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World Development Vol. 36, No. 11, pp. 2440–2455, 2008

0305-750X/$ - see front matter

doi:10.1016/j.worlddev.2008.04.004

Impact of Microfinance on Schooling: Evidence from Poor Rural Households in Bolivia

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Summary. — Channels for the influence of microfinance programs on a rural household's demand for schooling are identified: income growth, risk management, child-labor demand, gender empowerment, and parent information. Within a random-utility framework, a model of household consumption, investment in education, and borrowing suggests determinants at the individual, household and regional levels of the probability of schooling gaps. Using data from two surveys of households of clients of microfinance organizations in Bolivia, regression models examine determinants of schooling gaps. Inferences about otherwise positive microfinance impacts identify potential negative effects of increased child-labor demand, which challenge usual assumptions and pose dilemmas for policymakers.

Key words — Latin America, Bolivia, microfinance impact, schooling gaps, child labor, rural households

1. INTRODUCTION

Human capital formation is expected to play a major role in the reduction of poverty, a significant challenge for this century (Bils & Klenow, 2000; Krueger & Lindahl, 2000). In the rural areas of developing countries, however, access to education is limited (Barro & Jong-Wha, 2000). Some have highlighted supply constraints, due to missing infrastructure and resources (e.g., schools, teachers, and materials). Low schooling achievements also reflect effects on the demand for education of the household's preferences and budget constraints and of competing demands for the children's time. In turn, these determinants may be influenced by access to microfinance.

Financial services (loans as well as facilities for deposits, payments, and remittances) allow households to more fully take advantage of productive opportunities, facilitate consumption smoothing (given seasonal income flows), and offer tools for coping with risk, when adverse shocks occur (Sharma & Zeller, 1999). Typically, however, information, incentive, and contract enforcement problems constrain the access of poor rural households to formal financial markets (Conning & Udry, 2007). Moreover, because human capital cannot be seized in case of default, it cannot be used as

* Several results of this paper come from research jointly undertaken with Vivianne E. Romero, then National Operations Manager of Plan International, Bolivia, and currently General Manager, Pro Mujer Bolivia. The authors are grateful for the support of Evelyn Grandi and Alfonso Torrico (CRECER/Bolivia) as well as the cooperation of the staff and village bank clients interviewed. Vivianne Romero and Rodolfo Quirós were instrumental in the implementation of the field work, which was in part funded by FINRURAL and the United States Agency for International Development. Finally, Jorge wants to express his gratitude for the unconditional support of Rocio Moreno. Final revision accepted: April 14, 2008.

collateral. Consequently, the poor must fund their education out of past wealth or through abstention from productive work or from current consumption rather than with loans. Thus, financial market shortcomings accentuate a joint causation between income generation and human capital formation. Combined with increasing returns to investment in education, these shortcomings generate poverty traps (Bardhan & Udry, 1999).

Using innovations in lending technologies, microfinance institutions (MFIs) offer credit and sometimes deposit facilities to segments of the rural population otherwise without access to formal finance (Armendáriz de Aghion & Morduch, 2005; González-Vega, 2003). These innovations allow households without traditional collateral to pledge their reputation in the community or the present value of their relationship with the MFI—a value based on their human capital and future ability to generate income as well as on the sustainability of the MFI—as an incentive to repay loans.

The purpose of this paper is to evaluate the impact of microfinance on human capital formation by looking at whether children from rural households with access to credit or credit-cum-education programs are kept in school longer than children from households without access to these services. Building on various strands of the literature, we identify five channels through which microfinance may influence human capital formation.

Given a positive income elasticity of the demand for education, increased household income—a potential outcome of access to microfinance—should result in higher schooling expenditures. Further, if the higher productivity of educated household members is rewarded with higher incomes and wages, production and employment opportunities —including those in household microenterprises—should also influence schooling decisions (Behrman & Knowles, 1999; Duryea & Pagés, 2002). Low *per capita* incomes imply, however, high opportunity costs of keeping children in school, given their labor-supply potential. Moreover, if the marginal utility of income is higher for the poorer than for the richer, this opportunity cost should be higher for poorer households.

Child labor is demanded both for participation in income-generating activities and for taking care of younger siblings, which allows productive household members to work. This demand will be stronger when there are unexpected shortfalls in income. Thus, growing income levels should have a positive influence on schooling, while adverse income or expenditure shocks should have a negative effect. All these effects lead to the identification of several channels of influence of microfinance on schooling.

First, if access to microfinance services influences the growth of household income, microfinance will positively influence the demand for schooling (*income effect*).

Second, adverse exogenous shocks force rural households to engage in risk-coping strategies that may require pulling children from school. Income volatility does not allow sustained enrollment over time because either school expenses can no longer be afforded or the children are needed to earn extra income (Beegle, Dehejia, & Gatti, 2006; de Janvry, Sadoulet, & Vakis, 2006; Jacoby & Skoufias, 1997). Missing loans, deposit facilities, and insurance, as potential remedies for risk, result in costly income smoothing strategies, such as diversification and migration (Morduch, 1995), while households smooth consumption by using financial savings, selling assets, taking children out of school, and developing informal insurance and credit arrangements (Gomez-Soto & González-Vega, 2007; Kanbur & Squire, 2001). Access to financial savings or to credit—particularly when emergency loans are offered, such as those from the internal account of village banks—reduces the probability that children will be pulled from school (Casabonne, 2006). If access to microfinance improves a household's ability to cope with shocks, it may positively influence the demand for education (*risk-management effect*).

