The Impact of Educational Grants on Basic Education Completion: Do the Poor Benefit?

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Abstract

Cash transfers can help poor families to meet the costs associated with sending their children to school. Demand constraints are a major impediment to schooling attainment in rural areas. Educational grants can contribute to raise schooling attainment in rural areas and thereby to close the gap between educational levels in rural areas and national levels. In 1997, the Mexican government initiated such a program of cash transfers, called PROGRESA, targeted to children living in poor and extremely poor rural regions. The present work shows that the program effectively retains children in school leading to important gains in schooling attainment. The grants succeed at lowering the drop out rates by 30-45% for the eligible grades of primary and secondary school. On average, the program increases the schooling attainment of the poor by almost 5 months, from 6.9 years to 7.4 years. Moreover, the program successfully reaches the poorest and benefits them most. Children from the second lowest well-being quintile, as measured by a poverty index, are the ones that gain most from the program, along with children of uneducated parents. Finally, relaxing demand constraints with some financial help counters effectively the school accessibility constraints at the secondary school level.

1 Introduction

Education has long been recognized as a key weapon in fighting poverty, especially in developing countries. Significant efforts to raise schooling attainment by governments and international agencies have attempted to break the links between poverty and low education levels. Despite the recognition of education's importance in fighting poverty, illiteracy rates remain high and enrollment rates are low in many countries.

How can a government induce families to invest in their children's basic education, especially among rural families? Governments can address the inadequacy of the schooling services offered and/or the families' financial constraints to their demand of educational services. Most national and international agency-led programs have focused on improving the supply and access to schools. Recent initiatives to increase supply address financial impediments to building and operating new schools by encouraging private sector involvement. For example, the Pakistani government started in the early 1990's the Quetta fellowship program to attract private school operators in poor communities where public school construction was too expensive, and thereby increased school enrollment (Kim, Alderman and Orazem 1999). Education programs now also consider quality issues and related school inputs problems – school infrastructures, furniture, textbook availability, teachers' training and attendance. Schools' poor quality discourages enrollment and attendance, and might be responsible for high drop-out rates. The Mexican Pare Program, in 1992-1997, offers an example where provision of school inputs to successfully improved the students' schooling attainment (Lopez-Acevedo 1999).

Alternatively, voucher programs attempt to both address access and quality concerns. These programs provide a per child education voucher that is reedemable at a private school. Thus, it gives parents the freedom to choose between public and private schools, and allows them to base school choice upon quality rather than uniquely costs. Voucher programs do not increase the effective supply of schools or resources; instead, they give access to existing educational services, and therefore are not pure supply programs. They recognize the budgetary and financial constraints that limit access to private schools and consequently limit the available educational options a family have. By considering family constraints limiting their school options, voucher programs partially approach education issues from a demand perspective. Since they do not offer financial help to parents to send children to public schools, voucher programs are nevertheless not pure demand programs. Examples of voucher programs implemented in developing countries include the extensive Colombian voucher program for secondary schools, covering 217 municipalities (Angrist, Bettinger, Bloom, King and Kremer 2000), and similar programs in Bangladesh, Belize and Lesotho (West 1997). Voucher programs have a limited scope to improve school enrollment by poor children in rural areas. Few private schools operate in rural areas and the supply of public schools still represents a considerable challenge.

To encourage poor families in rural areas to invest further in their children's education, the Mexican government designed a program of educational grants called Progresa. After having addressed supply issues with programs like Pare to increase the access or quality of schools for rural poor families, the Mexican government changed its approach to the school attendance problem to a demand-based outlook. This approach relaxes budgetary and financial constraints impeding educational investments, and creates incentives for schooling in communities where these might be low. The program aims at encouraging families to send their children to school until they have completed basic schooling, which consists of six years of primary school and three years of junior high school.[1] To accomplish its goal, the program pays monthly educational grants and nutritional cash transfers to eligible families.

Through two channels, the program retain grantee children in school and thus promote higher schooling. First, educational grants increase enrollment through an income effect. The cash transfers add up to the family's income and resources, inciting enrollment of the children. The grants also indirectly influence higher enrollment and completion rates through an attendance condition: a monthly requirement of 85 percent minimum class attendance. To receive the grants for any given school month, the child must have attended at least 85% of the school days. This requirement helps to prevent drop-outs by promoting favorable conditions for academic success. At the same time, Progresa's health component promotes good health and nutritional status which are essential for children's concentration. Both continual attendance and better health favor learning and thus increase the chances of the success of the child. Progresa benefits thus can induce higher primary school completion by reducing the drop-out rate each year, and enable more teenagers to pursue their schooling at the secondary school level. These cumulated impacts should increase the schooling attainment in rural Mexico and the proportion of children that complete basic schooling.

This work both assesses the impact of the grant program on the per-grade drop-out rates and its cumulative impact on schooling attainment. Using the results from the estimation of a survival model, the gains in schooling attainment are calculated on average and then for different sub-groups. The grant program succeeds at lowering the drop out rates by 30-45% for the eligible grades of primary and secondary school. On average, the grants increase the schooling attainment of the poor by almost six months, from 6.8 years to 7.4 years. In addition, children of the second lowest quintile of a poverty measure gain most from the program, as well as children with uneducated parents. Hence, the program has a progressive impact among the poor. Finally, relaxing demand constraints by offering financial help to poor families counters effectively the school accessibility constraints that these families face; treatment children who have to travel more than three kilometers achieve schooling attainment close to control children who have a school in their village.

Previous studies of schooling attainment have analyzed its determinants using cross-sectional data (Bommier

[1] Since 1992, the three years of junior high school are compulsory by the Mexican constitution.

and Lambert 2000, Tansel 1998, Akhtar 1996). To our knowledge, only one study uses a "quasi-panel"[2] dataset to estimate schooling attainment (Lillard and Willis 1994). The Progresa panel dataset has bi-yearly information for two years, thus allowing for information updating of the family situation at the moment of the decision. The proposed empirical assessment of the impact of educational grants will complement the assessment work done by Schultz (2001). Schultz looks at the impact of the grants on enrollment by level. He calculates the average impact of the grants by using group differences in enrollment and then using regression techniques, measures the impact on the individual decisions. He further uses the group differences to non-parametrically infer the total gain in schooling attainment from the program. This work will disaggregate the impact for each grade, and further uses estimates controlling for individual characteristics to measure to the cumulative gain of the grants. Controlling for individual characteristics allows to differentiate the impact for different sub-groups of treatment children.

The paper is organized as follows. First, the program and the schooling situation in Mexico are described. Section 3 presents a dynamic model of schooling attainment and its econometric implementation. The empirical strategy discusses the data used, sample considerations and the impact measurement. Results are then presented and policy considerations are discussed in sections 5 and 6.

2 Progresa: The Mexican Cash Transfer Program

As mentioned above, illiteracy and enrollment rates continue to be problematic in many developing countries (see tables 1 and 2). Secondary school enrollment particularly raises a big challenge, and significant discrepancies exist between urban and rural areas in school attendance and thus in schooling attainment (table 3). While in many developing countries primary schooling has a long way to go to become universal, Mexico has experienced important gains in the 1990's. In the late 1990's, only 2.5 percent of children[3] never attend school and school continuation rates in primary school are in the range of 96-97 percent even in poor and extremely poor rural areas, as shown in figure 1. Similarly, the majority of Mexican teens that enter high school complete it, whether in urban centers or in rural areas. Then, why is the average schooling for rural children lagging behind that of their urban counterparts (6.36 years compared to the national average of 8.47[4]) and falling short of the minimum basic schooling by 3 years? Because only 55 percent of the children that complete primary school enter secondary school.[5] Even though junior high schooling is short, families appear to consider that the three extra years are not worth the net costs. It is also observed that girls have a lower schooling than boys with 5.78 against 6.02 for children in extremely poor rural backgrounds.[6]

The Mexican government cash transfer program, Progresa, aims at encouraging secondary schooling and thus at achieving universal basic schooling. The program consists of three components: education, health

[2]The value of the determinants at the different times of the decision is extrapolated, rather than actually surveyed, by using information from a panel dataset.

[3]Muniz (1999), p.1.

[4]de León, Hernández and Parker (1999), table 1.

[5]This figure includes every child that has completed sixth grade of primary school in 1998, using census data collected by the direction of Progresa. By excluding children that were out of school the previous year, the entry rate to secondary school jumps to 65%. These two numbers offer a lower and upper bound. Among the adults, 17 years old and over, the proportion of individuals that pursue school beyond primary school drops to 40%. The same proportion is found by restricting the group to the 17-26 years old.

[6]de León et al. (1999), table 1.

and nutrition. The educational grants are the most important component of the benefits given to families. A monthly stipend is given for every child attending 3^{rd} through 9^{th} grade. The benefits increase with every grade and are slightly higher for girls than for boys in secondary school (table 4). The grants are paid to the mother of the family every two months, conditional on a minimum attendance level of 85% of school days per month. The value of the per family grant is capped at 790 pesos per month (table 4).

