad (19)$$

This latent result cannot be measured. In its place, proxies for the potential determinants of the ENPV of schooling must be used. Further, given uncertainty about functional form and about unknown parameters, we must reinterpret the model in terms of probabilities: the probability that a child will be sent to school is the probability that his/her parents think that the household will be better off if he/she is studying:

$$Pr(\text{schooling}_i) = Pr[f(\mathbf{z}_i, \varepsilon_i) > 0] \quad (20)$$

Using the approach of the random utility model (RUM) and assuming the function f to be additively separable in deterministic and stochastic components (Haab and McConnell, 2002), the expected net present value of schooling can be written as:

$$f(z_i, \varepsilon_i) = h(z_i) + \varepsilon_i \quad (21)$$

Then, the probability of schooling can be rewritten as:

$$Pr(\text{schooling}_i) = Pr(h(z_i) > \varepsilon_i) \quad (22)$$

According to the RUM, we can regress a binary dependent variable ($y_i = 1$ if the child is studying, $y_i = 0$ if the child is not studying) against the vector of observable and deterministic variables \mathbf{z}_i .

In order to consider the possibility that, if the child is attending school this year, it does not mean that he/she had been able to attend continuously during previous years, a more dynamic framework is needed to capture the accumulated performance of each child.

The dependent variable capturing this effect and used for the empirical estimation of the model is the *education gap*, measured as the number of years of the difference between the highest level of education actually completed by the child and the expected level of education, according to the child's age. The expected level of education is calculated as:

$$\text{Expected education} = \begin{cases} 0 & \text{if } \text{age} \leq 6 \\ (\text{age} - 6) & \text{if } 7 \leq \text{age} \leq 18 \\ 12 & \text{if } \text{age} > 18 \end{cases} \quad (23)$$

The education gap is then defined as:

$$\text{Education gap} = \max \{0, \text{expected education} - \text{actual education}\} \quad (24)$$

For example, if a grown-up child successfully stayed at school up to the end of secondary education, the gap is zero. If she/he encountered problems (such as late entry, failed grades, or desertion), the gap is a positive number. If she/he never attended school, the gap is the level of expected education according to her/his age. As attendance to primary

school is widespread, only children between 13 and 18 years old are considered in the analysis.

Because the dependent variable is a positive integer number, the estimation is specified as a count model, rather than as ordinary least squares, as the latter may generate inefficient estimates. The *Poisson regression model* has been widely used to study such data (Wooldridge, 1997; Cameron and Trivedi, 1998; Greene, 2000). A source of criticism for these models is the implicit assumption that the variance of the dependent variable equals its mean. Many extensions of the Poisson model relaxing this assumption have been proposed by Hausman, Hall and Griliches (1984) and Cameron and Trivedi (1986), among others. The standard method to test and correct for over-dispersion is the use of a *negative binomial regression model*, which is a Poisson maximum likelihood regression with over-dispersion model.

The vector \mathbf{z} includes variables required by the model and some control variables. These variables can be grouped into three categories:

Individual variables. They refer to specific characteristics for each child. These are control variables expected to influence education achievements:

- **Age.** This variable measures the child's age in years. The expected sign is positive; the older the child, the more likely that she/he will show an education gap.
- **Gender.** This is an instrumental (dummy) variable that takes the value of zero if the child is a boy and the value of one if the child is a girl. The expected sign is positive, under the hypothesis that, within the culture, the value of the girls' education is less than the value of the boys' education; girls should show a larger education gap.
- **Position.** This variable assigns the value of one to the oldest child in the household, two to the next, and so on. When there are granddaughters/ grandsons in the household, the value of one is again assigned to the oldest child, two to the second one, and so on. A positive relationship between this variable and the gap is expected, under the assumption that the oldest children are more likely to be kept in school than the younger ones.

