UNIVERSIDAD CARLOS III DE MADRID

working papers

Working Paper 08-59
Economic Series (26)
June 2008

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Did PROGRESA send drop-outs back to school?

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Abstract

This paper analyzes the effect of PROGRESA education grants on school enrollment. It looks at its effect on total school enrollment and in particular on school enrollment of drop-outs, i.e. those children who face a re-enrollment decision since they were not enrolled in school the year prior to the implementation of the PROGRESA program. Estimates of the impact of PROGRESA education grants on drop-outs and non-drop-outs are obtained applying difference estimation and maximum likelihood estimation of a reduced form equation for schooling decision. Differences in results between both groups of children are discussed looking at the distribution of marginal effects. PROGRESA did send drop-outs back to school. It had a larger effect on drop-outs than on non-drop-outs. However, for the particular group of girls who dropped out of school just before attending secondary school PROGRESA grants only had a minor effect. This last finding highlights the fact that determinants of the schooling decision are different for young girls and that PROGRESA grants do not provide a strong enough incentive to send them back to school.

JEL Classification: C21; C23; I28; I38

Keywords: Anti-poverty program evaluation; School enrollment; Re-enrollment decision; Heterogeneous program effects; Correlated random effects model

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† Special thanks to Pedro Albarrán and Ricardo Mora for their advice, remarks and comments. I am grateful to Jesús Carro, Rodolfo Stucchi and Alejandra Traferri for insightful comments on preliminary drafts of this paper. I also acknowledge comments by seminar participants at Universidad Carlos III and Universidad de Oviedo, at EEA-ESEM 2006 Meeting and ESPE 2007 Meeting.

1 Introduction

Since the middle of the 1990's there has been a widespread use of anti-poverty programs in developing countries that condition aid on the behavior of the beneficiary. These programs run by central governments aim at helping the poorest families to reach higher levels of welfare. At the same time they try to promote development and growth of the economy.

Some of the most popular anti-poverty programs in developing countries focus on education. There is general about the key role of education as an anti-poverty and pro-growth policy via the effect of education on the accumulation of human capital. In addition, although education in some countries is compulsory until the secondary school level, it has been suggested that additional economic incentives are needed to reduce the observed high levels of drop-outs.

The increasing use of anti-poverty programs has been accompanied by comprehensive evaluations about the actual effectiveness of these programs. This has occurred not only because of the intrinsic interest in these programs but also because anti-poverty programs represent an important financial effort, both by governments and international institutions which often provide additional funds.

The program evaluation literature has been widely developed in the last decades with the seminal work of a group of economists on papers dealing with the evaluation of policies in the USA. These include, among others, Heckman (1992), Heckman (1997), Imbens and Angrist (1994), Angrist, Imbens, and Rubin (1996), Manski (1996), Heckman, Ichimura, and Taber (1997) and Angrist (1998).

Policy makers are undoubtedly interested in the overall effect of the program on the target population; thus, many papers in the theoretical literature have focused on the estimation of an "average treatment effect" or ATE. More specifically, the ATE can be computed as the average difference between an outcome variable for all individuals in a treated group and those in an untreated or control group. It is worth noting that the ATE can be interpreted as the actual causal effect of the program provided that the control group is reasonably well selected; i.e., individuals in both groups must be (ex-ante) comparable.

Although the ATE can be a good general characterization of the overall (average) effect, it is obvious that any program will have a different impact on different individuals. Some of them will benefit a lot whereas others will not. Therefore, it is also important to take into account individual heterogeneity.

This paper focuses on a Mexican anti-poverty program for rural communities, called PROGRESA. The program comprise three major areas one of which, the subject of this paper, is education. In particular, program beneficiaries are given financial aid conditional on school attendance. This paper analyzes the effects of such grants on school enrollment for two different groups of beneficiaries, drop-outs and non-drop-outs. The identification of these effects relies on the randomized assignment of the program benefits.

Following the arguments presented above, in what constitutes its main contribution, this paper tracks the differential effect of the program on individuals that dropped out of school before the program started. These children are facing a re-enrollment decision that may imply higher direct and/or indirect costs of schooling than the costs faced by the average child. Moreover, drop-outs are different from the average child in some observable characteristics related to the schooling decision. Thus, we can expect a different effect of the program on them. The methodologies applied are difference estimation and maximum likelihood estimation of a reduced form equation of education choice. For both cases the randomized design of PROGRESA is exploited. The outcome is the causal effect of the education component of this program. It allow us to evaluate how successful PROGRESA was in increasing enrollment rates among ex-ante drop-outs.