The program also provides an amount for school supplies at the beginning of every school year. In addition to the educational grants, families are given nutrition subsidies conditional on a monthly visit to the doctor. The benefits are adjusted for inflation every six months. The program has grown to include 2.6 million families in 2000, and the benefits represent an average of 22 percent of the recipient families' income. The extent and the importance of the benefits to the beneficiaries makes the program one of the largest cash transfers programs in a developing country, with a budget totaling 0.2% of the Mexican GDP.

3 Schooling attainment: result of sequential decisions

3.1 Theoretical Framework

Schooling attainment is the result of a series of sequential enrollment decisions. Parents decide to enroll their child in primary school for the first time with some desired or optimal length of schooling in mind. As the child progresses, parents must reiterate the enrollment decision every year until the optimal level of schooling is attained. While considering the current enrollment of their child, parents update their valuation for schooling and its corresponding desired level. Due to this updating, the optimal schooling may change during the school years of the child. Changes in the labor markets and wages, costs to schooling and/or family's demographics and resources all alter the schooling value and schooling attainment.

At the beginning of the school year, parents base their enrollment decision on the value for the child of completing $g+1$ grades. The child has already attended school at least g years and completed g grades. By enrolling the child in grade $g+1$, the family anticipates the benefits and costs associated with the extra year of schooling. In addition, attendance of the extra grade gives access to further schooling to the child upon his success of the current grade. Thereby, the discounted value of future schooling adds to the net benefits of enrolling in $g+1$. The full benefits associated with grade $g+1$ are thus: $T^e_{g+1} - C_{g+1} + \beta V(g+2)$ where T^e_{g+1} are the benefits, C_{g+1} the costs, and $V(g+2)$ the value of future schooling discounted by the time preference rate β.

On the other hand, the child can start working and earn wages associated with his completed schooling and his individual characteristics Z, for the rest of his working life. In this instance, the gains of not enrolling the child are the present value of lifetime earnings: $\frac{w(g;Z)}{1-\beta}$.

The value of $g+1$ grades takes the highest value between continuing school and starting to work. The following Bellman equation expresses this value upon which enrollment decision is made:

$$V(g+1) = \max\left\{T^e_{g+1} - C_{g+1} + \beta V(g+2), \frac{w(g;Z)}{1-\beta}\right\} \tag{1}$$

Using this value of grade $g+1$, parents decide to enroll or not their child in school for an additional year, conditional on the previous g enrollment decisions:

$$S_{g+1} = \begin{cases} 1 & \text{if} \quad T^e_{g+1} - C_{g+1} + \beta V(g+2) > \frac{w(g;Z)}{1-\beta} \\ 0 & \text{if} \quad T^e_{g+1} - C_{g+1} + \beta V(g+2) \leqslant \frac{w(g;Z)}{1-\beta} \end{cases} \qquad \text{s.t.} \quad S_k = 1 \quad \forall k = 1, \ldots, g \tag{2}$$

Parents will terminate their investment in the child's schooling when the present net benefits of an additional year of schooling is lower than the present value of the achieved schooling:
$T^e_{g+1} - C_{g+1} + \beta V(g+2) \leqslant \frac{w(g;Z)}{1-\beta}$ or $V(g+1) = \frac{w(g;Z)}{1-\beta}$. This terminal condition matches the enrollment decision taken at the beginning of the academic year, making it non-intuitive. The terminal condition represents the value of the non-completed grade $g+1$, the grade the child failed to enroll in, rather than the value of the last completed grade. The value of the last completed grade can then be solved by substituting the value of $V(g+1)$ in $V(g)$, which leads to $V(g) = T^e_g + C_g + \beta \frac{w(g;Z)}{1-\beta}$.

Assuming away reentry after a temporary absence of one or more years from school, schooling attainment is defined to be the last grade completed upon failure to enroll.[7]

3.2 Econometric Implementation

The event that schooling attainment G takes the value g is equivalent to the event that the child drops out of school after achieving g grades. From the standpoint of the econometrician that imperfectly observes the enrollment process, the decision in equation 2 becomes the conditional probability of observing a failure to enroll. Thus, the probability of failing to enroll in $g+1$, and thus drop out of school, matches the probability of attaining g years of schooling, conditional on past enrollment decisions:

$$\Pr(S_{g+1} = 0 | S_k = 1 \quad \forall k = 1, \ldots, g) = \frac{\Pr(G = g)}{\Pr(G \geqslant g)} = \lambda(g+1) \tag{3}$$

This expression corresponds to the risk or hazard rate of dropping out of school after having completed grade g and before the completion of grade $g+1$ given that the child has continuously been in school up to the $g+1$ enrollment time.[8] A duration model allows to estimate these conditional probabilities and to assess the impact of Progresa on the risk of drop out and schooling attainment. The duration model fits the dynamic nature of the schooling attainment decision because it allows for information updating and other changes in family situation that affects the decision. From year to year, the family's characteristics can change with members of the family leaving the household, new children starting school and others dropping out of school. These changes in familial demographics as well as in wealth affect the capacity of the family to incur schooling costs at any given moment. Duration models permit the updating of information affecting the enrollment decision.

[7]The model can easily accommodate reentry. Reentry can be prompted either by changes in family's situation or by changes in the labor market, thus changes in the discount rate or the market wage. The possibility of reentry does not alter the structure of the program. Some conditions would be required on the terminal condition, such as at the age of 17 years old the individual drops out of school independently the schooling completed.

[8]Schooling attainment has the particularity that if you "exit" during grade $g+1$, it takes the value g. To statistically satisfy this characteristic, the event is to drop-out after grade g which exactly corresponds to the failure of enrolling in $g+1$ at the beginning of the school year.

Alternatively, school continuation decisions for each grade can be separately estimated. By doing so, the researcher obtains multiple coefficients for each factor, per grade enrollment decision. A set of estimates for a given factor, say the education of the parents, is difficult to interpret, and on choice-theoretical grounds, difficult to justify. Why should the parents' education matter for one grade and not for the next grade, and what can be inferred about its impact on overall schooling attainment? If schooling attainment is the product of decisions taken over time by the same agent, the fixed characteristics of this agent should have a constant influence over time. On the other hand, factors such as age may have an increasing deterrent influence on continuation as the child progresses in his schooling. Then, a set of separate estimates appears reasonable and informative. Duration models have the advantage of accommodating both types of factors: fixed and varying components of the total schooling decision, following what the theory prescribes.

Following the decision rule (equation 2), the hazard rate is a function of the transfers (T^e), the costs (C), the wage for the schooling completed and individual characteristics that influence it ($w(g;Z)$), the value of future schooling ($V(g+2)$), and the discount rate (β);

$$\lambda(g+1) = f(T^e_{g+1}, C_{g+1}, V(g+2), w(g;Z), \beta) \tag{4}$$

To analyze how individual characteristics influence drop-out and hence schooling attainment, a proportional hazard model is used. Proportional models postulate that individual hazard rates λ for individual i at grade g are proportional to a baseline hazard rate such that: $\lambda_i(g+1) = \lambda_0(g+1)\mu_i$. The baseline hazard rate can be thought as being the average risk of dropping out in the population. It says that independently of individual characteristics, students will drop out of school influenced by outside factors. Common beliefs, such as cultural beliefs about the importance of schooling, and general labor conditions enter this common risk of dropping out. Rather than attempting to model and measure this average risk, proportional hazard models account for this common risk through the baseline hazard rate.

The proportion μ_i by which the individual rate differs from the average, is determined by some function of the individual's covariates. Let's assume that the data generating process takes the form of an exponential function such that $\mu_i = \exp(X_i\beta)$. This specification makes μ_i nonnegative, which has the advantage of not imposing restrictions on β.[9] The hazard rate for grade g is thus: $\lambda(g+1;X_i) = \lambda_0(g+1)\exp(X_i\beta)$ where X_i correspond to the vector of covariates for observation i.

As indicated above, the transfers, costs, earnings for the completed schooling, and individual characteristics enter X_i. The value of future schooling is unobserved and thus, enters the estimation error. The hazard rate with the estimation error ϵ can be written as:

$$\lambda(g+1) = \lambda_0(g+1)\exp(\alpha T^e_{g+1} + \gamma C_{g+1} + \delta w_g + \theta\beta + \sigma Z + \epsilon) \tag{5}$$

The hazard rates will be estimated following the Cox method. Cox proportional hazard model is a semi-parametric method that estimates parametrically the influence of individual characteristics, and estimates non-parametrically the baseline of the hazard ratio.

[9] Kiefer (1988), p.664.