Household variables. They are characteristics shared by all of the children within a household. Some of them are needed for control and others reflect specific effects to be tested for. As for control, the variables used are the **distance to school**, the **human capital of household workers**, and the **index of basic needs satisfaction**. The two later variables are also used to indirectly test for the presence of poverty traps in the education process. The level of schooling of working household members, a proxy for the stock of human wealth, is expected to improve the educational achievements of children. This variable can be used to reflect the household's income-earning capacity as well as perceptions about returns to education. The index of basic needs satisfaction is a proxy for access to health facilities and other public services, such as potable water (*i.e.*, social wealth). A more detailed description of these variables is:

- **Distance to school.** This variable is measured as the number of minutes needed to go from the house to the nearest high school. It is expected to have a positive relationship with the education gap, as the further the school is, the less likely that the child attends it.
- **Human capital.** This variable is measured as the number of years of schooling accumulated by the workers of the household divided by the number of workers. The expected sign is negative, under the hypothesis that if the workers (who usually make decisions about the children's education) have higher levels of education, they will have a stronger preference for schooling and the gap will be smaller. Also, the level of the workers' human capital is an indicator of their income-generating capacity and, therefore, of their ability to pay for education expenses. This variable in part incorporates income effects and information effects.
- **Poverty index.** This variable is based on the poverty index used in Navajas *et al.* (2000), adopted from the *1992 Mapa de Pobreza* for Bolivia. For each household, the index of minimum satisfaction of basic needs (health, access to public services, such as water and electricity, housing materials and overcrowding, and literacy and education) was used here with a special adjustment; the education component of the original index was dropped, in order to avoid endogeneity problems in the estimation (See González-González and González-Vega (2004) for a detailed discussion of the index). The expected sign is negative; the higher the index of basic needs satisfaction, the less poor the household is estimated to be, and the smaller the expected education

gap will be. The assumption is that greater poverty increases the opportunity cost of keeping children at school and that it also reduces the prospective yields of education.

The variables used in order to test for other channels of impact comprise (i) the **length of membership** of the client as a borrower of the MFO, (ii) the use of the **internal account**, (iii) the **empowerment** of women within the household, (iv) the **land holdings** of the family, and (v) the presence of **toddlers** in the household. Length of membership is intended to measure a general effect of access to microfinance and, in particular, income effects derived from membership. The internal account measures risk-management effects. Women empowerment measures gender effects (e.g. the importance of women in the decision-making process for the *ith* child's education). Land holdings and the presence of toddlers measure the child-labor demand effect. Landholdings are a proxy for physical wealth and also reflect the potential demand for farm labor within the household. A description of these variables comes next, while the sources of data are discussed in the following section.

- **Length of membership.** For the Batallas clients, the survey was designed in order to compare new clients (with less than one year of membership) with old clients (with more than two years). This differentiation was used in the regression analysis by incorporating a dummy variable that takes the value of one for old clients and zero for new clients. For the other datasets, the variable to measure exposure to microfinance was the computed number of months that the earliest client in the household had been a member of the organization. A dummy analog to the one used in the Batallas dataset was computed for all the samples as well.
- **Internal account.** This variable is a dummy that takes the value of one when the client declared having used the internal account during the year previous to the survey. The expected sign is negative, assuming the risk-management effect exists, so the internal account prevents households from taking children out of school, when they are confronted by shocks.
- **Women empowerment.** This variable represents the proportion of the accumulated human capital –measured by the number of years of schooling– held by the women who work in each household. The expected sign is negative, to incorporate the view

that empowerment reduces the schooling gap. There were some doubts about possible correlation of this variable with the household's human capital variable, but the relationship was weak and both can be used without fear of collinearity effects.