The structure of the paper is as follow. Section 2 presents the main features of the program and a brief review of the literature evaluating PROGRESA. Section 3 discuses factors that influence the enrollment decision and presents differences to the re-enrollment decision made by drop-outs. Section 4 describes characteristics of the PROGRESA data base. It provides some main statistics that focus on the differences between drop-outs and non-drop-outs. In Section 5 results for the difference estimation of the effects of the program are presented for both groups and are analyzed separately. Section 6 introduces a reduced form equation for the schooling decision including PROGRESA education grants variables. Section 7 presents maximum likelihood estimates of a probit model for schooling decision, comparing results for non-drop-outs and drop-outs. Finally, Section 8 concludes the paper with its main results and some suggestions for future research.

2 The PROGRESA program and its education component

The Education, Health and Nutrition program, PROGRESA, was implemented by the Federal Government of Mexico in 1997, with the aim of helping the poorest families in rural communities. A fundamental characteristic of the program is that aid is conditioned on a specific behavior of the beneficiary. This conditionality tries to guarantee that the program does not lead to undesired outcomes, such as distortions in work decisions, and that it successfully accomplishes its initial objectives.

The program comprises actions in three major areas: education, health and nutrition. The education component includes monthly grants for children of a family qualified as beneficiary. They need to be less than 18 years old, enrolled in school between the 3^{rd} year of primary school and the 3^{rd} year of junior secondary school, and to fulfill a minimum attendance requirement. The grants are not based on academic achievement. A child who does not pass a grade is still eligible for the grant in the following year. But if the child fails the same grade twice, she/he losses eligibility. The grant increases by years of schooling. In the junior secondary level the grant is slightly higher for girls, since there exist evidence that in poor families girls are more likely to drop-out of school and that they also tend to drop-out earlier than boys. Additionally, beneficiaries receive an annual grant for school supplies. The health component of the PROGRESA program consists of a basic package of free health services, nutritional supplements, and informative talks on health, nutrition, fertility, and hygiene. Special attention is paid to pregnant women and children younger than five years. Finally, the nutrition component of the program supplies beneficiary families with a monthly monetary payment intended to improve amount and diversity of food consumption and thus increase the nutritional status, in particular of children. This aid is independent of residence, and size, and composition of the family. All aid is given to the mother of the family as there exist evidence that mothers are better than fathers at allocating family resources.

A family is qualified as being poor and thus eligible for the program according to a single index. This index contains information on family income and housing like presence of running water, etc.[1]

Some numbers can provide a better understanding of the extent and significance

[1] For a complete analysis of the targeting see Skoufias, Davis, and Behrman (1999a) and Skoufias, Davis, and Behrman (1999b).

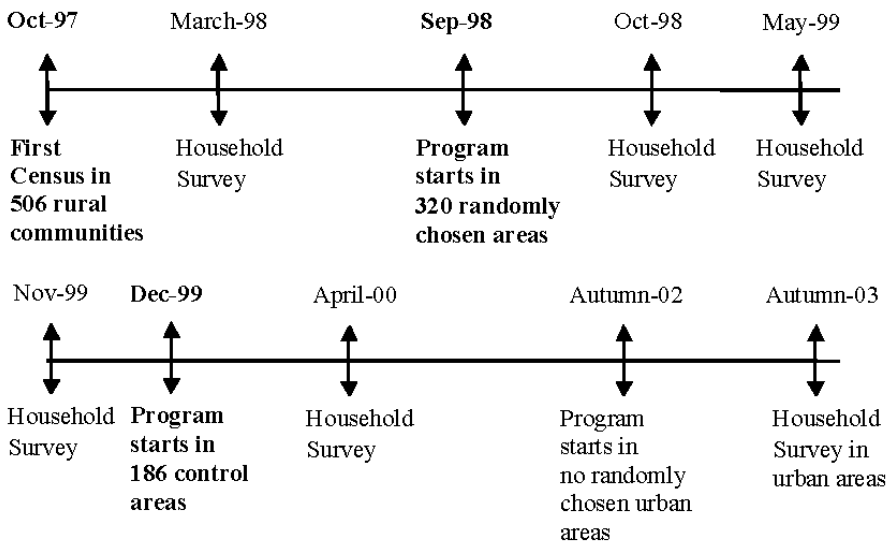
of PROGRESA as an anti-poverty policy. In 1997 the program reached 6,357 communities, giving aid to 300,705 families. This implied transfers of 34 million USD (approx. 340 million Mexican pesos). After two years of being implemented the program included nearly 2.6 million families in 72,345 communities in all 31 Mexican states. It reached around 40% of all rural families and nearly 12% of all families in Mexico. Total annual transfers of the program in 1999 were around 710 million USD, equivalent to 0.15% of Mexican GDP. 40% were educational transfers, 42% food transfers and 18% was spent on health transfers. Among the total annual cash transfers of 578 million USD, food transfer accounted for 49%. The remaining 51% went to education. In 1999 the program distributed 273 million USD in education grants[2].