Third, compared to men, women show a stronger preference for educating their children (Behrman & Rosenzweig, 2002). If preferences are gender-related and microfinance improves direct access to loans by women, thereby changing their power to influence household decisions, the rate of human capital formation may be affected (*gender effect*). This approach substitutes a bargaining process within the household for the unitary model of optimization of a single preference set (Haddad, Hoddinott, & Alderman, 1997). The outcome reflects gender differences in both preference functions and the power to influence household decisions (McElroy, 1997; Nanda, 1999; Swain & Wallentin, 2007).

Fourth, given uncertainty about the future, imperfect information about opportunities, and high private discount rates, the schooling

choices of uneducated poor households may be shortsighted. Indeed, it has been shown that the levels of education of the parents affect schooling decisions (Lillard & Willis, 1994). These parent choices may be revised, however, with the acquisition of new knowledge that modifies intertemporal preferences or perceptions about the value of schooling. If access to microfinance programs changes perceptions about opportunities or allows learning about returns, schooling choices may be influenced (*information effect*). In particular, preferences about schooling may be changed by adult training programs. Some MFIs, such as CRECER in Bolivia, take advantage of regular borrower meetings to disseminate information about health, nutrition, and education.

There is much debate about the influence of credit-cum-education programs in improving standards of living (MkNelly & Dunford, 1999). Another debate questions the optimality, from an organizational perspective, of jointly providing credit and non-financial services. On the one hand, there may be economies of scope, for both provider and client, from this joint provision. This may matter in countries where governments have failed to deliver these services. On the other hand, the supply of non-financial services may jeopardize the pursuit of financial sustainability, through diseconomies due to overburdening of the organization's management or through signals that weaken borrower discipline (González-Vega, 1998; Rhyne & Otero, 1992).

The analysis here is incomplete, therefore, in that it only attempts to assess the marginal benefit of credit-cum-education, but it does not measure the marginal cost of jointly providing these services. The MFI may face a trade-off, however, between successfully offering non-financial services and a package of rudimentary but still valuable financial services *versus* solely offering a broader, more diversified menu of less standardized financial services (Quirós, Rodriguez-Meza, & González-Vega, 2003). Moreover, these costs and benefits will depend on initial conditions about the target population and existing public infrastructure for the delivery of non-financial services.

Fifth, there is a growing literature on the influence of the demand for child labor on schooling outcomes (Grootaert & Patrinos, 1999; Gunnarsson, Orazem, & Sanchez, 2006; Psacharopoulos, 1997; Ray, 2003; Rosati & Rossi, 2003). Given that schooling and child labor are joint outcomes of a single time allocation decision, the interpretation of any correlation between labor status and schooling is difficult (Edmonds, 2007). There is a possibility, nevertheless, that additional productive activities, made possible by the household's access to microfinance, may change its demands for child labor, either directly, in the newly-created microenterprises or expanded farm and livestock duties, or indirectly, in child care and other household chores (*child-labor demand effect*).

2. METHODOLOGY

Any assessment of impact, which involves attributing specific effects to specific interventions, encounters formidable problems (Ravallion, 2001). Meyer (2002) claimed that the measurement and attribution of impacts on clients is the most difficult and controversial aspect in the evaluation of MFIs. One dimension of the difficulties, of relevance here, is the possibility of selection bias. Both the incorporation of clients and program placement are the sources of concern. The first one arises because clients will not likely be randomly selected. Self-selection occurs because of systematic differences in initial conditions and 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 potential endogeneity can lead to biases due to omission of unobserved relevant variables (Moffitt, 1991).

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

We attempt to minimize selection problems by using a cohort approach, with results similar to those from reflexive comparisons. There is no information about non-participants in the surveys. Participants were then controlled according to the length of their relationship

Table 1. *Main statistics for the group of 13–18 years old children from the surveys, according to membership duration*

Variable	Batallas			CRECER		
	New clients	Old clients	Total[a]	New clients	Old clients	Total[a]
Observations (number)	93	42	135	159	196	355
Average schooling gap (years)	2.0	1.2	1.8*	2.4	1.9	2.2*
Average age of children (years)	15.3	15.3	15.3 ns	15.5	15.4	15.4 s
Household size	6.6	7.0	6.8 ns	6.6	6.7	6.7 ns
Students in the household	3.5	3.9	3.6 ns	3.4	3.4	3.4 ns
Children in the household	4.0	4.3	4.1 ns	3.9	3.8	3.9 ns
Presence of toddlers (percentage)	47	45	47 ns	43	37	40 ns
Distance to school (minutes)	23	45	30**	16	18	17 ns
Proportion living in rural municipalities (percentage)	100	100	100	39	61	51***
Human capital of family workers (cumulative years of schooling)	27.7	29.1	28.1 ns	19.1	21.1	20.2 ns
Average holdings of land (hectares)	1.2	1.6	1.4 ns	1.6	2.0	1.8 ns
Basic needs satisfaction index (BNSI)	0.64	0.57	0.62*	0.77	0.78	0.78 ns
Adjusted BNSI (without education)	0.79	0.70	0.76*	0.87	0.89	0.88 ns
Human capital of working women as a fraction of total (percentage)	42	48	43 ns	47	45	46 ns
Average schooling of female workers (years)	4.6	4.4	4.5 ns	5.2	5.4	5.3 ns
Human capital of all women as a fraction of household total (percentage)	42	41	42 ns	52	50	51 ns
Proportion of household income generated by women (percentage)	52	56	53*	56	56	56 ns
Participation of women in education decisions (percentage)	86	83	85 ns	N/A	N/A	N/A
Affiliation to the MFI (months)	N/A	N/A	N/A	5.4	28.6	17.8***
Proportion of old clients (percentage)	0	100	31	0	100	55
Knowledge about internal account (percentage)	N/A	N/A	N/A	88	95	92**
Use of internal account (percentage)	N/A	N/A	N/A	59	52	55 ns