- **Land holdings or own arable lands.** This variable shows the size of the plots of land owned by the household and used for crops and other productive activities, measured in hectares. The sign will be positive if, when the household owns land, it is likely that it will demand the child's labor time for farming activities, in competition with school time. The sign may be negative, however, if the variable influences education through the level of the household's wealth and its availability as a consumption-smoothing tool.
- **Presence of toddlers.** This is a dummy variable that takes the value of one if the household of the child has at least one member six years old or younger. The expected sign is positive, under the hypothesis that the presence of toddlers requires that some children be kept out of school to take care of them, especially if the parents are engaged in income-generating activities, possibly funded by the loan.

Regional variables. These variables capture if the household is located in an **urban** or a **rural** municipality. In the case of the CRECER dataset, the urban setting can be differentiated between capital towns of municipalities and other urban municipalities. These variables are proxies both for the quality of education and job opportunities, which increase the marginal rate of return from education. They are constructed as explained next:

- **Rurality of the household.** This variable considers the difference between a household living in the rural areas, the urban areas, and capital towns of municipalities. It is constructed through dummy variables. Capital towns is the variable dropped for the econometric analysis for the CRECER dataset. The rural dummy can be expected to be positive compared to the control (capital towns) if the hypothesis is that the rural areas are less likely to have schools with good quality of education and attractive job opportunities for educated people.

5. The Data

The data for the empirical analysis are obtained from Bolivia, one of the poorest countries in Latin America. Deep inequalities and poor quality characterize its education outcomes. For instance, the average number of years of schooling completed declined from 4.2 in 1960 to 4.0 in 1980 and then increased to 5.5 in 2000 (Barro and Jong-Wha, 2000). Productivity and wages are very low for a large share of the working population. Over 45 percent of urban male workers earn less than one dollar a day (Duryea and Pagés, 2002).

In turn, over the past 15 years, Bolivia has experienced a strong development of microfinance (González-Vega and Rodríguez-Meza, 2002; González-Vega and Villafani-Ibarnegaray, 2004). Microfinance institutions (MFO's), originally developed as employment-generation tools for excluded sectors of society, have grown into a competitive and sustainable segment of the Bolivian financial system. Outreach toward the rural areas is, however, limited compared to urban centers.

The available dataset is made up of the results of three independent household surveys. One survey investigated households of microfinance clients of CRECER and SARTAWI in the municipality of Batallas (from now onwards, referred to as the Batallas dataset). This dataset includes 130 households, mainly from the countryside of the municipality, surveyed in April 2001 (Romero, 2002). The second dataset resulted from a survey of households of CRECER clients in five departments (Chuquisaca, Cochabamba, La Paz, Oruro, and Potosí) undertaken in November 2000 (from now onwards referred to as the CRECER dataset). This dataset includes 427 households and about half of the sample comes from rural areas. The third dataset includes the results of a survey of households of Pro Mujer clients in four departments (Chuquisaca, Cochabamba, La Paz, and Tarija). This survey was conducted in April 2001, and it included 400 households, mostly from urban settings. This dataset will be referred to as the Pro Mujer dataset. Although the three surveys were designed for different purposes, they share the same structure, given the Ohio State University connection. A large number of the same questions were asked in all three cases.

For the analysis of education achievements, the children in school age (7 to 18 years old) were divided into two groups: primary-school children (7 to 12 years old) and high-school

children (13 to 18 years old). Tests with the sub-sample of children between 7 and 12 years old, a fairly homogeneous group, did not reveal any key significant differences according to participation. This paper focuses, therefore, on the sub-sample of children from 13 to 18 years old.

The results for the dependent variable, the education gap, are reported in Table 1. On average, 64 percent of all children in secondary-school age show some schooling gap. Most of the gap cases correspond to one or two years of delay (37 percent), with a few cases of complete abandonment of studies. Comparing among datasets, the CRECER sample is the one with the smallest share of children without a gap. This may reflect deficits from the supply side, as half of the CRECER sample comes from rural settings where schools are less available. Although the Batallas population is mostly rural, the road network and school facilities are more frequent there, due to its closeness to La Paz.

Main statistics for the independent variables in the sub-sample of children in high school age (13 to 18 years old) are presented in Table 2.