Given the financial importance of PROGRESA, Mexican authorities have intended to evaluate the program since its beginning, not only to measure results and impacts but also to provide information that allow for a redesign of policies. Accordingly, in 1997 and 1998 a high quality data set was collected in 506 communities where the program was to be implemented, and several surveys were carried out afterwards. In October 1998, the program was implemented in 320 randomly selected communities (treated communities) while in the remaining 186 communities (control communities) the implementation was postponed until December 1999[3]. In Figure 1 below, I present the timing of the program.

[2]For more details on PROGRESA costs see Coady (2000).

[3]The quality of the randomization has been extensively documented in Behrman and Todd (1999), who conclude that, at least at community level, the implementation of the random assignment was performed successfully.

Figure 1: Timing of the PROGRESA program



The evaluation of the program was conducted by the Mexican Federal Government and by external local and international evaluators such as the National Institute of Public Health (INSP, Mexico), Research and Advanced Studies Center in Social Anthropology (CIESAS, Mexico), International Food Policy Research Institute (IFPRI), and Research and Educational Documentation Center (CIDE, Spain)[4]. The evaluation efforts have resulted in an extensive literature by authors like Orazio Attanasio, Jere R. Behrman, David Coady, Costas Meghir, T. Paul Schultz, Emmanuel Skoufias, Petra Todd and Kenneth Wolpin, among others.

This paper is closely related to Schultz (2004). In his paper Schultz presents an extensive evaluation of the education component of PROGRESA. The author performs pre-program comparisons to check the randomization of the design, and he calculates difference and difference-in-difference estimators by gender and grade which allow him to quantify the program's causal effect. To validate difference estimations he shows results of maximum likelihood estimation of a reduced form equation of the school enrollment decision. He concludes that the program has effectively reached its goal since he finds positive and large post-program differences in enrollment rates of comparably poor children in treatment and control communities.

Other related relevant papers are Attanasio, Meghir, and Santiago (2005) and Todd and Wolpin (2003), who follow a structural approach to evaluate PROGRESA.

[4]Corresponding web pages: Federal Government: www.oportunidades.gob.mx; INSP, www.insp.mx; CIESAS, www.ciesas.edu.mx; IFPRI, www.ifpri.org; CIDE, www.mec.es/cide/

They can thus simulate the effects of counterfactual programs and they can identify alternative subsidy schemes with a greater impact on schooling decisions.

Attanasio, Meghir, and Santiago (2005) estimate the structural parameters of a standard model of education choices that considers schooling as an individual decision. Similarly to Schultz (2004), they find that PROGRESA has a positive effect on the school enrollment of children, especially after the completion of primary school. They also show that a revenue neutral change in the program that increased the grants for junior secondary school children while eliminating the ones for primary school children, would have a substantially larger effect on enrollment of secondary school children, while having only minor effects on the enrollment of primary school children.

Todd and Wolpin (2003) estimate a dynamic behavioral model of parental decisions about fertility and children schooling. Their paper differs from Attanasio, et al in two main aspects. Todd and Wolpin (2003) model schooling as a family decision. They use data from the control group prior to the experiment in the validation and estimation of the model, i.e. they use only pre-program information in the estimation of the parameters of interest. They then apply the model to analyze the effectiveness of alternative policies to increase enrollment rates.

3 Enrollment vs. re-enrollment decision

3.1 Influential factors for the enrollment decision

From an economic point of view, the school enrollment decision is taken based on the private price of schooling. The total price of schooling includes tuition fees, direct costs of attending school, such as clothing, books, materials and transportation costs but also the opportunity cost if attending school. Since in Mexican rural communities public schools are mostly tuition-free, the main component of the price of schooling is the opportunity cost of time. A student could devote her/his time spent at school to other activities, such as paid work, farming, or any other productive activity at home. PROGRESA directly reduces the price of schooling through grants and aid for school supplies. From this reduction in the price of schooling, we would expect a positive effect of the program on enrollment rates.

The main component of the opportunity cost of schooling is the rural wage a child can earn as farming or home production activities are difficult to measure in monetary terms. Unfortunately only a small fraction of communities report such information.

As a proxy we consider the agricultural wage for adult male.