4 Empirical Strategy

4.1 Progresa data

The data comes from a baseline survey performed in November 1997, the Encaseh 1997 and evaluation surveys Encel performed every 6 months by the National Direction of Progresa starting in October 1998. It covers 7 states, 506 villages and some 24,000 households of which about 11,000 households have school-aged children. Using only children that were enrolled in 1997 and who's two parents were living at home, the sample counts 20,486 children between the age of 5 and 16 years old. The surveys are part of the evaluation strategy of the program to assess the impact of the transfers, and include a control group along with the beneficiaries group.

The sampling was done in accordance with the targeting strategy. To identify beneficiaries, the program direction first determined the degree of marginality of all the localities in rural areas[10] and using this indicator, they decided which localities would be incorporated into the program and the timing of the incorporation. Then, using census data from the villages, the eligible households were identified on the basis of a discriminant analysis of income and other poverty considerations like dependency ratio and dwelling qualities. Households were characterized as poor and therefore eligible, or non-poor and non-eligible.

To build the experimental sample, a subset of localities with an identical degree of marginality and from the same incorporation round was chosen from the pool of localities identified as program recipients. Randomization was performed within the subset, assigning each locality to be either part of the control group or the treatment group. In figure 2, this randomization splits the sample of 506 villages into villages with program provision, that we call Progresa villages, and villages without program provision, non-Progresa villages.

This eligibility rule excludes non-poor families, both group A in the Progresa village and group B in the non-Progresa village. Group A and B thus compose the non-eligible group.[11] Both group C and D are eligible to receive the transfers but only those in group D chose to participate. The eligible non-participant households includes both households that started as participants and withdrew, and households that never participated. The reasons for withdrawals range from moving out of the community to withdrawing because the costs of receiving the transfers are higher than the benefits. Similarly, a wide range of reasons led families to never participate. It is however difficult to identify why a given family withdraws or chooses to never participate. Given the small number of non-participants relative to participants, we choose to focus on the impact of being eligible rather than being beneficiary.

The surveys contain information about each household member as well as household characteristics such as assets and consumption. To capture earning potential in the school continuation equation above (equation 2), both the off-farm work opportunities and the on-farm labor needs must be accounted for. A characterization of the village's labor market is used along with the distance to large urban centers for off-farm opportunities. On-farm labor needs are driven by the family's agricultural assets. Moreover, caring for younger siblings (children of 0 to 5 years old) may require the help of an older child. The agricultural

[10] Localities were deemed rural if their population was below 2,500 inhabitants and for services accessibility concerns also excluded localities of less than 50 inhabitants.

[11] The terms non-eligible and non-poor are used interchangeably.

assets, except for land, and the number of young siblings are measured both in 1998 and 1999 to capture the changes between the two points in time. Age and gender influence the wage opportunities by the children and enter the Z variable of the earnings function.

Glewwe and Jacoby (1994) suggest there are factors that affect the child's learning productivity and thus the earnings potential of the child. To account for learning productivity, the entry age to primary school, and grade failure in the previous year are included in Z. The human capital of the parents also influence the learning productivity. These additional dimensions of learning productivity are proxied by the education of parents, as well as their ethnicity (to allow preference differences across ethnicity).

The costs of schooling C_{g+1} include fees, school supplies, expenditures on public transportation and uniforms. In the Mexican context, however, the main costs are traveling costs, as schools are free and uniforms are generally not required. Very little information is available on school supplies, as very few families report having expenditures for this item. Since the program is offered in villages that have a primary school, there is no traveling cost for this level. Only the distance to secondary school is included to capture costs of schooling for children considering an enrollment decision at the secondary school level.

Finally, the discount factor is influenced by the family's wealth and capacity to face the costs and opportunity costs of schooling, especially if there are market imperfections limiting the family's ability to borrow against the child's future earnings. The poverty index calculated by the program direction to identify the poor families is included, as well as the number of children in age to attend primary and secondary school. The latter will capture the total schooling costs the family faces. The strategy to capture the impact of the grants, T^e is explained in the two following sections.

4.2 Sample considerations and timing

The impact of the program Δ is assessed by comparing the decisions taken after the program was implemented by the eligible group to the ones of the control group: $\Delta = E[G|T^e = 1] - E[G|T^e = 0]$ where $T^e = 1$ indicates eligibility for the treatment.

Figure 3 illustrates the sample of cohorts used for the assessment. A cohort is a group of children that start school at the same time. Let us assume, for the moment, that there is no grade repetition and no temporary absence from school.[12] When Progresa was implemented in 1998, children of cohort 5 were deciding whether to enter in grade 5. To evaluate the impact, children from Progresa villages (eligible children) are compared with children from non-Progresa villages. Children that chose to enroll in and completed grade 5, must decide in 1999 whether or not to pursue into grade 6. If the sample exclusively includes the children of cohort 5, the analysis could only capture the impact of the program on grade 5 and 6, and not schooling attainment as a whole. Because of this, a cross-section of cohorts is used. Moreover, only children that were enrolled in 1997 are included in the analysis. Children not enrolled in 1997 may have left school prior to 1997, and thus the time of leaving and the associated situation is unknown. Finally, only two enrollment decisions out of the complete series of enrollment decisions are observed for each children in the sample,

[12]Temporary absence from school occurs when a child drops out of school, either in the middle of school year or fail to enroll one year, and re-enrolls into school the following academic year. The causes of temporary absence are not well documented, but if they are mainly caused by temporary shocks, the impact of the program as a form of insurance against short-term risk should be evaluated for its sake and separately from the schooling decisions.

since all the enrollment decisions prior to 1997 are unobserved. This characteristic of the sample is referred to as left truncation. The estimation corrects the survival probability for this truncation.

Taking into account grade repetition requires to include cohorts prior to 1990 in the sample. As pointed out earlier, grade repetition is a common phenomenon in rural Mexico. Consequently, children may take well beyond 9 years to complete 9 years of schooling. The 1988 and 1989 cohorts are added to the sample to ensure that the hazard rate calculations for higher grades are based on a sufficient number of children that had the opportunity of making the decision to enroll in higher secondary school grades. The data does not allow us to go further back than 1988. Temporary absence from school constitutes a second problem. On average, 17-20 percent of children that left school return after one or two years. The short observation period for each cohort and the limited information on the past schooling history prohibits the inclusion of this additional problem in the analysis. Thus, it will underestimate the schooling attainment of children. Moreover, it will bias the impact of Progresa downward, because the return rates are slightly higher for the eligible group than the population in general. Given the data limitations, schooling attainment is defined as being observed after the first failure to enroll.

4.3 Assessing Progresa's impact on school attainment

As explained in the previous section, the impact of educational transfers on schooling attainment is assessed by comparing the schooling outcome for the treatment group to the one of the control group. Let P_v indicates whether the village is a Progresa village. It will capture intrinsic differences between the Progresa villages and non-Progresa villages. This difference is assumed to be constant over grades and over time. e_i indicates that child i comes from a poor family. The product of these two indicators identifies children of an eligible family (thus children of groups C and D in figure 2). Since the sample includes children enrolled in first grade of primary school up to third grade of junior high school, the child's eligibility does not exactly match the family's eligibility. The lack of correspondence comes from the children entering first grade and second grade of primary school whereas the program gives grants starting in third grade , and thus necessitates the distinction between eligible grades and non-eligible ones. To capture the per-grade impact for the eligible grades, a set of dummies d_{ig} indicating the child's grade multiplies $P_v e_i$. Parents may however anticipate that their first-grader will be eligible for grants in two years and thus alter their enrollment decision. To capture this anticipation effect, dummy variables for first and second grades are also included, leading to:

$$\lambda_i(g) = \lambda_0(g) \exp\left(\alpha_1 P_v + \alpha_2 e_i + \sum_{g=1}^{9} \gamma_g d_{ig} e_i P_v + \beta X_{ijv}^g\right) \tag{6}$$

where X_{ijv}^g contains the other factors entering the enrollment decision previously discussed. For third grade through ninth grade, γ_g captures the impact of the child's eligibility for receiving benefits for grade g, whereas γ_1 and γ_2 capture the anticipation effect the program may have.

To compute the cumulative impact of the educational grants on schooling attainment, the expected schooling attainment is calculated for the eligible and the control groups separately, following:

$$E[G] = \sum_{g=1}^{K} g \Pr(G = g) = \sum_{g=1}^{K} g f(g) \tag{7}$$

Since $\lambda(g) = \frac{f(g)}{S(g)}$, $f(g)$ can be recovered, and the expected schooling attainment can be simplified as:

$$E[G] = 1 + \sum_{g=1}^{K} \left(\prod_{k=1}^{g} (1 - \lambda_k) \right) \tag{8}$$

The derivation and simplification of the expected schooling attainment are found in appendix A. Using the estimation results, the drop-out risks are calculated for every child for the grades when he is observed. Averaging these probabilities by grade for each group, the expected schooling attainment is then calculated and compared across the two groups to assess the gain due to the program.