Schooling Gap (years)	Survey			Total
	Batallas	CRECER	Pro Mujer	
0	62 (46)	103 (29)	144 (40)	309 (36)
1	28 (21)	103 (29)	84 (23)	215 (25)
2	13 (10)	49 (14)	42 (12)	104 (12)
3	7 (5)	29 (8)	28 (8)	64 (8)
4	4 (3)	15 (4)	19 (5)	38 (4)
5	6 (4)	10 (3)	9 (2)	25 (3)
6 and more	15 (11)	46 (13)	37 (10)	98 (11)

Source: client household surveys

Table 1. Schooling gap for the sample of children 13-18 years old. (Percentages in parenthesis)

Variable	BATALLAS	CRECER	Pro Mujer	Total
Observations (number)	135	355	363	853
Average schooling gap (years)	1.8	2.2	1.8	1.9
Average age (years)	15.3	15.4	15.4	15.4
Household size (members)	6.8	6.7	7.1	6.9
Students in the household (number)	3.6	3.4	3.7	3.6
Children in the household (number)	4.1	3.9	4.1	4.0
Presence of toddlers (percent)	47	40	53	47
Direct son/daughter (percent)	N/A	91	87	N/A
Distance to school (minutes)	30	17	11	17
Proportion living in urban municipalities (percent)	0	49	100	65
Proportion living in rural municipalities (percent)	100	51	0	35
Human capital of family workers (years of schooling)	28	20	35	28
Average holdings of land (hectares)	1.4	1.8	2.1	1.9
Basic needs satisfaction index	0.62	0.75	0.79	0.75
Adjusted BNSI	0.76	0.85	0.89	0.85
Human capital of working women as a fraction of total (percent)	43	46	48	47
Average human capital of female workers (years)	6	13	8	10
Human capital of women as a fraction of the household's (percent)	42	51	47	48
Proportion of income generated by women (percent)	53	56	53	54
Participation of women on education decisions (percent)	85	N/A	N/A	N/A
Affiliation to the MFO (years)	4.8	2.0	2.8	2.8
Affiliation to the MFO (months)	N/A	18	N/A	N/A
Proportion of old clients (percent)	31	35	68	49
Knowledge about internal account (percent)	N/A	94	58	76
Use of internal account (percent)	N/A	55	16	37

N/A means not available

Table 2. Main statistics for the sub-sample of high school children (13-18 years old)

6. Results

The regression analysis examines the dependence of the schooling gap on the explanatory variables. The regressions test for the difference in gaps between households that have had access to credit for a certain period of time versus households with members with less experience in the program. The hypothesis is that access to credit makes a marginal difference in the size of the gap. The results are shown in Table 3. Regressions are calculated for the three samples separately.

For all the cases, the independent variable for length of access to credit is a dummy taking the value of one for old clients and zero for new clients.

In the Batallas and CRECER cases, the coefficient for the *membership* as client of the microfinance program variable is negative and statistically significant. The null hypothesis can thus be rejected. It appears that, *ceteris paribus*, children from households with a longer history of affiliation to microfinance programs have a greater chance of being kept longer in school in contrast to children from households just entering the program. This is the central and an important result.

For the case of Pro Mujer, however, the membership variable is not significant. This result may be explained by the fact that households from the Pro Mujer survey are mainly urban and engaged in microenterprise activities. Therefore, the opportunity cost of education is higher, as the creation of these microenterprises may demand child labor, either to work in the new activity or to fulfill the duties that now the parents are unable to complete due to their commitment to the microenterprise. This finding suggests a dilemma for urban microfinance.