(ns) Not significant (*) significant at 10% (**) significant at 5% (***) significant at 1% (N/A) means not available.
Source: client household surveys.
[a] Statistical significances are shown for differences between old and new clients.

with the MFI. 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 had passed the screening mechanism but for whom benefits would not have yet accrued and who would thus serve as a control group. When dividing the sample into *old* and *new* clients, we control for unobserved variables that induce participants to become clients. Thus, the inference that schooling gap differences between the children of old and new clients—after controlling for demographic and environmental variables—can be identified as a program effect is reasonable, as is the expectation that the regression estimates are unbiased.

The appropriateness of this strategy rests on the absence of systematic differences between old and new clients. We address this issue in two ways. First, we rely on first-hand information on the two MFIs regarding the continuity of their screening criteria. Entry requirements are very simple (there are no credit formalities) and participation rests mostly on agreements with other members of the village bank. Moreover, the communities targeted for expansion are similar in terms of levels of poverty and village size. Second, we look at relevant characteristics of the sub-samples of old and new clients

for each dataset (Table 1) and we do not find critical differences.

3. THE MODEL

Based on Schultz (1993), several authors have recognized that the late incorporation of children and their early withdrawal from school are mostly due to demand factors. These circumstances lead to gaps between actual and expected schooling outcomes (grade for age). The assumption is that parents decide to allocate a fraction of household income to education according to their perceived expected profitability of schooling. This perception depends on their level of education and features of the environment. Credit-cum-education programs may influence this perception. Behrman, Pollack, and Taubman (1986) further argued that resources for education are split according to the number of children, their gender, and their age, given household composition and the severity of budget constraints.

In rural areas of developing countries, the demand for schooling is also 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 (Grossman, 2005; Junkin, Berry, & Perez, 2006), by productivity gains and the diversification of the sources of labor income (also influenced by microfinance), by flows of non-labor income, such as subsidies and remittances (Cardoso & Souza, 2004; Ravallion & Wodon, 2000), and by the ownership of assets that can be used as collateral for loans. Khandker (1998) found that, in Bangladesh, micro loans had a significant impact on the children's schooling, especially for boys. This finding implies that the child's gender may also matter.

Several authors model schooling as an investment that generates flows of benefits and costs over time (Becker, 1993; Glick & Sahn, 2000). Given a rate of time discount, δ, and other characteristics, each household perceives an expected net present value from the decision about educating their children. Here, we assume a household whose members can be divided into three groups: adults who work (L_1), teenagers who can either work or attend school (L_2), and younger children who cannot work. For the sake of simplicity and without loss of generality, adults are assumed uneducated. In the first ($t = 0$) of a two-period model, the household invests in the education of its teenagers. In the second period ($t = 1$), the household reaps the benefits. In addition to spending on 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 labor (L), supplied by adults and teenagers, at a wage rate w for all non-educated household members. If the assumption that the unskilled-labor wage rate is the same for adults and teenagers does not hold in reality, the opportunity cost of educating teenagers will be less than assumed here.

If the household decides to educate some teenagers, a proportion of the labor force provided by teenagers, α, will not be available to generate income in period $t = 0$. In period $t = 1$, however, the educated portion of the labor force will earn a higher wage rate $w'(w' > w)$. Therefore, in period $t = 0$, income will be $[wL_1 + (1 - \alpha)wL_2]$; in period $t = 1$, income will be $[wL_1 + (1 - \alpha)wL_2 + \alpha w'L_2]$. Assuming a composite good C, with price $p = 1$, in period $t = 0$ expenditures will be $[C_0 + \alpha L_2 E]$ and in period $t = 1$ they will be $[C_1]$. During period $t = 0$, if the proportion of teenagers in the household's labor force is high, or if the wage differential for skilled and non-skilled workers is not high enough, a small proportion of teenagers will go to school. This will be further the case if the household's impatience is high (reflected in a high discount rate δ), as is the case among the poor. These features describe many poor households in rural areas of developing countries.

To consider the potential impact of microfinance, assume that the household gains access to a loan B, to be repaid in the second period. This loan is assumed to have no productivity impact; rather, it simply facilitates the household's inter-temporal allocation of consumption. Define r as the sum of the interest rate and *per peso* borrower transaction costs. Thus, the budget constraint for period $t = 0$ becomes $[wL_1 + (1 - \alpha)wL_2 + B]$, 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 ($t = 0, 1$), the rate of schooling α, and the optimal loan size B, in order to

$$\begin{aligned} &\mathrm{Max}_{C_0,C_1,\alpha,B} U(C_0, \rho C_1) \\ &\text{s.t. } wL_1 + (1-\alpha)wL_2 + B = C_0 + \alpha L_2 E; \\ &\quad wL_1 + (1-\alpha)wL_2 + \alpha w'L_2 = C_1 + (1+r)B. \end{aligned} \tag{1}$$

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

$$\max_{\alpha,B} U\{wL_1 + (1-\alpha)wL_2 + B - \alpha L_2 E, \rho[wL_1 + (1-\alpha)wL_2 + \alpha w' L_2 - (1+r)B]\}. \quad (2)$$