In communities with high salaries we expect that children are less likely to go to school, because they face a higher opportunity cost. Additionally, medium and large cities have more developed labor markets that usually offer higher wages. So we expect a child residing near a metropolitan area or near the main city of her/his municipality to be more likely to drop-out of school and to work instead.

Transportation cost are an important direct cost of schooling for children attending junior secondary school. Only in 25% of all communities under study have a proper junior secondary school. A reasonable proxy for this cost is the distance from the community where the child resides to the nearest one that has a secondary school. In all the communities studied there exist at least one primary school, so we can set transportation costs for primary school children equal to zero.

Given that a child's schooling is a family decision, it is necessary to analyze family characteristics that may influence this decision. There is a general agreement that more educated parents are more likely to send their children to school. If the father lives at home and works we expect his children to be more likely to go to school, as the financial situation of the family is more stable. Health and work status of the head of the household are also relevant for a child's schooling decision. If the head of the household was unemployed or ill for some weeks before the children should have been enrolled at school it is likely that the children are sent to work.

3.2 The re-enrollment decision

The focus of this paper is not the overall population but those children that are making a re-enrollment choice, i.e. drop-outs. Drop-outs are those who have made the decision of not attending school at some point in time and were not enrolled in October 1997, before the implementation of PROGRESA. These children were not receiving enough incentives to go to school, to improve their educational level, and to contribute finally to human capital accumulation and the development of their communities. Regarding the aim of PROGRESA, drop-outs are thus an important target of the program.

Is there any reason to think that PROGRESA education grants could have a different impact on enrollment rates of drop-outs than on those of non-drop-outs? A hypothetical answer to this question can be made based on observable differences between both groups. In particular, we can look at information provided by the pre-program census (October 1997) and interpret it referring to the conclusions from the previous subsection. Some numbers are given in Table 1 below.

As I expect values of some variables to be different for different levels of schooling and gender, data is presented separately for primary and secondary school children and for girls and boys. The primary school sample includes all children aged 6 to 18 who have completed 0-5 years of schooling and are thus qualified to enroll in primary school grades 1 to 6. In the secondary school sample I considered all children aged 11 to 18 who have completed at least 6 years of schooling and are thus qualified to enroll in junior or senior secondary school.

Table 1: Difference in averages and proportions of selected variables between Drop-outs and Non-drop-outs (pre-program census)

Variable name	Primary		Secondary	
	Female	Male	Female	Male
Percentage of children belonging to a poor family	4.2***	3.7***	8.0***	3.7*
Mother's schooling (years)	-1.5***	-1.3***	-1.0***	-1.0***
Percentage of children with father living at home	-3.4**	-5.8***	0.9	-0.1
Number of siblings enrolled at school	-1.7***	-1.6***	-1.2***	-1.3***
Distance to secondary school (km)	0.92***	0.64***	1.11***	0.74***
Distance to metropolitan area (km)	-17.6***	-19.3***	-22.8***	-31.4***

* Statistical significance = 10%. ** Statistical significance = 5%. *** Statistical significance = 1%.
The statistical significance of the differences is tested using tests for equality of means and proportions.

Having a more educated mother increases the probability of enrollment for non-drop-outs. The positive effect of parents' education on the education of their children is well known. Additionally, the proportion of children of families with the father living at home is higher, making them more likely to attend school (at least in primary school). Non-drop-outs face lower direct cost of schooling since they live closer to a secondary school.

On the other hand, drop-outs reside closer to metropolitan areas and the main cities of their municipalities. Drop-outs reside in communities with higher wages. These facts imply a higher opportunity cost of schooling leading to a lower probability of re-enrollment for drop-outs. Moreover, a higher proportion of them belong to a poor family, making them more likely to work and not to attend school.

Additional information is given in the surveys that were carried out after PROGRESA started. In particular, these surveys ask why the child was not enrolled in school. For drop-outs the answers are: "There was not enough money" (47%), "She/he did not like going to school" (26%), "The school was very far away" (9%), and "Her/his help was needed at work or at home" (4%). Clearly the main reason for not attending school are financial restrictions at home making the alternative of working even more attractive.

Summing up, there exists enough evidence to conclude that drop-outs have more incentives to work rather than to attend school compered to non-drop-outs. Given the higher opportunity cost of schooling that drop-outs face and since the grants are a monetary incentive[5], I expect the effect of the program on drop-outs to be larger than on the average child. Thus, the proposed hypothesis based on observable characteristics is that the program has a stronger effect on the schooling decision of drop-outs. However, we do not know in which direction any unobservable characteristic of the child, like ability or ambition, could affect the schooling decision and if it could affect the schooling decision of drop-outs and non-drop-outs in a different way.