Variable	Batallas Coeff.	CRECER Coeff.	Pro Mujer Coeff.
Length of membership	-0.74***	-0.21*	0.11
Child's age	0.19**	0.12***	0.14***
Child's gender	0.04		-0.08
Position of child		0.17***	
Child working			-0.46**
HH human capital	-0.13**	-0.09***	-0.26***
Poverty index	-0.92*	0.22	-0.76**
Land holdings	0.10*	0.01	-0.00
Internal account		-0.20*	0.35*
Empowerment	-0.07*	-0.03***	-0.77**
Rural dummy		0.03	
Constant	-0.60	-0.55	1.27*
Over dispersion	1.16***	0.65***	0.60***
Number of observations	134	343	296
LR chi2(k)	28.97	77.92	109.78
Prob > chi2	0.00	0.00	0.00
Pseudo R2	0.06	0.06	0.10

(*) Significant at 10% (**) Significant at 5% (***) Significant at 1%

Table 3. Results from regressions about schooling.

As expected, the coefficient for the variable **age** is significant and positive. That is, the older the child, the greater the probability that she/he will show an education gap.

The coefficient for the variable **gender** is not significant. This is an important result. Lack of statistical significance means that there are no differences between girls and boys in their educational achievements. The results cannot show if this gender neutrality has been due to the influence of the MFO or not, but anecdotal references to this effect abound. Gender is not included in the CRECER regression due to the presence of collinearity with the empowerment variables. That is, households with high women empowerment are highly correlated to girls' school attendance.

In order to consider intrahousehold characteristics, the presence of **toddlers** in the family was tested for. This attribute causes a direct effect (positive sign) on the educational delays of children. This effect, however, is not significant and the variable was not included in the final regressions. In the CRECER dataset it was possible to build a variable showing the **position** of the child compared to her/his siblings. The regression results show a positive and statistically significant effect on the schooling gap, which supports the hypothesis that position matters and that first daughters/sons are more likely to be sent to school than younger siblings.

The **distance to school** is not significant in any case. This may show that lags in educational performance can be attributed more to demand factors than to supply factors such as the existence of schools. This variable was dropped from the final regressions.

The household's **human capital** (the average level of education of the working members) significantly reduces the schooling gap. More educated household decision-makers have a greater propensity to encourage the education of their children. This may be facilitated by the higher incomes earned by more educated household workers. A poverty trap related to human capital formation may therefore exist.

The coefficient on agricultural **land** holdings is positive in the Batallas and CRECER cases but significant only in the case of the Batallas dataset. This finding may be explained by the fact that Batallas is an agricultural region and that the dataset is the one with the highest proportion of rural households. For them, agricultural activities play a decisive role in their income-generation decisions. In this case, farming appears to be a substitute or a competition for education. This presents policymakers with a similar paradoxical result: increased opportunities to farm may pull children away from school. To the extent to which farming households tend to be the poorest, this may create a poverty trap for these households. For the case of Pro Mujer, this effect is negative although not significant. This confirms the hypothesis that access to land generates an opportunity cost of education for agricultural households. This finding is in contrast to that in Trigueros (2002), who finds that land ownership in El Salvador explains continued enrollment in the presence of adverse shocks.

The lack of significance of the explanatory variable of ***length of membership*** in the Pro Mujer dataset leads to the suspicion that the opportunity costs of education in urban settings are higher than in rural settings. To confirm this presumption, a new variable was included in the Pro Mujer regression; a dummy variable with value of one if the child is working either in family productive activities or in off house employment. This variable was significant and showed the expected negative sign: given the broader spectrum of labor opportunities in urban settings (compared to rural ones), children engage in income-generating opportunities more frequently, with the corresponding delay in or withdrawal from school. It was not possible to establish with accuracy if this is an effect of access to microfinance, which enhances productive opportunities within the household, or of the differential in the labor market characteristics between rural and urban scenarios.

The coefficient for the ***poverty*** index is significant and shows the expected sign. That is, households with the least satisfaction of basic needs have children with greater schooling gaps. This reflects the high opportunity cost of the child's school attendance in households with a low productivity of labor and a tight budget constraint. In the absence of other productive household assets, expected returns from education also appear low. A poverty trap may also exist here.