The first-order conditions for an optimum are given by

$$\frac{dU}{dC_0}(w+E) = \rho\frac{dU}{dC_1}(w'-w), \quad (3)$$

$$\frac{dU}{dC_0} = \rho\frac{dU}{dC_1}(1+r). \quad (4)$$

Condition (3) indicates that the marginal utility of current consumption, weighted by the sum of education expenses 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 teenager labor force to an investment in education, should equal the discounted marginal utility of future consumption, weighted by the difference between earnings from 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 teenager labor force. Calculating the intertemporal marginal rate of substitution,

$$\frac{\frac{\partial U(.)}{\partial C_0}}{\frac{\partial U(.)}{\partial C1}} = \rho\frac{(w'-w)}{w+E} \cong \frac{\Delta C_1}{\Delta C_0}. \quad (5)$$

The household will 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 (i.e., the marginal rate of return on education), the lower the opportunity cost of sending one person to school (i.e., the wage rate for non-educated workers), the lower the expenses needed for school attendance, and the lower the time discount rate (implicitly, the less poor the household is). The propensity to send teenagers to school (α) will be increasing in salary differentials $(w' - w)$ and decreasing in the salary of the non-educated (w) and school costs (E).

Condition (4) 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).

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 the females and males involved in household decisions about levels of consumption and human capital formation. If γ represents the proportion of women decision-makers and $(1-\gamma)$ the proportion of men, the household's utility function can be written as

$$U(.) = U_F^{\gamma} U_M^{1-\gamma}. \quad (6)$$

This specification makes it possible to include differential preferences. Assuming stronger preferences about schooling among women, when they gain greater access to decision-making within the household due to the empowerment gained by borrowing and training, this will be reflected in different consumption patterns and levels of investment in education.

The model thus accounts for the expected effects of microfinance on schooling decisions. The household's actual labor supply $[L_1 + (1-\alpha)L_2]$ 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 influences the demand for child labor. Note that household size and dependency rates can play an important role here. With a greater share of adults generating income (L_1), children will be more likely to be educated. Similarly, the larger the number of teenagers able to work (L_2), the more likely it will be for some of them to be educated. In turn, the greater the number of younger children who cannot work, the less likely it will be for their older siblings to be educated.

In the budget constraint, B accounts for effects of credit on both consumption and investment in human capital. In the utility function, the γ and $(1-\gamma)$ shares account for the gender effect, while the functional form may capture the information effect on preferences about education. This simple model, however, does not incorporate the impact of credit on the household's ability to take advantage of new productive opportunities (which may raise implicit wages and create new self-employment opportunities for household members and perhaps increase the demand for child labor) or the use of loans to overcome shocks, two of the potentially most powerful impacts of microfi-

nance. Further, the model does not recognize credit rationing as a binding constraint.

Risk-coping effects from loans as well as the release of credit constraints, due to innovations in lending technologies (represented here by access to B and the level of r, with the costs of borrowing becoming arbitrarily high when no credit is available), would increase the positive impact of microfinance on schooling achievements beyond the predictions of the simple model. Nevertheless, the expansion of household employment opportunities, through larger or new microenterprises, may represent a channel for a potentially negative impact of microfinance on schooling (child-labor demand).

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

$$\alpha = \alpha(w, w', E, r; L_1, L_2, \gamma, \rho), \tag{7}$$

$$B = B(w, w', E, r; L_1, L_2, \gamma, \rho). \tag{8}$$

The outcome of this decision-making process determines the optimal proportion of the household's labor force to be kept out of work and into schooling and the optimal size of loan to be demanded to facilitate this process, as functions of the opportunity cost of education, expected future income, education expenses, and the cost of credit, given parameters about the size and composition of the household's labor force, the importance of women in the decision-making process, and the time discount rate.

4. ECONOMETRIC APPROACH

The conceptual analysis mentioned above identifies key variables that influence household decisions about sending their children to school. An econometric specification is necessary to test for the impact of microfinance on schooling achievements. The household decides on schooling by looking at the current marginal costs and expected future marginal benefits of education. This decision is made for each individual child. That is, the household will decide to educate a particular teenager if the present value of the expected net benefits that he/she will accrue is positive. Otherwise, he/she will work. Given the low levels of income, unoccupied teenagers are not observed.

Thus, the net expected utility from education may be expressed as a function of a vector of observed household and child characteristics (z) 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 (denoted by i) can be written as

$$ENPV_i = f(z_i, \varepsilon_i). \tag{9}$$

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 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:

$$Pr(schooling_i) = Pr[f(z_i, \varepsilon_i) > 0]. \tag{10}$$

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

$$f(z_i, \varepsilon_i) = h(z_i) + \varepsilon_i. \tag{11}$$

Then, the probability of schooling can be rewritten as

$$Pr(schooling_i) = Pr(h(z_i) > \varepsilon_i) \tag{12}$$

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 z_i. To consider the possibility that if the child is now attending school it does not mean that he/she had been able to attend continuously during previous years, had performed acceptably, or had started school at the right age; a dynamic framework is needed to capture the accumulated performance of each child. Indeed, beyond attendance, working may undermine human capital accumulation by interfering with learning, as reflected in grade completion rates (Heady, 2003).

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

$$Expected\,schooling = \begin{cases} 0 & if\ age \leqslant 6 \\ (age-6) & if\ 7 \leqslant age \leqslant 18 \\ 12 & if\ age > 18 \end{cases} \tag{13}$$

The schooling gap is then defined as

$$Schooling\ gap = max\{0, expected\ schooling - actual\ schooling\}. \tag{14}$$

For example, if a 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 schooling according to her/his age.