4 Data base and descriptive statistics

Since in this paper I analyze the grants' impact conditional on the schooling decision children have made before the implementation of the program, only post-program information can be used. From the education component of the PROGRESA post-program surveys (October 1998, May 1999 and November 1999) a matched panel sample for children aged 6 to 18 can be obtained. This panel includes 74,427 observations, 45,666 (61%) in the treatment group (individuals residing in a community where PROGRESA grants were implemented in September 1998) and 28,761 (39%) in the control group.

Before going into detail on the description of the data base, three comments should be made. First, there exists a maximum amount of aid a household can receive by means of the education component of the program. Those maximum amounts are updated every six month (as it happens with grants). When the maximum is reached each child receives only a percentage of the grant. Unfortunately, the exact amount each child receives is not reported in the data base. For this reason what can be

[5]The monthly agricultural wage is around $ 500, but a child actually earns less than this amount. A secondary school child's grant is approximately $ 250. These numbers show how important PROGRESA grants are as an additional source of family income.

measured is only the effect on school enrollment of the "potential grant". Using this measure for the effect of the program we may overestimate the "actual grant" effect. If the child's family is not receiving the maximum amount the potential grant coincides with the actual grant. In the PROGRESA data base the average number of children in a family is 4. This makes it very likely for a family to attain the maximum amount of aid.

The second comment is about the treatment group. Around 5% of those children fulfilling the requirements to obtain the grant are not receiving it[6]. The reason for this is not available in the data base. The grant amount for them is set to zero.

Finally, the variable reflecting the stock of education (years of schooling completed) presents some inconsistencies along the waves of the surveys. 29% of the observations show some of these inconsistences. For this reason I perform a hand-correction of the variable "stock of education", making it consistent among waves and with age and enrollment information.

In terms of the data base, drop-outs are those individuals aged 8 to 18 in the post-program surveys who were not enrolled at school in the first census (October 1997). The re-enrollment or drop-outs panel includes 6,948 observations, 4,155 (60%) in the treatment communities and 2,793 (40%) in the control communities.

Table 2 presents a set of descriptive statistics that characterize the population in the drop-out panel.

[6]The exact numbers are 5.62% for non-drop-outs and 5.14% for drop-outs.

Table 2: Descriptive statistics for Drop-outs (post-program surveys)

Variable	Primary Female	Primary Male	Secondary Female	Secondary Male
Sample size	1,310	1,490	2,431	1,717
Enrollment rate	0.526	0.528	0.258	0.259
Percentage of treatment communities	57.5	59.9	59.2	62.3
Percentage of children belonging to a poor family	92.9	92.9	84.2	83.1
Percentage of children eligible for receiving a grant	26.9	31.8	44.5	46.7
Grant (for grant different from zero) (pesos)	118.7	122.7	250.7	237.6
	(31.4)	(30.5)	(22.9)	(19.2)
Mother's schooling (years)	1.5	1.6	2.1	2.0
	(2.1)	(2.0)	(1.9)	(2.1)
Percentage of children with head of household ill	6.3	6.5	6.8	6.9
Percentage of children with head of household employed	89.2	89.5	90.2	87.5
Percentage of children with father not living at home	13.3	16.2	9.6	10.9
Number of girls from 5 to 16	2.0	1.0	1.9	1.0
	(1.2)	(1.0)	(1.2)	(1.0)
Number of boys from 5 to 16	1.0	1.9	1.0	1.9
	(1.0)	(1.3)	(1.0)	(1.2)
Number of children under 5	0.9	0.9	0.6	0.5
	(1.0)	(1.0)	(0.9)	(0.9)
Number of adult women	1.7	1.6	2.0	1.8
	(0.9)	(0.8)	(1.0)	(1.0)
Number of adult men	1.6	1.8	1.8	2.2
	(1.0)	(1.0)	(1.4)	(1.1)
Number of siblings enrolled at school	2.1	2.3	2.3	2.0
	(1.5)	(1.4)	(1.4)	(1.5)
Distance to secondary school (km)	3.2	3.0	2.8	2.6
	(3.3)	(3.0)	(2.0)	(1.9)
Percentage of children that have a secondary school in their community	18.0	21.9	15.1	18.5
Distance to nearest metropolitan area (km)	131.8	131.0	129.2	125.2
	(64.8)	(59.7)	(73.2)	(66.4)
Distance to the main city of her/his municipality (km)	11.2	11.2	12.0	10.7
	(7.2)	(7.2)	(9.4)	(7.4)
Community daily agricultural wage (pesos)	29.4	30.2	33.4	31.8
	(11.4)	(11.2)	(11.9)	(11.6)

Standard deviations are in parenthesis *(continued in Appendix as Table 1-continued)*

Table 6 of the Appendix reports similar statistics for non-drop-outs.