5 Results

5.1 Impact on the drop-out rates

The risk of dropping out is estimated using a Cox proportional hazard model with a baseline hazard estimated non-parametrically. The results of the estimation are presented in tables 5 and 6 with the non-parametric estimates of the baseline hazard depicted in figure 4. Figure 4 shows that the baseline hazard is quite low throughout primary school, even slowly declining as the child nears grade 6. These baseline rates indicate the probability for an individual to leave school in grade g given he has completed $g - 1$ grades already, independently of his personal characteristics. The risk of dropping out is relatively much higher at the entry to secondary school, mirroring the school continuation rates in figure 1. The baseline risk is also higher for the rest of secondary school than elementary school grades. The relatively low magnitude of these average risks indicates that individuals characteristics largely drive the dropping out decision, rather than some natural process of schooling.

How and by how much do educational grants alter the drop-out decision? Progresa grants significantly attenuate the risk of dropping out for all the eligible grades except in fifth and eighth grade (table 5. Surprisingly, the greatest impact on the grade baseline rate is in the third and fourth grade of primary school where eligibility decreases the baseline drop-out rate $\lambda_0(3)$ and $\lambda_0(4)$ by about 45 percent. At the entry to secondary school, grade 7, Progresa decreases the drop-out by 32 percent from its baseline $\lambda_0(7)$. Hence, the large impact on the survival rate for grade 7 observed in figure 5 can be in parts attributed to the retention effects in grade 3 and 4 of primary school. Furthermore, non-parametric estimates of the survival rates (figure 5) support this result that grants have a significant per-grade impact and thus overall impact on schooling attainment (see Appendix B). Finally, that first and second graders will receive grants in two and one years respectively does not influence the enrollment decisions parents make. This lack of anticipation effect may be due to the initial announce that the eligibility of the families would last three years and then be re-evaluated. Alternatively, budget and financial constraints may be so tight that parents cannot alter their enrollment decisions for their first and second graders, even if they receive grants for older children.

To test whether the impact of the grants varies over time, the estimation was carried to allow for differentiated impact in the second year of the program (1999) from the average impact. The results reject the hypothesis of differentiated impact in 1999 from 1998 for all the grades except the eighth grade.[13] Moreover, the year dummy for 1999 does not indicate any significant differences in the average drop out rates from 1998 to 1999.

Table 6 reports the rest of the estimation results. As discussed in section 4.1, one can suspect that some covariates influence the drop-out risk differently across grades, levels or age groups. To determine whether a covariate should vary in any of these three dimensions, several specifications were estimated and tested.[14] The proportional hazard model assumes that the influence of individual characteristics on the hazard is a constant proportion over time, in the present context throughout schooling. For example, if being a girl increases the hazard by 10%, the proportional hazard model implies that the gender bias is constant throughout primary school and junior high school. The test verifies the validity of this assumption for each covariate and for the overall specification. Only the overall specification test is reported at the bottom of table 6. The specification reported only includes the interesting subset of time-varying covariates, but it should be noted that the significance and proportion effect of the reported factors were unaffected by the removal of the insignificant factors.

As expected, the distance to high school strongly discourages pursuing secondary schooling. For every additional kilometer, teenagers are 21% more likely to drop out of school up to six kilometers. The effect of distance is lower after six kilometers,[15] and every additional kilometer beyond this point increases the hazard rate by 18% instead of 21%.

The supply conditions for high school may affect the schooling decisions at the primary school level. The value of primary school completion may partially depend on schooling continuation to high school, especially if the returns in the village to complete primary schooling and the opportunities to migrate are low. Parents will anticipate the traveling costs for high school attendance, and will evaluate whether the benefits for completed primary schooling is greater than the returns. To test this hypothesis, the distance to high school was included separately for children in fourth through sixth grade. Enrollment for these grades was not influenced by the distance to high school, thus refuting this idea that secondary school supply conditions alter schooling decisions in primary school. The value of primary schooling is in itself high enough to induce its completion, independently of the value of future schooling (including the benefits and traveling costs of high school) to which primary school gives access.

Labor markets that offer greater opportunities to work as agricultural worker, and unskilled work draw teenagers out of school earlier. Moreover, work opportunities in large urban areas induce teenagers to leave

[13]The inclusion of per-grade differentiated impact for 1999 makes the average impact significant for grade 8, whereas it is insignificant without this 1999 year effect in table 5. With the 1999 year effect, the grants decreased the hazard risk in grade eight by 52% in 1998, but increase it by less than one percent in 1999. Additionally, the year differentiated impact for grade 5 was not significant, but its inclusion rendered the average impact for this grade significant at 10%. Since the results are almost identical to the ones presented in table 5, these results are not included.

[14]The test follows a generalization of Grambsch and Therneau (1994).

[15]The non-linear effect was determined from estimation results including a linear and a quadratic term. At six kilometers, the rate at which distance influences the decision starts to decrease, thus the non-linear term is set to zero up to six kilometer and thereafter measures the squared influence of the additional distance from six kilometers. This specification of the non-linear effect was chosen over a simple quadratic term, since the turning point (point at which the effect of distance diminishes) is within the observed range of the variable. With the quadratic term, the results would suggest that the hazard rate drops after six kilometers, and not that the hazard rate increases with distance at a slower rate.

school earlier. For example if the urban center is 10 kilometers further, the teen will be 2% more likely to stay in school. On the other hand, the more educated the village population is, the greater the incentives for children to pursue school. The average education in the village can take two related interpretations. First, a labor market with more educated workers will expect a higher level of education from future workers, matching at least the education of the current work force. Then, a village where educated people choose to stay rather than to migrate to large urban center leading to a higher average education, probably offers greater work opportunities for educated individuals and higher returns to schooling.

The opportunity cost to attend school associated with activities at home comes mainly from the need for someone to watch over the younger siblings (aged between 0 and 5 years old) and having some draft animals to work the land. Interestingly, the amount of agricultural land the family operates, helps parents to send the children 8 to 11 years of age to school, but does not increase the drop-out rates for teenagers. One could have expected that the teenagers' labor would be in greater demand for families exploiting some agricultural land. However, it should be noted that the 50 percentile of the families involved in agriculture, work on 2 or less hectares of land. The need for labor on plots of this size does not interfere with school time and teenagers can help out after school.[16] On average, the opportunity costs of schooling for teenagers mainly lie in the off-farm work opportunities rather than in on-farm activities. Furthermore, the prospect of entering labor markets where the workers are more educated on average induces children to continue school.

The individual characteristics reveal that girls are less likely than boys to stay enrolled at high school, as well as older children independently of their schooling level. The age is particularly important for the completion of primary school: being one year older than his cohort increases the risk of dropping out by 77%. Older children have higher opportunity costs as they can sell their labor off-farm or contribute to productive activities on-farm.

Learning productivity also plays an important role in determining the drop-out rates. Having failed in the previous year and repeating the grade doubles the risks of dropping for the second half of primary school and for high school. The age of entry to primary school however, has the surprising effect of reducing the risk of dropping out. That is, a child that started school one year later, is more likely to stay in school than if he had started a year younger. Given that 90% of the children have started school by the age 6 and the quasi-totality of the remainder starts at the age of 7, it suggests that letting children physically mature one more year leads them attain a higher level of education. However, this advantage is strongly offset by the current age influence on the drop-out rate.

The father's and mother's education equally encourage the schooling continuation, by decreasing the drop-out risk by 5% for every additional year of schooling. Having an indigenous mother also positively influences schooling continuation by decreasing the dropping out risk by 20%. This last factor may appear surprising, as indigenous populations in Latin America often live in remote areas, have poor access to infrastructures and are discriminated against in the labor markets. Indigenous populations in Mexico face a similar reality, but are also known to educate their children more than Spanish-descent families of similar socio-economic background.

[16] School hours particularly fit such after-school work, as children attend from 8am to 1pm and are free for the rest of the day.

Finally, the family's poverty index does not indicate that the wealth of the family influences education decisions. This index not only accounts for the family's earnings and wealth in the form of assets but also for the dwellings' characteristics like the material the floors, walls and roof are made of. The poverty index may not include or weight sufficiently the most important wealth dimensions to schooling decisions to show any explanatory power. However, the dummy indicating that the child is from a poor family is significant at 10% (table 5) and indicates that poor children drop out 17% more than non-poor ones. The number and composition of the sibship affect the drop-out risk of a child, as it dictates the total schooling costs and income needs of the family. Elder children (or first-borns) are less likely to complete their basic schooling, as their drop-out rates are higher than the ones of his siblings both in primary school and secondary school. Moreover, having both younger siblings or siblings of the same age group increase the chances of teenagers to drop out. Having younger siblings increases more this risk than having siblings of the same age group (we reject the hypothesis that the hazard ratios are equal with a test statistics of $\chi^2 = 5.80$). Unexpectedly, the number of siblings of the same age group helps children of 6 to 11 years old to pursue school. A possible explanation for these contrasting results is that constrained parents pursue the strategy of equally investing in all their children at least until the completion of primary school. Further work is needed to understand the educational investment strategy at the household level, and requires a different theoretical and empirical framework than the present one. Yet, the results suggest that families facing high total schooling expenditures as represented by the number of children of each group age, will withdraw teenagers, but not younger children. To summarize, the educational grants succeed at reducing the drop out rates for all the grades they are offered in. The poor are at a disadvantage in their schooling attainment. Older children are particularly vulnerable in all grades, the more so if they are among the elder of their siblings. Traveling to school discourages greatly school continuation, as well as unskilled work opportunities and being close to a large urban center. Finally, educated parents and indigenous mothers favor higher schooling attainment for their children.