Because the dependent variable is a positive integer number, the estimation is specified as a count model, as ordinary least squares may generate inefficient estimates. The Poisson regression model has been widely used to study such data (Greene, 2000; Wooldridge, 1997). A criticism of these models is the implicit assumption that the variance of the dependent variable equals its mean. Extensions of the model relaxing this assumption have been proposed by Hausman, Hall, and Griliches (1984) and Cameron and Trivedi (1986, 1998), 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.

Given that in the sample there are children from the same household, they may share some *within* family characteristics that differ from *between* family characteristics. To account for this source of variance, the correct specification should treat the data as a panel. The combination of a negative binomial specification with a panel approach suggests that the most suitable model is one based on random effects, which is the technique we use here.

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

Individual variables: These control variables refer to characteristics of each child expected to influence education achievements: (1) *Age*. The expected sign is positive; the older the child, the more likely there will be a schooling gap. (2) *Gender*. This dummy variable takes the value of zero if the child is a boy and of one if the child is a girl. The expected sign is positive; in Bolivian culture, girls are expected to show larger schooling gaps. (3) *Position*. This variable assigns the value of one to the oldest child in the household, two to the next, and so on. A positive sign is expected; the earlier children are more likely to be kept in school.

Household variables: These characteristics are shared by all the children within a household: (1) *Distance to school*. It is measured as the number of minutes needed to get to the nearest high school. The expected sign is positive. (2) *Human capital*. The household's *stock* of human capital is measured as the accumulated number of years of schooling of all the workers in the household. This variable directly reflects the aggregate household's earning capacity and ability to pay for education (income effect) as well as indirectly reflecting the greater preference for schooling among educated decision-makers in the household (information effect). The expected sign is negative. Following advice from an anonymous referee, as an alternative we use the level of education of each parent separately, as a measure of the influence of parental education and gender on schooling decisions. (3) *Poverty index*. This variable is based on the index used in Navajas, Schreiner, Meyer, González-Vega, and Rodriguez-Meza (2000), adopted from the *1992 Poverty Map* for Bolivia. The index measures, for each household, the satisfaction of basic needs (health, access to water and electricity, housing materials, overcrowding, literacy, and education). Here, the education component was excluded, in order to avoid endogeneity problems. The expected sign is negative; the higher the index of basic needs satisfaction (the less poor the household), the smaller the expected schooling gap. Moreover, influences of microfinance may already have been incorporated in the levels of wealth reflected by this index. (4) *Land holdings or own arable land*: This variable shows the amount of land owned by the household and used for crops and other productive activities, measured in hectares. The sign will be positive if it is likely that the household will demand the child's labor for farming, in competition with schooling. The sign may be negative, however, if schooling is influenced by the level of the household's wealth and availability of land as a consumption-smoothing tool. The effect of land holdings is thus analogous to the child-labor demand effect.

Variables related to access to microfinance services include the following: (1) *Length of membership*: The samples were drawn in order to compare new clients (with up to one year of membership) with old clients (with more than one year). For the CRECER sample, the average length of membership was 5.4 months for new and 28.6 months for old clients. Because detailed information about length was not available for Batallas, the regression analysis incorporated a dummy variable that takes the value of one for old clients and of zero for new clients. The expected sign is negative, as the main hypothesis to test is if, ceteris paribus, clients with an older relationship—as compared to the group of new clients—have children with smaller schooling gaps. (2) *Internal account*: In traditional village banking programs, weekly loan recoveries and forced savings are accumulated into an internal account for the group, managed by its members until repayment of the loan to the MFI is due. In addition to their regular loan, funded by the MFI loan to the group, members can obtain short-term liquidity and emergency loans from this account, at terms and conditions decided by the members. This dummy variable takes the value of one when, at some point, the client had used the internal account. The expected sign is negative, assuming that use of the internal account would have allowed the household not to pull children out of school when confronted with an adverse shock. Use of the internal account thus measures some risk-management effects. (3) *Women empowerment*: This variable is measured by the household's accumulated human capital -measured by the number of years of schooling of its members- corresponding to working women. The expected sign is negative, to incorporate the view that gender empowerment, resulting from the ability of female household members to generate income, reduces the schooling gap. There were some doubts about possible correlation with the household's stock of human capital, but the relationship is weak and both can be used without fear of collinearity. *Regional variables*: These characteristics are shared by all children in a given geographic setting. The constructed dummy variable is *rurality* of the household. It is a proxy for both the quality of education and job opportunities for the educated (namely, rates of return from schooling). Although all the clients living in Batallas are considered rural (so this variable was not included in this regression), in the case of the CRECER dataset the household setting can be differentiated between rural and urban municipalities, and a dummy variable is constructed with a value of one if the household is located in a rural municipality. The sign of the rural dummy is expected to be positive, given the narrower set of employment opportunities available for an educated labor force (which reduces the expected rate of return of education, unless education facilitates migration out of the rural areas).

5. THE DATA

Deep inequalities and poor quality characterize education outcomes in Bolivia, where productivity and wages are low. In turn, over the past 20 years, microfinance has grown strong. Regulated MFIs have become a competitive and sustainable segment of the Bolivian financial system (González-Vega & Villafani-Ibarnegaray, 2007). They accounted for 59% of the total number of borrowers and 20% of the portfolio of all financial intermediaries by 2006. The growth of non-regulated MFIs, such as those examined here, has been equally impressive. When both types of MFIs are considered, microfinance reached 72% of all institutional borrowers in Bolivia.