In both tables variables are somewhat different for girls and boys, as expected. Also, we see different variable values for children in primary and in secondary school. Hence, I want to use an estimation strategy that will allow for differences in the program's effects by gender and by level of education.

Comparing Table 2 and Table 6 we observe differences between drop-outs and non-drop-outs. Below, in Table 3 there is a list of variables for which means and proportions in both panels are statistically different.

Table 3: Difference in variable means and proportions between Drop-outs and Non-drop-outs (post-program surveys)

Variable name	Primary		Secondary	
	Female	Male	Female	Male
Enrollment rates	-0.450***	-0.443***	-0.508***	-0.531***
Percentage of children belonging to a poor family	3.5***	3.1***	3.7***	1.2
Mother's schooling (years)	-1.6***	-1.4***	-0.8***	-0.9***
Percentage of children with head of household employed	-2.6***	-2.1***	0.1	-1.9**
Percentage of children with father living at home	-3.5***	-6.1***	0.7	-0.2
Number of siblings enrolled at school	-0.7***	-0.6***	-0.6***	-0.6***
Community daily agricultural wage (pesos)	-1.2***	-0.4	1.7***	0.7**
Distance to secondary school (km)	0.9***	0.6***	0.9***	0.6***
Distance to metropolitan area (km)	-16.9***	-19.4***	-23.1***	-28.8***
Distance to the main city of her/his municipality (km)	-0.6**	-0.4**	-0.2	-0.8***

* Statistical significance = 10%. ** Statistical significance = 5%. *** Statistical significance = 1%.
The statistical significance of the differences is tested using tests for equality of means or proportions.

An important fact pointed out by Tables 2 and 3, is the low enrollment rate of drop-outs. Only almost 60% of primary school children are actually attending class. Still worse is the situation for secondary children. Only 25% of them go to school. Compared with non-drop-outs, enrollment rates after the implementation of the program are 45% lower for primary school drop-outs, and more than 50% lower for secondary school drop-outs. Some questions naturally arise from these figures. Why are these differences so large? Why is a child that decided not attend school once unlikely to re-enroll? Can we infer from these numbers that PROGRESA is not working all that well for drop-outs contrary to what we expected?

To answer the first two questions take a look at Table 3. Again, as in Section 3.2, we conclude that, not considering grants, drop-outs have more incentives to work than to attend school. Moreover, a higher proportion of drop-outs come from poor families and with unemployed heads of households. Also, they have a higher direct cost of attending secondary school reflected in higher distances to secondary schools. Another explanation for the differences in enrollment rates could be that some unobserved characteristics as ability or personal ambition affect a child's schooling decision.

The remaining question is if the PROGRESA program is convincing those children who dropped out of school before the implementation of the program to go back to school and finish their education. If the answer is yes this implies that without the program enrollment rates would be much lower. On the other hand, if the program is not working for drop-outs pre and post program enrollment rates should be equal. In both situations it is necessary to study alternatives schemes for the grant design that could send more drop-outs back to school.

The answer cannot be obtained by just looking at descriptive statistics but needs to make use of the randomized assignment of the program. Comparison of results between treatment and control communities allows us to estimate the causal relationship between enrollment decision and PROGRESA grants.

5 Difference estimation of PROGRESA impact

The random assignment of PROGRESA at community level has a crucial advantage. Randomization balances all observed and unobserved variables other than enrollment decision and treatment status across the two groups (treatment and control). Hence, this makes it possible to quantify the effect of the program on enrollment rates by simply comparing enrollment in treatment vs. enrollment in control communities, i.e., difference estimation can simply measure the program's effects.

To analyze if there exist differences in the effect of the program on non-drop-out and drop-outs we can estimate separately difference estimators for both groups, and compare the results.

In the context of this paper difference estimators are defined in the following form:

$$\hat{\mathbb{E}}_n(S_{it} \mid grant_{it} > 0, P_i = 1) - \hat{\mathbb{E}}_n(S_{it} \mid grant_{it} = 0, P_i = 1) \qquad (1)$$

$$i = 1, ..., N \qquad\qquad t = 2, 3, 4$$

where

S_{it}: dummy equal 1 if the child is enrolled in school at time t.

$\hat{\mathbb{E}}_n$: post-program period averages.

$grant_{it}$: the potential grant amount, that takes a value different from zero only if the child belongs to a poor family, resides in a PROGRESA community, and is attending a grade between 3^{rd} year of primary school and 3^{rd} year of junior secondary school. $grant_{it} > 0$ defines the treatment group while $grant_{it} = 0$ defines the control group[7].