The ***internal account*** variable was available only for the CRECER and Pro Mujer datasets, and it showed ambiguous results. In the case of the CRECER dataset –where the internal account is widely used– the coefficient was negative and significant, confirming the effect of access to microfinance as a tool useful in consumption smoothing and risk coping, and therefore improving the human capital formation of the borrowers' children. In the case of the Pro Mujer dataset –where the internal account use was reported only in 16 percent of the households– the coefficient was significant but positive. This result may confirm the fact that Pro Mujer clients use microfinance in general and the internal account in particular to increase income generating opportunities, increasing in turn the demand for child labor, which results in larger schooling gaps for children.

The ***empowerment*** variable always shows a negative and statistically significant coefficient. This indicates that the empowerment of women reduces the education gap for high-school children. This is an important result, confirming the importance of women in overcoming poverty at household level across generations (gender effect).

The dummy variables used to control for the type of household (rural or urban) are not significant. They are necessary, however, to provide consistency to the regression and to account for differences among types of household. For instance, if they are dropped from the regression, the coefficient related to landholdings becomes not significant, as landholdings have a different impact in rural than in urban households. For rural households, landholdings are a factor of production, which generate demands for the household members' labor, while for urban households land ownership mostly reflects wealth. Demands for child labor may still emerge in urban households if the children are asked to help in the microenterprise activities or help with childcare.

Over-dispersion was observed in all regressions, leading to the conclusion that the negative binomial regression model was the appropriate choice. With this method, over-acceptance of coefficient significance and over-rejection of the null hypothesis is avoided.

6.1. Marginal Effects and Elasticities

Given the econometric specification adopted, the coefficients that result from a negative binomial regression are only useful for their sign and significance but not for their magnitude. This is because the functional form is not linear but exponential, and the derivative of the function with respect to any independent variable is not the coefficient but the product of the coefficient and the mean function, evaluated at specified values for all the independent variables. A proper assessment of the effects of different variables can, therefore, be achieved only by looking at the marginal effects, which measure the actual impact of changes in each independent variable over the dependent variable, *ceteris paribus* (Table 4).

Here, the marginal effects are calculated at both the mean and the median values of the independent variables. Moreover, to assess the relative responsiveness of the dependent variable and to compare across independent variables, it is necessary to compute elasticities, which consider not absolute but relative changes in magnitude. Elasticities tell how proportional increases in the independent variable affect (also in percentage terms) the dependent variable. These elasticities are shown in Table 5, and they are also

calculated at the mean and median values of the independent variables. Both marginal effects and elasticities are discussed for each one of the surveys.

For the case of Batallas, participation in a microfinance program has important effects on schooling, as measured by the length of membership (that is, by the difference between new and old clients). In effect, old clients have, on average and controlling for other things, children with almost one year less of educational gap compared to new clients. The impact of the package of microfinance services from these organizations is beneficial, significant and, most importantly, substantial, both for the average and median household. The empowerment of women and the education of household members of working age are also beneficial and significant. One extra year of schooling of household members, however, reduces the gap by about one-fifth of a year. A smaller effect, but still significant, is attributed to the level of education of the females in the household labor force, which is the proxy used for empowerment. Less poor households show, on average, significantly smaller gaps. Finally, an additional hectare of land increases the demand for child labor, and it increases the gap by about one-sixth of a year.

Still for the case of Batallas, the elasticity of the schooling gap of children with respect to membership is, however, lower than the elasticities corresponding to variables such as the household's human capital, the poverty index, and empowerment. That is, schooling is very responsive to reductions in poverty and to the gender effect and information effects.

In particular, a 10-percent improvement in the poverty index induces a 7-percent reduction in the schooling gap. Similarly, a 10-percent increase in the average schooling of the working members of the household induces a 7.6 percent reduction in the gap. Regarding female workers in the household, the reduction in the gap would be 4.3 percent in response to a 10-percent increase in their schooling, *ceteris paribus*. The high elasticity of the gap with respect to age shows that older children are more likely to have less schooling than expected for their age and that this occurs at an increasing rate.