The dataset emerges from two independent household surveys, using the same questionnaire. One investigated the households of clients of CRECER and SARTAWI in the municipality of Batallas (referred to as the *Batallas* survey). This dataset includes 130 households, randomly selected mainly from the countryside of the municipality, surveyed in April 2001 (Romero, 2002). The second survey, applied to households of CRECER clients in five departments (Chuquisaca, Cochabamba, La Paz, Oruro, and Potosí), was undertaken in November 2000 (*CRECER* survey). This dataset includes 427 households; about half of the sample comes from rural areas. Results from a similar 2001 survey of 400 households of ProMujer clients, in urban areas, were reported elsewhere (Maldonado & González-Vega, 2005).

SARTAWI began operations in the Batallas municipality in 1990. It was among the first MFIs to develop a lending technology to reach poor households in rural areas. Loans are granted to individual borrowers under a community liability scheme. Since 1994, CRECER uses the credit-cum-education approach,

combining village banking with a program of non-formal education for adults. Rural women have been the main focus of this program. Small, short-term loans are granted for working capital, guaranteed only by the joint liability of the women in each group. Repayment takes place at weekly meetings. The design of the program's educational activities attempts to change attitudes and behavior (e.g., the value of children's education) or to increase the self-confidence and skills of women (MkNelly & Dunford, 1999).

For the analysis of schooling achievements, children in school age (7–18 years old) were divided into primary-school (7–12 years old) and high-school (13–18 years old) children. Tests with the primary-school sub-sample did not reveal significant differences in schooling. This was not surprising, as attendance to primary school is widespread in Bolivia. The paper focuses, therefore, on the sub-sample of children from 13 to 18 years old. The demand for child labor is stronger among this group and the opportunity cost of additional schooling higher.

Statistical results for the dependent variable, the schooling gap, are reported in Table 2. Of all children in secondary-school age, 66% show some gap. Most of the cases correspond to one or two years of delay (39% of all teenagers and 59% of those with gap), with a few cases of desertion. This suggests that the gaps observed have emerged recently. The CRECER sample shows a larger share of children with some gap. Although the Batallas population is mostly rural, the road network and school facilities are more developed than in other rural areas and promising employment opportunities may be better, due to its closeness to La Paz. Considering the two categories of clients (new and old), cumulative distributions for the schooling gap show stochastic dominance for both sub-samples, where children from old client households consistently have less gap than those from new client households (Figure 1).

Key statistics for the independent variables in the sub-sample of children in high school age (13–18 years old) are shown in Table 1 (above), for those coming from households of new and old clients. While households within the different sub-samples are very similar in size, number of children, and their age, some statistically significant differences are notable. One is the greater distance to a high school among old clients in Batallas, compared to the new, which

Table 2. *Schooling gap for the sample of children 13–18 years old (number and proportion in the category) for old and new clients, in both surveys*

Schooling gap, in years	Batallas			CRECER			Total		
	New clients	Old clients	Total	New clients	Old clients	Total	New clients	Old clients	Total
0	40	22	62	43	60	103	83	82	165
	43%	52%	46%	27%	31%	29%	33%	34%	34%
1	20	8	28	44	59	103	64	67	131
	22%	19%	21%	28%	30%	29%	25%	28%	27%
2	8	5	13	22	27	49	30	32	62
	9%	12%	10%	14%	14%	14%	12%	13%	13%
3	4	3	7	16	13	29	20	16	36
	4%	7%	5%	10%	7%	8%	8%	7%	7%
4	3	1	4	5	10	15	8	11	19
	3%	2%	3%	3%	5%	4%	3%	5%	4%
5	5	1	6	2	8	10	7	9	16
	5%	2%	4%	1%	4%	3%	3%	4%	3%
6	1	0	1	6	6	12	7	6	13
	1%	0%	1%	4%	3%	3%	3%	3%	3%
7 and more	12	2	14	21	13	34	33	15	48
	13%	5%	10%	13%	7%	10%	13%	6%	10%
Total with	53	20	73	116	136	252	169	156	325
Gap	57%	48%	54%	73%	69%	71%	67%	66%	66%
Total observations	93	42	135	159	196	355	252	238	490

Source: client household surveys.

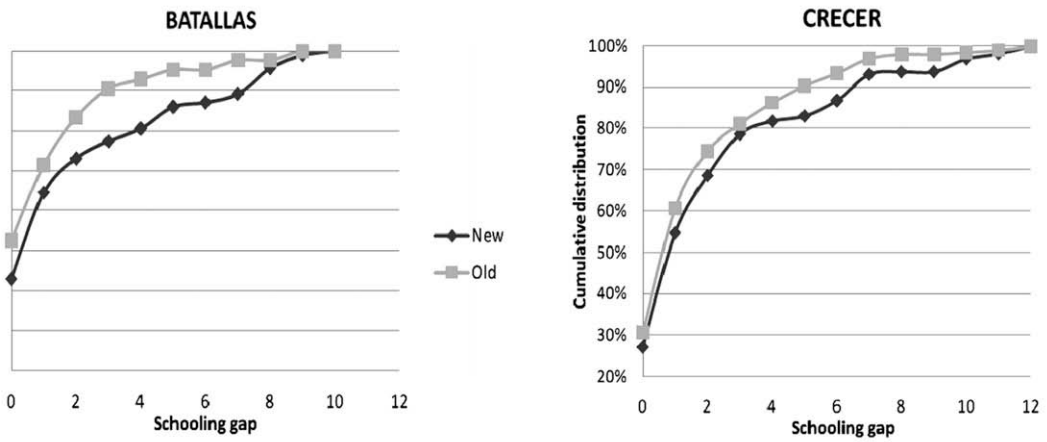

Figure 1. *Cumulative distribution of the schooling gap, for old and new clients, for the two sub-samples.*