5.2 Gains in Schooling Attainment

Using these regression results and the estimated baseline hazard rates, the cumulative impact of the educational grants is calculated using sample enumeration method. Overall, control children achieve 6.9 years of schooling, while the treatment children complete 7.4 years (see table 7a).[17] Progresa leads to an increase of half a year of schooling (or five months more of schooling, where the academic year consists of 10 months). Children receiving the grants on average will also attain a greater schooling than the non-poor who achieve 7.3 years. Schultz (2001) finds a slighter higher gain of seven months on average (6.6 months) by using double differences, while This higher gain may come from the less restrictive nature of sample used. Schultz includes both continuing and reentering children wherein the present analysis restricts the sample to children enrolled

[17]These calculation are performed under the following assumptions: 1) The grant program is running for a period of seven years, such that a child can receive the grants from third grade through the end of junior high school; and 2) the impact of the grants remains constant over time, that is the impact on third grade will be the same in five years than the one measured for 1998-99. As mentioned in section 5.1, various tests have been performed to verify the behavior of the drop-out rates and responses to the grants over time. The results show that over the observed two-years period both drop-out rates and the response to the program were constant. Moreover the lack of anticipation effect for the first and second graders seem to suggest that expectations do not play an significant role in the response to the grants. These two results partially validate the soundness of assuming that the impact of the grants will remain over time.

in 1997 and do not consider children that return to school in 1998 or 1999. Schultz also calculates the gain accounting for pre-program and post-program differences in the two groups for boys and girls. He finds that girls have a gain of seven months with no apparent pre-program difference between the control and the eligible group. Boys however exhibit a gain of 8.5 months using simple differentiating and 6.5 months using double differentiating. This suggests that the treatment boys have a pre-program attainment higher than the one of the control group. Another study finds an intermediate result of 6 months (Behrman, Sengupta and Todd 2001) using markov transitions process and fully accounting based on observed probabilities future temporary absence from school. In other words, the exclusion of reentry leads to a conservative estimate of the gains, and the gain from attracting back drop-outs is around 17% (one month of six).

Looking at continuation rates per grade (figure 1), the rationale of giving educational grants in primary school seems questionable since the obvious critical dropping-out time is at the entry to secondary school. The gains from giving the grants only at the entry to high school were also calculated. These gains were performed by supposing that only children enrolling in seventh grade could receive the grants. As such, the predictions of drop-out were obtained by setting all the eligibility terms equal to zero except grade seven (that is $e * P * d_g = 0$, except grade 7). Under that trimmed scheme, giving grants only for one academic year instead of the current seven-year scheme, children would achieve 7.21 years. Giving grants from the third grade of primary school to the third grade of secondary school increases the gains by 60% from 3.5 months to 5.7 months, or from a third of academic year to two-thirds of academic year. This 60% greater gain comes from all the small number of drop-outs at each eligible primary grade that Progresa succeeds at retaining in school. The two schemes have, however, very different magnitude of costs, and as such it is not clear the current scheme is the optimal one.

Do children all equally benefit from the grants, and most importantly do the poorest of the poor benefit equally or less than other eligible children? To answer these questions, the gains in schooling attainment were computed for sub-groups of treatment and control children.

The first criterion chosen is the parents' education. Throughout the literature, the importance of this factor in the schooling decisions has been repeatedly shown (Handa 1996, Behrman and Knowles 1999, Tansel 1998), and the results in this work add further evidence. Different explanations of the role of the parents' education have been put forward. One explanation argues that better educated parents have higher preferences for education leading them to invest more in their children's education. In addition, more educated individuals have higher earning opportunities and thus can invest more in their children's education. If the first explanation is true, one would then expect more educated families' schooling decisions to be more responsive to a grant program such as Progresa. Given a certain level of income and wealth, more educated parents will take more advantage of the grants as it leads to higher level of utility, ceteris paribus. On the other hand, if education and wealth are linked and preferences for education are similar for educated and less educated individuals, it is unclear that children of more educated parents will gain more from the grants.

The results in table 7b show that children from families where the father or the mother has no education are the ones with the greatest increase in schooling attainment due to the grants. It appears that the increase is slightly higher when it is the father that is uneducated, rather than the mother (a gain of 8.6 months versus 6.6 months). Moreover, comparing the difference in the gains across the education level of the mother to the same difference across the education level of the father, the gain differs less with respect to the mother's education than with respect to the father's. Strikingly, the sons of an uneducated man benefit much more from the program than the daughters, while boys and girls have similar gains if the father has some education. It should be noted that there is no difference in gains between boys and girls in general, the gains being 5.6 and 5.8 months respectively. Going back to the premise that less educated individuals have lower earnings, these gains suggest that the grants not only raise the schooling attainment of the poor in general, but they also help relatively more the poorer of the poor. One must however remark that the schooling attainment for eligible children from uneducated families remains below that of children from educated families (comparing the 6.6 years of schooling of eligible children from uneducated fathers to 7.2 years of control children from educated fathers).

To check if in fact the poorest of the poor are the ones gaining most from the program, the gains are measured by quintiles of the poverty index constructed by the program. The baseline survey data served to construct this poverty index, and the later was used to determine which family qualified as poor and could receive the benefits. The by-quintile results show that the children of the lowest and the second quintile definitely gain more than the children from families with a higher standard of living.[18] However, children from the second quintile respond more to the grants and achieve a greater gain than their counterpart of the lowest quintile. Parents from the first quintile are so constrained that they may not be able to fully take advantage of the grant program. For example, the grants may not be sufficiently high to make up for the labor or the earnings that the child contributes to the family's livelihood and/or to meet the costs linked to send the child to school. This implies that to raise the schooling of the poorest of the poor, educational grants may need to be combined with other mechanisms that specifically address constraints faced by the poorest. Alternatively, grants could increase in value with higher levels of poverty rather than be uniform. This last option however would require more administrative resources and may lead to greater discretionary power in the application of the rules, and thus may be less desirable.

To get a better sense of how the gains behave with respect to poverty, a kernel estimation was performed and the graphical representation of the result is found in figure 6. This non-parametric method estimates a locally weighted average for each observation, by using a subset of points around the observation. The bandwidth chosen to perform the estimation is 0.6, or 60% of the observations around each point, that were equally weighted. This non-parametric estimation of the relationship shows a general decline in the gains as the resources of the family increase, that is as one moves towards the higher percentile of the poverty index. An overall monotonic relationship appears that was unsuspected from the average gain by quintile. On the other hand, the lower gain observed for the first quintile compared to the second one is not as clear, and the few negative gains suggest that the average calculation may be influenced by some outliers. Both methods support the general conclusions that the poorest of the poor gain more than the richer quintiles, but the gain within the first and second quintiles may be more similar than the average gain suggests.

The last criterion deals with supply constraints to demand for education. As the estimation results indicate, the distance to the closest high school discourages considerably school continuation. One may infer from this that the emphasis should be put on building schools in villages without one. While this appears

[18]It should be noted that richer families in this sample are richer relative to the other families in the sample, but by Mexican standards, fall in the poor and extremely poor categories.

the appropriate solution, it may not be the best use of educational funds as a large proportion of the villages in rural Mexico have population of less than 320 inhabitants with less than 30 children in age to attend high school.[19] Educational grants offer an effective alternative to raise schooling attainment. In fact, the impact of the grants increase with the distance to high school. Children that have to travel more than three kilometers to reach the closest school, gain 7.7 months compared to 6.5 and 4.3 months for children traveling respectively between one and three kilometers and less than one kilometer. This highlights how demand constraints worsen the effect of supply constraints and by relaxing the demand constraints, the educational attainment can be raised to levels nearing the one achieved under no supply constraint.

6 Discussion

Educational grants do succeed at retaining children in school, and thus increase their schooling attainment. The gain falls short of inducing completion of basic schooling by about a year and a half. It should be noted however, that with the program, the poor achieve levels comparable to the ones of the non-poor, and thus clearly demonstrates the potential of educational grants to contribute to raising schooling attainment.