P_i: is a dummy variable that takes on a value of 1 if the child belongs to a poor family.

$t = 1, 2, 3, 4$ identify the October 1997 census and the October 1998, May 1999 and November 1999 surveys, respectively.

Unfortunately, difference estimation applied to the original data set partitioned in our two groups, drop-outs and non-drop-outs, may not be reliable. Randomization in the assignment of the program assures that any kind of analysis of the complete panel that implies disaggregation based on observable characteristics, other than the dependent variable and the treatment definition variable, is valid. Also, a sufficiently high number of observations is needed for a law of large numbers to hold in both groups defined by the treatment status. However, the variable that defines the groups under analysis is the dependent variable, school enrollment, in October 1997. Moreover, the drop-outs panel fails to contain enough observations when we split the data between treatment and controls, by school level and by gender[8].

Only if randomization still holds when considering non-drop-outs and drop-outs observations separately, difference estimation is valid. But this is not the case here. I carried out an analysis of the randomization in both sub-panels following the methodology of Behrman and Todd (1999). Comparing means and distributions of observable characteristics between treatment and control observations I found some differences. Hence, the main conclusion is that the assignment of the program is not completely random when considering the groups as presented. Results for a set of relevant variables can be consulted in Table 9 and Table 10 of the Appendix. Therefore, difference estimation cannot provide accurate results. However, they could give us a first idea of the grant's impact on non-drop-outs and drop-outs.

The program's effects difference estimation in the post-program periods by grade

[7]For children who fulfill the requirement to obtain the grant but are not receiving it I set $grant_{it} = 0$. In the calculus of difference estimates they belong to the control group.

[8]Size for each group are reported in Table 8 of the Appendix.

completed are reported in Table 4.

Table 4: Difference estimation of program's effects

Years of schooling completed in previous year	Post-Program Differences			
	Non-drop-outs		Drop-outs	
	Female	Male	Female	Male
From 2 to 5	0.0220***	0.0195***	0.0220	0.1517***
	(0.0029)	(0.0029)	(0.0354)	(0.0322)
6	0.1216***	0.0767***	0.1256***	0.0457*
	(0.0155)	(0.0146)	(0.0194)	(0.0242)
7 or more	0.0242**	0.0137	0.2142***	0.0166
	(0.0081)	(0.0088)	(0.0737)	(0.0767)
Sample size:				
Primary	23,564	25,521	1,310	1,490
Secondary	8,659	9,735	2,431	1,717

* Statistical significance = 10%. ** Statistical significance = 5%. *** Statistical significance = 1%.
The statistical significance of the differences is tested using a test for equality of proportions.
The statistic has a standard normal distribution. In particular, I test whether the proportion
of children enrolled in school is the same within the two groups defined by treatment status.

Consider secondary school girls in the non-drop-out group that have completed grade 6. The corresponding figure in the previous table should be interpreted as follows: mean enrollment rates for secondary school girls that did not drop-out of school are higher for those who receive the grant. In other words, enrollment rate for this group is 12.16% higher due to the grant.

For the non-drop-outs we observe a positive effect of the program on girls and boys in all grades. The program has the strongest effect for girls and boys in 6^{th} grade , when they have just finished primary school and are about to start secondary school. This is a good result since the lowest enrollment rates are precisely in that grade and it is crucial for the purpose of human capital accumulation that those children at least enter secondary school. Here the effect is higher for girls than for boys probably due to the fact that at this level grants paid to girls are higher than those paid to boys. The estimated effects for non-drop-outs are similar to the results obtained from post-program differences by Schultz (2004)[9].

[9] As it can be seen in Table 7 in the Appendix, confidence intervals in this paper include or are included in Schultz's intervals in 6 out of 10 results presented.

Comparing results for non-drop-outs and drop-outs, I found the expected higher effect on drop-outs in primary school boys. However, this is not the result for children in secondary school. In particular, for girls there exist a small difference while for drop-outs boys the effect is clearly lower than the effect for non-drop-outs boys.