would make attendance costlier. The other is the greater poverty of old clients in Batallas, as given by the lower index of basic needs satisfaction. If long distances and poverty explain a lower demand for education, schooling gaps should be larger. These differences would then strengthen inferences from the observation of a negative impact of the length of the relationship with the MFI on schooling gaps. In the case of CRECER, there is a higher proportion of old—compared to new clients—in the rural areas. If the likelihood of a child-labor demand is larger in rural than in urban areas, this difference would also strengthen the inference about the impact of microfinance on schooling. Controlling for these variables in the regression reduces the chances of selection bias in the results and the chances of over-estimation or sub-estimation of microfinance impacts.

6. RESULTS

The regression analysis examines the dependence of the schooling gap on the explanatory variables. The regressions test for differences in gap between households that have had access to the MFIs for some time *versus* households that recently joined the program. The hypothesis is that access makes a marginal difference in the size of the gap, for old compared to new clients. Regressions are calculated for the two samples separately.

Given the nature of the dependent variable (schooling gap) and of the dataset (panel data), the estimation is based on a negative binomial specification (which accounts for over-dispersion in count models), with random effects. Since the coefficients from a negative binomial regression are only useful for their sign and significance but not their magnitude, because the functional form is exponential, the results from the random effects model reported in Table 3 are marginal effects.

Table 3 shows two models for each dataset. In Model I, the household's stock of human capital is accounted for as the number of years of schooling accumulated across all workers. In Model II, the level of schooling is considered separately for the child's mother and father, while the education of other household members is ignored. This specification was suggested by an anonymous referee, and it leads to interesting results too.

In both specifications and for both samples (local Batallas and nationwide CRECER), the coefficient for *membership* is negative and statistically significant. The null hypothesis can thus be rejected. It appears that, *ceteris paribus*, children from households with affiliations to MFIs—of over one year—have a greater chance of being kept in school, in contrast to children from households just entering the program, for which this impact would not have yet emerged. This is the central and important result: the children of old clients have about half a year (in the case of Batallas) or a quarter of a year (in the case of CRECER) less schooling gap than children from new client households. Given average gaps of 1.8 and 2.2

Table 3. *Marginal effects from panel regressions about the schooling gap of children 13–18 years old, for the two datasets and alternative models*

Variable	Batallas		CRECER		
	Model I	Model II	Model I	Model II	Model III
Length of membership	−0.431*	−0.452*	−0.250*	−0.257*	−0.252*
Child's age	0.209***	0.202***	0.080**	0.078**	0.063*
Child's gender	0.392*	0.279 ns	0.267**	0.265**	0.171 ns
Position of child			0.138***	0.128***	0.096**
HH human capital	−0.022***		−0.008 ns		
Father's education		−0.023 ns		−0.020 ns	−0.038**
Mother's education		0.008 ns		0.015 ns	−0.049**
Poverty index	−0.883**	−1.166**	−0.136 ns	−0.084 ns	−0.248 ns
Land holdings	0.094**	0.087*	−0.005 ns	−0.005 ns	−0.004 ns
Internal account use			−0.219 ns	−0.222 ns	−0.207 ns
Rural dummy			0.198 ns	0.200 ns	0.279*
Women empowerment	−0.148***	−0.150***	−0.089***	−0.110***	
Constant	−1.482 ns	−1.630 ns	0.233 ns	0.239 ns	0.470 ns
Observations	134	134	343	343	355
Groups	81	81	204	204	211
Wald test (chi2)	50.51***	38.75***	44.42***	44.27***	33.35***
Test for pooled data (chi2)	0 ns	0 ns	18.12***	17.33***	15.97***

(ns) Not significant (*) significant at 10% (**) significant at 5% (***) significant at 1%.
In Model I, human capital is measured for the whole household. In model II, only each parent's schooling is considered, separately. In model III, the empowerment variable is not included. The coefficients reported are marginal effects.

years, respectively, these are important differences. Participation in microfinance programs matters for schooling.

The results for the various control variables are as expected and interesting. The coefficient for *age* is significant and positive. The coefficient for gender varies in significance depending on the specification: models considering the household's human capital tend to show more significance of the gender variable than models using each parent's schooling. In the former, the results suggest that girls have about 0.3 years more schooling gap than boys, while in the latter the marginal effect is not significant. That the coefficient for *gender* is not significant would be an important result. The lack of statistical significance would mean that there are no differences between girls and boys in their schooling achievements. The results here cannot show if this potential gender neutrality is due to the MFI's educational influence, but anecdotal references to this effect abound (Romero, 2002).

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. In earlier tests, *distance to school* was not significant. Thus, differences in schooling gaps might be attributable more to demand rather than supply factors. This variable was dropped from the final regressions.