Variable	Batallas		CRECER		Pro Mujer	
	At mean	At median	At mean	At median	At mean	At median
Membership	-0.91***	-0.77***	-0.39*	-0.35*	0.15	0.12
Age of child	0.26**	0.28**	0.21***	0.18***	0.19***	0.17***
Gender of child	0.06	0.07			-0.04	-0.10
Position			0.31***	0.25***		
Child working					-0.71**	-0.71**
HH human capital	-0.18**	-0.19**	-0.17***	-0.14***	-0.35***	-0.31***
Poverty Index	-1.26*	-1.36	0.41	0.34	-1.03**	-0.92**
Land holdings	0.14*	0.15*	0.01	0.01	-0.00	-0.00
Internal account			-0.37	-0.34*	0.53	0.50
Empowerment	-0.09*	-0.10*	-0.06***	-0.05***	-1.04**	-0.93**
Rural dummy			0.05	0.04		

(*) Significant at 10% (**) Significant at 5% (***) Significant at 1%

Table 4. Marginal effects of the schooling gap for the variables used in the regression, calculated at the mean and median values of the variables.

Variable	Batallas		CRECER		Pro Mujer	
	At mean	At median	At mean	At median	At mean	At median
Membership	-0.23***	N/A	-0.12*	-0.21*	0.06	0.11
Age	2.89**	2.83**	1.80***	1.75***	2.18***	2.13***
Gender	0.02	N/A			-0.04	-0.04
Position			0.39***	-0.33***		
Child working					-0.35**	-0.46***
HH human capital	-0.76**	-0.76**	-0.59***	-0.56***	-1.77***	-1.73***
Poverty Index	-0.70*	-0.70*	0.19	0.19	-0.68**	-0.69**
Land holdings	0.13*	0.05*	0.02	0.00	-0.01	N/A
Internal account			-0.11	-0.20*	0.06*	N/A
Empowerment	-0.43*	-0.41*	-0.44***	-0.36***	-0.41**	-0.39**
Rural dummy			0.01	0.03		

(*) Significant at 10% (**) Significant at 5% (***) Significant at 1%

Table 5. Elasticities of the schooling gap with respect to the variables used in the regression, calculated at the mean and the median values of the variables.

The results for the CRECER sample are similar, but some special features are worth mentioning. In absolute terms, the length of membership in the program (new versus old clients) continues to be beneficial, significant and still substantial, although not as much as in the case of Batallas, where CRECER is also one of two organizations examined. This is an interesting result, among other things because Batallas is one of the earlier locations for CRECER, while the broader sample includes other regions of the country where program development has been more recent. Use of the internal account (which is a proxy for the risk-management effect) has the correct sign and has a statistically significant marginal effect in reducing the schooling gap when measured for median values but not when measured for average values of the variables.

The position of the child with respect to her/his siblings matters; that is, a particular child has, on average, almost a third of a year more of schooling gap compared to his/her immediately next older sibling, when compared at the same age. The beneficial effect of the household's human capital on the education of children is slightly smaller than for the Batallas sample. The same is true for empowerment, but the effects have a stronger statistical significance.

When looking at the elasticities, similar results as in the Batallas data set emerge. The schooling gap is more elastic to the household's human capital and to the empowerment of women than to other variables. The elasticity of the gap with respect to the empowerment of women is similar to the observed in Batallas, while the elasticities of the gap with respect to program participation and household human capital are lower for the larger CRECER sample than for Batallas.