A grant program also has the potential to benefit significantly children of the poorer segments of society, both in terms of poverty levels and in terms of education backgrounds. The results clearly showed that the poorest groups gain most of all the groups. The Mexican program did not have any build-in rule or scheme to achieve progressive gains in schooling. This result is important at two levels. First, the greater number of rules (either for eligibility or for payments), the larger is the share of program budget devoted to administrative and logistical structures. Second, greater number of rules creates the possibility of discretionary power in the application of the rules. Thus, a few simple rules are preferable to a large set of rules. The Mexican experience proved that progressive results can be obtained without employing numerous or complicate eligibility rules. Educational grants offer an effective policy tool to raise schooling of the poor that can achieve progressive results without extra administrative resources and with minimal local discretionary power.

Nevertheless, special attention needs to be given to the poorest of the poor. While they benefit more than the average from the availability of the program, their schooling attainment with the grants remains the lowest of all groups. The mechanisms put in place should attempt to account for the realities of the poorest such as having numerous children. Having a family with numerous children poses an especially large impediment to the school continuation and thus schooling attainment of teenagers, as shown by the effect of an extra sibling of any age group. By imposing a monthly maximum, a grant program prevents creating distortions of incentives for instance having more children to get more grant money. Such conditions limit the support given to the ones that most need the help. A grant program can help the poorest of the poor by having further provisions specifically targeting the most vulnerable groups within the incentive scheme.

The grants prove to be an efficient mean to palliate school accessibility issues undermining schooling attainment. They offer an additional policy option to supply-based approaches to raise schooling attainment even in areas without schools, and without paved roads nor public transportation. Building and operating

[19]In the sample, 75 percentile of the villages have such small populations.

schools in remote regions may be difficult, if not financially nonviable, either because of the impossibility to find teachers to live in those regions, or because of the small clientele, especially at the secondary school level. The grants may be used by the parents to pay for public transportation and in the case where public transportation is not available, they pay can for the time the child spent walking rather than helping out on the farm or earning wages.

Finally, one may wonder if and how educational grants could achieve universal basic schooling on its own or combined with some other intervention. The analysis revealed that the main forces driving the drop-out rates consist in grade repetition and age. Children do not continue school past the age of 16 years old, as the opportunity cost in terms of work opportunities become too great. Older kids in a given grade may have not progressed through school not only because of grade repetition but also temporary absence of school. The present analysis and the available data do not permit to study neither the determinants nor the potential impact of the educational grants of these phenomena. The preponderance of these factors in dropping out decisions indicates a clear need, to first understand the mechanisms underlying them and to secondly analyze if and how educational grants could counter them, and thus be even more effective at increasing schooling attainment.

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A Expected Schooling Attainment

The impact of Progresa grants onto the schooling attainment of children will be calculating by the difference in the expected schooling attainment of the control and the eligible groups. Using the equivalence of the event of attaining g years of schooling and of dropping out of school in grade $g+1$, the expected schooling attainment can be expressed as:

$$E[G] = \sum_{g=1}^{K} g \Pr(G = g) = \sum_{g=1}^{K} g \Pr(S_{g+1} = 0) = \sum_{g=1}^{K} g f(g)$$

We know that $f(g) = \lambda_g * S(g)$ where $S(g) = \prod_{k=1}^{g-1}(1-\lambda_k)$. Given that children must enter school before dropping out, thus $S(1) = 1$, and substituting in for $f(g)$ in the expectation:

$$E[G] = \lambda_1 + \sum_{g=2}^{K} g \left(\lambda_g \prod_{k=1}^{g-1} (1 - \lambda_k) \right)$$

Assuming that everybody drops out after secondary school such that $\lambda_{10} = 1$, then

$$E[G] = \lambda_1 + \sum_{g=2}^{10} g \left(\lambda_g \prod_{k=1}^{g-1} (1 - \lambda_k) \right) = \lambda_1 + \sum_{g=2}^{9} g \left(\lambda_g \prod_{k=1}^{g-1} (1 - \lambda_k) \right) + 10 \prod_{k=1}^{9} (1 - \lambda_k)$$

By factoring the last term into separate terms, it can be rearranged:

$$\begin{aligned}
10 \prod_{k=1}^{9} (1 - \lambda_i) &= 9 \prod_{k=1}^{9} (1 - \lambda_k) + \prod_{k=1}^{9} (1 - \lambda_k) \\
&= 9(1 - \lambda_9) \prod_{k=1}^{8} (1 - \lambda_k) + \prod_{k=1}^{9} (1 - \lambda_k) \\
&= 9 \prod_{k=1}^{8} (1 - \lambda_k) - 9\lambda_9 \prod_{k=1}^{8} (1 - \lambda_k) + \prod_{k=1}^{9} (1 - \lambda_k) \\
&= 8 \prod_{k=1}^{8} (1 - \lambda_k) + \prod_{k=1}^{8} (1 - \lambda_k) - 9\lambda_9 \prod_{k=1}^{8} (1 - \lambda_k) + \prod_{i=1}^{9} (1 - \lambda_i) \\
&= \quad \vdots \\
&= 2(1 - \lambda_1) - \sum_{g=2}^{9} g \left(\lambda_g \prod_{k=1}^{g-1} (1 - \lambda_k) \right) + \sum_{g=2}^{9} \left(\prod_{k=1}^{g} (1 - \lambda_k) \right)
\end{aligned}$$

and substituted back in the expectation:

$$E[G] = \lambda_1 + \sum_{g=2}^{9} g\left(\lambda_g \prod_{k=1}^{g-1}(1-\lambda_k)\right) + 2(1-\lambda_1) - \sum_{g=2}^{9} g\left(\lambda_g \prod_{k=1}^{g-1}(1-\lambda_k)\right) + \sum_{g=2}^{9}\left(\prod_{k=1}^{g}(1-\lambda_k)\right)$$
$$= 1 + \sum_{g=1}^{9}\left(\prod_{k=1}^{g}(1-\lambda_k)\right)$$

Such calculations will be performed for the control children and the eligible children. The children will be used for only the grades that they are observed. The drop-out rates are averaged over the children of each group and then used to calculate the expected schooling for the 2 groups, i.e. $E[G|P_v e_i = 1]$ and $E[G|P_v e_i = 0]$. The gain in schooling attainment will thus be assessed by comparing the two, $E[G|P_v e_i = 1] - E[G|P_v e_i = 0]$.

B Non-Parametric Estimates of the Impact on Survival Rates

Non-parametric estimation of the survival function offers to make a quick assessment of the impact of Progresa. They also offer supplementary evidence of the per-grade influence of the grants and thus support the parametric results. The Kaplan-Meier survival estimator calculates the probability of surviving up to g by multiplying the probability of survival for this grade with the survival of the previous grades. Letting n_g represents the individuals that dropped out in grade g, the probability to survive is the number of survivors over the pool of individuals at risk N_g at the beginning of the period g:

$$S(g) = \prod_{r=1}^{g} \frac{N_r - n_r}{N_r} = \prod_{r=1}^{g} \left(\frac{\#\text{survived}}{\#\text{at risk}} \right)_{\text{grade } r}$$

The risk pool implies taking all the individuals that ever faced the decision of continuing and enrolling in grade g. Since the question of interest is how Progresa altered the schooling decisions and ultimately the "survival" or schooling attainment, and the program only started in 1998, the risk pool for grade g consists of the individuals that made the decision to continue in grade g either in 1998 or 1999. Referring back to figure 3, individuals of cohorts 4 in 1999 and 5 in 1998 form the risk pool for grade 5, thus N_5, and the children that dropped out from these two cohorts also compose n_5.

Figure 5 represents the results of the non-parametric estimation of the survival rates for the eligible and the control group, where analysis time represents the grade to be entered. Progresa appears to start to have an impact with the entry in grade 4, retaining an additional 2.3 percent of children in school. By the entry in secondary school (grade 7), the cumulative impact of Progresa leads to 14 percent more children pursuing school. Using log-rank tests, I can verify if these differences in the survival curves are significantly different from zero. Tests confirm that the curves are overall significantly different from one another (with a χ^2 statistics equals to 94.06 giving a ρ-value of 0.000), and they start to be significantly different in grade 3 (with a difference of as little as 1 percent, $\chi^2 = 13.68$ thus a ρ-value of 0.000). These results support the findings of the semi-parametric analysis showing that educational grants have an overall impact, and a per-grade impact starting with third grade of primary school.