When the household's stock of *human capital* is measured by the level of education of all working members (as a proxy mostly for its income-generating ability), it significantly reduces the schooling gap in the Batallas dataset. When both the mother's and the father's education are considered, the coefficients are not significant. This result may be influenced by the presence of the women empowerment variable, which might be capturing part of the mother's interest in educating her children. In Model III, estimated only for the CRECER dataset, the empowerment variable is dropped and each parent's schooling becomes significant, with the mother's marginal effect being larger (Table 3). Actually, the *empowerment* variable shows a negative and statistically significant coefficient in all cases. The empowerment of women thus reduces schooling gaps for high-school children and it would help overcome poverty across generations.

The coefficient on agricultural *land* holdings is positive and significant in the Batallas but not in the CRECER case, reflecting that Batallas is mostly an agricultural region. Farming plays a decisive role in income generation and it appears to be in competition with education. This presents policymakers with a 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. This result is in contrast to Trigueros (2002), who found that in El Salvador land ownership explains continued enrollment in the presence of adverse shocks. Bolivia had not experienced major systemic shocks at the time of the surveys, so the adverse child-labor demand effect for farming households seems to have offset any potential favorable effects of land ownership on risk management.

The coefficient for the *poverty* index is significant in the case of Batallas and it shows the expected sign. That is, households with the least satisfaction of other 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, a high discount rate, and a tight budget constraint. Also, in the absence of other productive household assets, expected returns from education may appear low. Further, households with a higher index of satisfaction may have accumulated wealth in part as a result of the microfinance program, so this variable may capture an indirect impact that is not captured by participation in the program.

The *internal account* variable is available only for the CRECER dataset, and it shows a negative but not significant coefficient. We expected to find a stronger effect of the access to the internal account as a useful tool in consumption smoothing and risk coping, thereby protecting human capital formation. However, we could not differentiate if the internal account is used only as a risk-coping mechanism or also as a tool for income generation, offering extra liquidity in peak periods along the year.

The effect of the dummy variable used to control if the household is rural is positive, suggesting a greater schooling gap in rural environments, but the coefficient is significant only in model III. The inclusion of this variable, however, provides consistency to the regressions and accounts for differences between types of households. For instance, landholdings have a different impact in rural than in urban households. For rural households, landholdings are a factor of production, which generates demands for (child) labor, while for urban households land ownership mostly reflects wealth (with a potential beneficial impact on schooling).

Over-dispersion was observed in all regressions, leading to the conclusion that the negative binomial model was the appropriate choice. With this method, over-acceptance of coefficient significance and over-rejection of the null hypothesis is avoided. Similarly, the random effects model designed to control for both within and between household effects generates better estimates for the CRECER sample.

In summary, for the Batallas sample, access to microfinance has an important impact on schooling. Old clients have, on average and controlling for other things, teenagers with almost half a year less of schooling gap, compared to new clients. The empowerment of women and the household's stock of human capital also matter. For every year of additional education of the household's female workers, the schooling gap is reduced by about one sixth of a year. A smaller effect, but still significant, is attributed to the schooling of all household members. Less poor households show, on average, significantly smaller gaps. However, an additional hectare of land increases the demand for child labor and, thereby, it increases the gap by about one-tenth of a year.

For the CRECER sample, access to microfinance—when comparing old with new clients—is beneficial, significant, and still substantial, although not as much as in the case of Batallas. This result is interesting, because Batallas is one of the earliest locations for CRECER, while the broader sample includes other regions of the country where program development has been more recent. In this dataset, the effect of each parents' education is clear, with a larger effect of the mother. The marginal effect of the household's human capital on schooling is slightly smaller for the CRECER than the Batallas sample. The same is true for empowerment, but the effects continue to show a strong statistical significance. The position of the child with respect to her/his siblings matters; that is, a particular child has, on average, almost a tenth of a year more of schooling gap compared to his/her immediately next older sibling, when compared at the same age. Similarly, the results suggest that girls may have up to a quarter of a year more of schooling gap compared to otherwise identical boys.

Finally, the poverty index shows no statistical effect on schooling achievements, likely due to the fact that both groups (new and old clients) exhibit similar levels of poverty in this sub-sample.

7. CONCLUSIONS

Increased access to education will be critical in efforts to improve the quality of life and welfare of the next generation in Bolivia and other developing countries. Constraints on both the supply and demand of education must be overcome. This demand may be influenced by attitudes, opportunities, and constraints of poor rural households that are, in turn, affected by access to microfinance. The results here confirm this perspective.

The paper uses data from two surveys of households of clients of MFIs to examine channels through which microfinance may exert direct and indirect influences on schooling outcomes. The results challenge usual assumptions about microfinance programs. In particular, for some ranges of household income and some types of borrowers, access to MFIs may have conflicting impacts on schooling gaps. On the one hand, microfinance may 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 may discover new demands for child labor for farming (or perhaps taking care of siblings while the mothers operate a new or expanded business). Significant program and policy consequences are derived from these paradoxical results.

Consistent with threats of poverty traps, deeper levels of poverty and low stocks of human capital may be associated with lower demands for education. Results for the index of basic needs satisfaction confirm unfavorable influences of poverty on schooling gaps. More educated household workers generate a stronger demand for the schooling of children, both by earning higher incomes and possessing more optimistic perceptions about returns from education.

The relationship between farm size and the demand for education may create some policy dilemmas, as increased opportunities for farming appear to raise the household's demand for child labor. Similar effects seem to emerge from the encouragement of household microenterprises. The first source to fill this larger demand for labor is the family. Even when household members are aware of 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. MFIs in Bolivia have been able to reach segments of the rural population that otherwise would not have had access to these services. The importance, for investments in education, of the access to credit and the other financial and nonfinancial services that they have provided has been a valuable development contribution.

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