Finally, results for the Pro Mujer data set may reflect consequences of living in an urban setting. The marginal effects of membership are no longer significant. Instead, empowerment of women, household human capital, and the poverty index have strong significant marginal effects. The elasticity of the schooling gap is quite high with respect to poverty. Women in urban settings are in charge of their productive activities –mainly in trade– through microenterprises. These women gain empowerment from both their earnings and access to microfinance. Empowerment and human capital matter a lot in this setting, but the influence of program participation is not properly captured by the

specification. Moreover, greater job opportunities for children seem to reduce significantly the schooling gap, which is another perplexing result.

Across data sets, the results are consistent, especially for the impact of empowerment of women and the household's human capital on the children's educational performance. This finding highlights the outcome of the strategy of offering financial services to women.

7. Conclusions

Poverty in Bolivia is dramatic, reducing standards of living not only for the current but also for the future generation. In the long run, the alleviation of poverty will require substantial improvements in education. To make this possible, constraints on the supply as well as the demand side of education must be overcome. The demand side of the education equation seems to be influenced by the attitudes, opportunities, and constraints of poor rural households. The results of this dissertation confirm this perspective. If a clear diagnosis is a precondition for the adoption of appropriate policies, important lessons emerge from this essay. These results suggest that programs that improve the income-generating capacity of households and their ability to withstand adverse shocks shift the demand for education. In particular, the beneficial role of the internal account, though improvement in risk management, highlights the comparative advantage of village banking programs that emphasize this service.

Consistent with the threat of a poverty trap, deeper levels of poverty are associated with lower demands for education. The results for the index of basic needs satisfaction in all cases confirm a significant and unfavorable influence of poverty on schooling gaps. Educated household workers generate a stronger demand for the education of household children than non-educated members do. Larger stocks of human capital are not only associated with higher household incomes but also with more optimistic perceptions about the returns from education. These outcomes reinforce the prediction of a poverty trap: less educated parents demand less education for their children. Non-formal adult education may in part offset these attitudes.

The relationship between wealth and the demand for education may create, however, some policy dilemmas. First, greater access to land and, therefore, to opportunities for farming appear to increase the household's demand for child labor. Land tenure policies, therefore, while increasing income opportunities for the household may, at the same time, increase the opportunity cost of keeping children at school. Similar effects seem to emerge from the encouragement of household microenterprises.

Larger stocks of capital or land make these households search for additional labor inputs, given the highly labor-intensive technologies they use. The first source to fill this demand for labor is the family, thereby creating a trade-off between potential future welfare and the satisfaction of current needs. Even when household members are aware of some advantages from educating their children, their precarious conditions may force them to sacrifice the potential flow of future benefits in order to compensate for extremely low current income flows. If, further, there is the perception that current employment options do not reward sufficiently investments in education, the best alternative is to keep children employed at the farm or microenterprise since their early ages.

Unfortunately, at low levels of household income, this adverse impact of incentives to agricultural production and microenterprise development on the demand for education will be inevitable. Agricultural intensification policies, rather than land extensification, which substantially increase the productivity of available household labor and other resources and improve the returns on human capital, may be the only way out of this dilemma. There is a coincidence here with the favorable impacts of intensification on natural resource conservation, as shown in the first essay.

Another challenge presented by this dilemma is the demand of youth labor for childcare. As the nascent microenterprise demands the attention of the older women in the household, an internal demand for childcare emerges, and this demand will be met by keeping the older children at home and away from school. This effect will be stronger in younger families, because of the larger number of toddlers and the smaller number of adults in the household. The education component of some microfinance programs may have an impact on the spacing of pregnancies and on the fertility rates of these women, and this may contribute to a reduction of this paradoxical threat to human capital formation (Romero, 2002).

The importance of access to credit and other financial services that allow households to postpone or smooth their consumption, in increasing their investment in education, leads to evident policy recommendations. Microfinance organizations in Bolivia have been able to reach segments of the rural population that otherwise would not have had access to these services and, to the extent to which they have been cost-effective, this has been a valuable development contribution. The sustainability and cost-effectiveness of these MFOs has not been evaluated, however, in this essay.

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