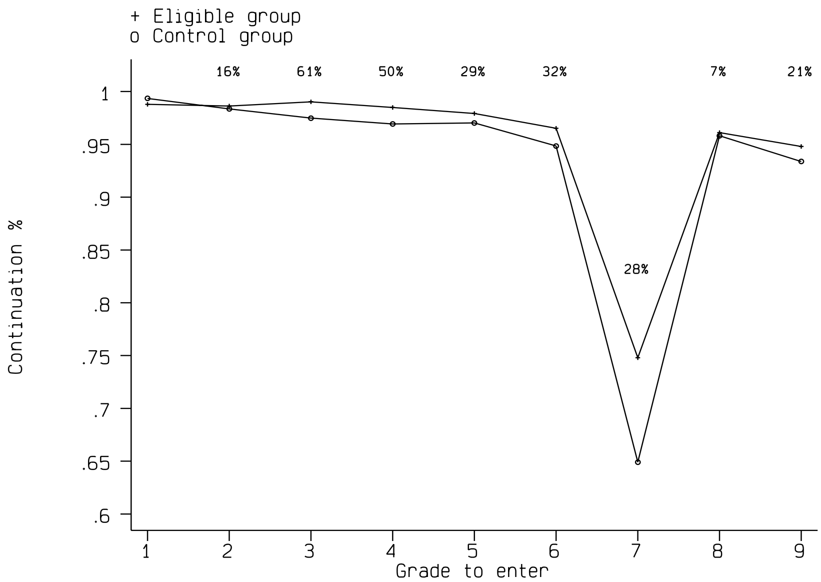

Figure 1: Progresa impact on school continuation (%) with the retention rates per grade

<table>
<tr><td colspan="2">Not Eligible
A</td><td>Non Poor hhd</td><td>Would not be Eligible
B</td></tr>
<tr><td colspan="2">Eligible</td><td rowspan="2">Poor hhd</td><td rowspan="2">Control

E</td></tr>
<tr><td>Not Participant
C
(4%)</td><td>Participant
D
(96%)</td></tr>
<tr><td colspan="2">Progresa village</td><td></td><td>non-Progresa village</td></tr>
</table>

Figure 2: Progresa program design

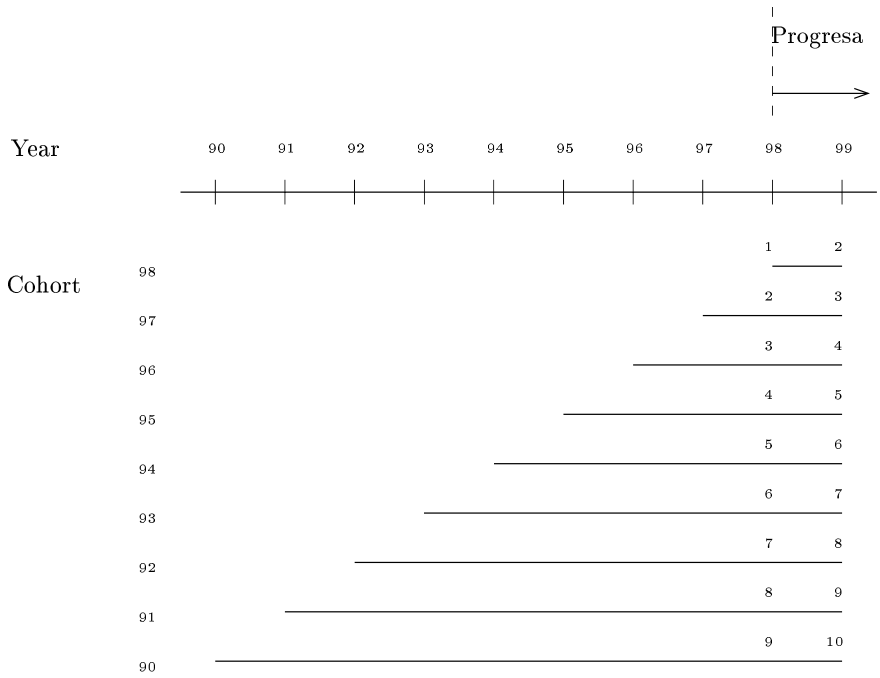

Figure 3: Sample for the survival model.

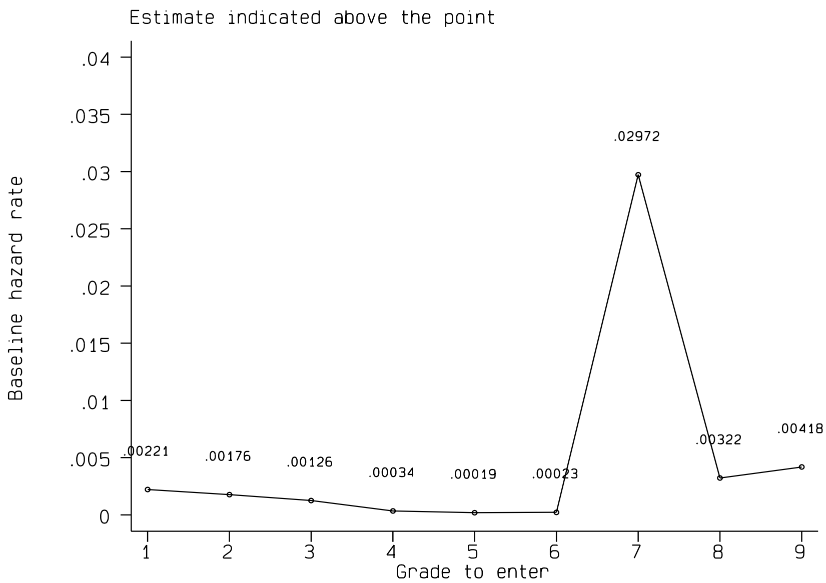

Figure 4: Non-parametric estimates of the baseline hazard rate.

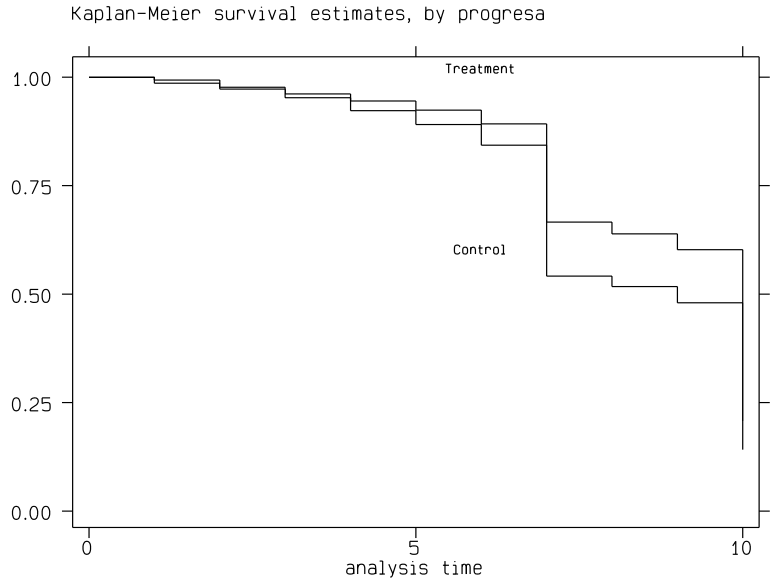

Figure 5: Survival function for eligible and control children.

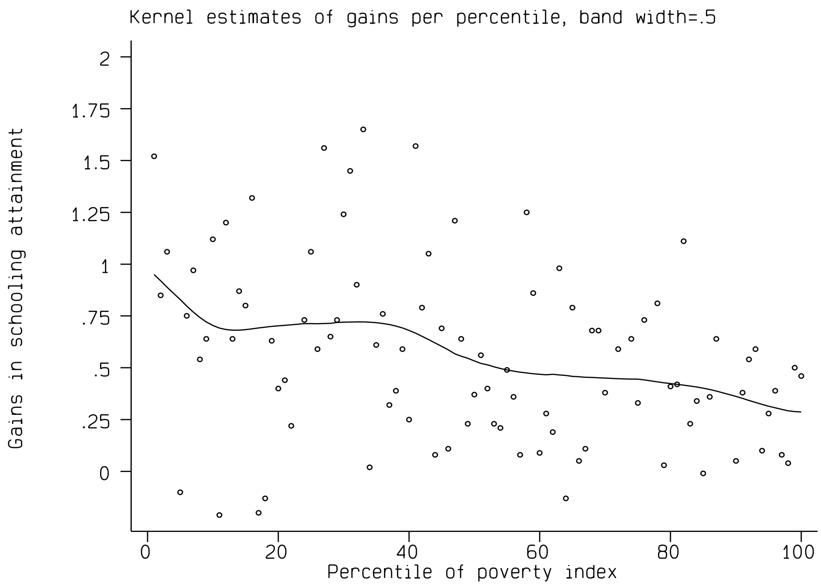

Figure 6: Non-parametric estimation of the relationship of the poverty index and the gains in schooling attainment.

Table 1: Illiteracy Rates found in adult population (15 years old and older).[a]

		Total		Female		Male	
Country Name	GDP/cap	1990	1995	1990	1995	1990	1995
Haiti	1129	47.0	55.0	52.6	57.8	40.9	52.0
Nicaragua	2039	..	34.3	..	33.4	..	35.4
Honduras	2120	26.9	27.3	29.4	27.3	24.5	27.4
El Salvador	2798	27.0	28.5	30.0	30.2	23.8	26.5
Bolivia	2913	22.5	16.9	29.3	24.0	15.3	9.5
Paraguay	3530	9.9	7.9	11.9	9.4	7.9	6.5
Belize	4344	..	9[1]	..	..	..	..
Peru	4518	14.9	11.3	21.3	17.0	8.5	5.5
Ecuador	4970	14.2	9.9	16.2	11.8	12.2	8.0
Brazil	5986	18.9	16.7	20.2	16.8	17.5	16.7
Costa Rica	6618	7.2	5.2	6.9	5.0	7.4	5.3
Colombia	6915	13.3	8.7	14.1	8.6	12.5	8.8
Panama	7046	11.9	9.2	11.8	9.8	11.9	8.6
Uruguay	7246	3.8	2.7	4.1	2.3	3.4	3.1
Mexico	7592	12.7	10.4	14.9	12.6	10.5	8.2
Venezuela	8544	8.0	8.9	16.8	9.7	13.3	8.2
Chile	11162	6.6	4.8	6.8	5.0	6.5	4.6

[a] World Development Indicators 1998 CD-ROM, World Bank, 1998.
[1] For 1992.

Table 2: Primary and Secondary School Enrollment for Selected Countries.[a]

			Gross Rates[b]				Net Rates		
Country	GDP/cap	Year	Total	Female	Male	Year[c]	Total	Female	Male
Haiti	1129	1990	22	22	23		..	..	..
Nicaragua	2039	1995	47	50	43	1993	27	28	25
Honduras	2120	1991	32	37	29		21	..	..
El Salvador	2798	1995	32	34	30		21	22	19
Bolivia	2913	1990	37	34	40		29	27	32
Paraguay	3530	1994	38	39	38		33	34	32
Belize	4344	1994	49	52	47	1991	36	37	34
Peru	4518	1995	70	67	72		53	52	54
Ecuador	4970	1994	50	50	50		..	..	..
Brazil	5986	1994	45	..	..		19	..	..
Costa Rica	6618	1995	50	52	48		43	37[2]	35[2]
Colombia	6915	1995	67	72	62		50	53	47
Panama	7046	1995	68	65	60	1990	51	53	48
Uruguay	7246	1995	82	89	74		..	..	..
Mexico	7592	1994	58	59	58	1990	45	..	..
Venezuela	8544	1993	35	41	29	1992	20	24	16
Chile	11162	1996	72	76	66	1995	55	57	52

[a] World Development Indicators 1998 CD-ROM, World Bank, 1998.
[b] *Gross rates* are ratios of the total enrollment to the number of children of official school age in the population regardless of the age of the enrolled children.
Net rates are ratios of the number of children of official school age enrolled in school to the number of children of official school age in the population.
[c] Year for the net enrollment rates are given only if it differs from the one for gross enrollment statistics.
[1] For 1996. [2] For 1990. [3] For 1995.

Table 3: Current school attendance of children 12-13 (%).[a]

Country	Year	Total	Urban	Rural
Brazil	1990	53.8	63.8	31.4
	1996	63.7	71.5	37.1
Chile	1990	90.7	92.0	85.4
	1996	94.0	95.4	87.4
Colombia	1990	.	83.8	.
	1997	72.1	86.1	54.5
Costa Rica	1990	78.1	85.5	73.4
	1997	80.5	86.0	76.7
Honduras	1990	60.1	78.4	48.4
	1997	75.9	85.8	68.7
Panama	1991	88.7	91.4	83.5
	1997	89.5	94.5	84.0
Venezuela	1990	81.6	86.1	62.4
	1995	86.3	89.7	70.9

[a] Including children with at least 4 years of schooling.
Source: ECLAC/CEPAL, "Social Panorama of Latin America 1998 Edition", 1999, table V.5.

Table 4: Progresa educational monthly grants by grade and sex.

Grade	Grant (in pesos)					
	July 1998		July 1999		Jan 2000	
primary						
3	70		80		85	
4	80		95		100	
5	100		125		130	
6	135		165		170	
secondary	boy	girl	boy	girl	boy	girl
1	200	210	240	250	250	265
2	210	235	250	280	265	295
3	220	255	265	305	280	320
Maximum per family	625		750		790	

Source: Evaluacion de Resultados del Programa de Educacion, Salud y Alimentacion, p.27, Progresa, 1999.

Table 5: Impact of Progresa on the hazard ratio.[a]

	Hazard Ratio	P> $\|z\|$
Transfers ($\mathbf{T}^e$)		
Progresa village (α_1)	0.99	0.907
Poor family (α_2)	1.17	0.078
Time trend (1=1999)	1.00	0.958
Per grade treatment impact (γ_g)		
Grade 1	2.08	0.223
Grade 2	1.10	0.754
Grade 3	0.58	0.033
Grade 4	0.55	0.007
Grade 5	0.74	0.134
Grade 6	0.65	0.010
Grade 7	0.68	0.000
Grade 8	0.76	0.165
Grade 9	0.64	0.024

[a] See at the bottom of table, next page.

Table 6: Cox estimates of the hazard ratio, (continued).[a]

	Hazard Ratio	P> $\|z\|$
Costs (C_g)		
Distance to school (0-15Km)[1]	1.21	0.000
Distance for extra Km beyond 6 squared[1]	0.99	0.000
Earnings ($w(g-1,Z)$)		
Importance of ag employment (0-100)[2]	1.01	0.000
Importance of non-ag employment (0-100)[2]	1.03	0.000
Importance of other employment types (0-100)[2]	1.02	0.000
Importance of schooling in village (0-6 yrs)	0.78	0.000
Distance to capital (per 10 Km)	0.98	0.000
Family owes business	1.06	0.338
Agricultural land used (in Ha) for 8-11 yrs old	0.91	0.014
Agricultural land used (in Ha) for 12-16 yrs old	1.00	0.719
# of draft animals	1.01	0.035
# of cattles	0.99	0.152
# of small productive animals	1.00	0.998
# of 0-5 yr old children	1.05	0.022
Work while in school	0.99	0.822
Girl in primary school	0.92	0.331
Girl in secondary school	1.18	0.000
Age in grade 1-3	1.66	0.000
Age in grade 4-6	1.77	0.000
Age in grade 7-9	1.30	0.000
Individual Characteristics & Learning Productivity (Z)		
Entry age to primary school	0.92	0.015
Repeating grade, grade 1-3	1.26	0.192
Repeating grade, grade 4-6	2.05	0.000
Repeating grade, grade 7-9	1.71	0.000
Mother's schooling	0.96	0.000
Father's schooling	0.94	0.000
Indigenous mother	0.80	0.052
Indigenous father	0.90	0.367
Family wealth (β)		
Poverty index	1.00	0.651
Birth order in primary school[3]	0.58	0.000
Birth order in high school	0.81	0.000
# of siblings 6-11, for a 6-11 yrs old	0.88	0.042
# of siblings 6-11, for a 12-16 yrs old	1.01	0.638
# of siblings 12-16, for a 6-11 yrs old	1.35	0.000
# of siblings 12-16, for a 12-16 yrs old	1.12	0.000
No. of observations	35295	
No. of subjects	20486	
Chi^2 overall (47degree of freedom)	2201	
Log Likelihood	-17374	
Time Varying Hazard test, Chi^2	0.79	

[a] A Huber correction is used to obtain robust error estimates along with clusters at the family level to correct for the correlation among children of a same family.
[1] For high school grades only. [2] For teens 12-16 years old only. [3] 1 = Eldest, 2 = Second child, ...

Table 7: Schooling Attainment and Gains from Progresa grants.

Table 7a. Gains in general (years)

	Schooling attainment	Gain
Non-Poor[a]	7.3	
Control	6.9	
Grants in		
3^{rd} through 9^{th}	7.4	.5
Only in 7^{th}	7.2	.3

Table 7b. Gains for selected sub-groups[b]

	$E[G]$ in years		Gain
	Treatment	Control	
Father's education			
None	6.6	5.8	.8
Some	7.7	7.2	.5
For girls			
None	6.6	5.9	.7
Some	7.7	7.2	.5
For Boys			
None	6.6	5.7	.9
Some	7.7	7.2	.5
Mother's education			
None	6.7	6.1	.6
Some	7.7	7.2	.5
Poverty Index, by quintile			
Lowest	7.2	6.6	.6
Second	7.4	6.7	.7
Third	7.5	7.0	.5
Fourth	7.4	6.9	.5
Highest	7.6	7.3	.3
Distance to high school			
Within 1 Km	7.8	7.4	.4
At 1 to 3 Km	7.5	6.8	.7
Beyond 3 Km	7.1	6.3	.8

[a] Includes both the non-poor from Progresa villages and non-Progresa villages. The number of non-poor per grade is too small in each village to allow separate calculations.

[b] As the sample is broken into categories, the number of children in each grade-category cell shrinks. The smallest number of observations for any given grade-category for this calculation was 38 for girls in first grade with a father with no education. Ten grade-category cells had less than 100 observations.