6 The enrollment decision equation

6.1 A general enrollment decision equation with PROGRESA variables

Following the discussion presented in Section 3.2 and including variables that reflect the impact of the PROGRESA program, a reduced form equation in latent variable form for the probability of being enrolled in school at time t, S^*_{it}, is[10]:

$$S^*_{it} = \eta_i + \alpha_{0t} + \alpha_1 P_i + \alpha_2 T_i + \sum_{k=2}^{8} \alpha_{3k} grant_{kit} + \sum_{k=1}^{K} \gamma_k C_{kit} + \sum_{j=1}^{J} \beta_j X_{jit} + e_{it} \quad (2)$$

$$i = 1, 2..., n \qquad t = 2, 3, 4 \qquad \text{and} \qquad e_{it} \sim F$$

What we observe, in fact is:

$$S_i = \mathbf{1}[S^*_i > 0] \qquad i = 1, 2..., n \quad (3)$$

η_i is an unobserved factor, individual specific and time-constant. It may reflect ability, personal ambition, etc.

α_{0t} is a time variant unobserved effect.

P_i is a dummy variable that takes on a value of 1 if the child belongs to a poor family.

T_i is a dummy variable that takes on value 1 if the child lives in a community where the program started in September 1998, i.e., in a treatment community.

$grant_{it}$ as defined in Section 5[11].

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[10] This reduced form equation is similar to the one proposed in Schultz (2004). The main differences are the introduction of an additional term to allow for time-constant unobserved effects and the introduction of a set of variables that allow for identification of differential effects of the program for drop-outs.

[11] For children who fulfill the requirement to obtain the grant but are not receiving it I set $grant_{it} = 0$ and $T_i = 1$.

C_{kit} is equal to 1 if the child has successfully completed k years of school, $k = 1$ or less, $2, ..., 8$ and 9 or more, which qualifies the child for enrollment in $(k+1)^{th}$ grade.

X_{jit} are a set of J individual, family, and community characteristics that includes the age of the child and the square of the age, mother's schooling, a dummy equal to one if the head of household was ill, a dummy equal to one if the head of household was employed in the week before the survey was conducted, a dummy set equal to 1 if the father lives at home, the number of girls younger than 16 years in the family, and the number of boys younger than 16 years in the family, the number of children younger than 5 years in the family, the number of adults women and men in the family, number of siblings enrolled in school, daily mean agricultural wage for men, distance to nearest junior secondary school, distance to nearest metropolitan area, and distance to the main city of her/his municipality.

F any distribution function.

The expected values for the coefficients are the following. α_1 should be negative reflecting the common hypothesis that credit constraints limit the investment of the poor in their children's education. The effect of residing in a treatment community, or α_2, should be close to zero, since the assignment of the program is random, or slightly positive capturing some "spillover effects" of the treated communities on the control communities. α_{3k} captures the program effects, so it is greater than zero if the program successfully reaches its goal.

For the $\beta's$, we expect a negative effect of age, since for a given grade being older implies higher costs of schooling (higher opportunity costs for being more likely to get a job and to obtain a higher salary, psychological cost of disappointment if she/he failed, etc), a positive effect if the mother is more educated, a negative effect if the head of the household was ill and a positive effect if she/he had a job, a positive effect if the father lives at home, also a positive effect if the proportion of siblings attending school is higher, a negative effect from the opportunity cost of schooling (captured by wages), a negative effect from the direct cost of attending a junior secondary school (i.e. the non-existence of a school in the community), and finally a positive effect of the distance to the nearest metropolitan area and of the distance to the main city of her/his municipality.

6.2 Allowing for differences between drop-outs and non-drop-outs

To answer the question "Did PROGRESA send drop-outs back to school?" it is necessary to model the probability of being enrolled for individual i at time t conditional on the schooling decision she/he made before the program started:

$$\mathbb{P}(S_{it} \mid S_{i1}) \qquad t = 2, 3, 4 \tag{4}$$

and then compare these probabilities between ex-ante drop-outs ($S_{i1} = 0$) and children who were at school before the program started ($S_{i1} = 1$).

In order to capture the differences in the program's effects on non-drop-outs compared to drop-outs, the equation for the enrollment decision is modified as follows:

$$S^*_{it} = \eta_i + \alpha_{0t} + \alpha_1 P_i + \alpha_2 T_i + \alpha_3 D_i + \alpha_4 P_i * D_i + \alpha_5 T_i * D_i + \tag{5}$$
$$\sum_{k=2}^{8} \alpha_{6k} grant_{kit} + \sum_{k=2}^{8} \alpha_{7k} grant_{kit} * D_i + \sum_{k=1}^{K} \gamma_k C_{kit} + \sum_{j=1}^{J} \beta_j X_{jit} + e_{it}$$
$$i = 1, 2..., n \qquad \text{and} \qquad t = 2, 3, 4$$

where D_i is a dummy variable, that takes a value of 1 if the child dropped out of school before the program started.

The impact of the program for non-drop-outs is captured by the variable "grant", i.e., by the coefficient α_{6k}. The impact for drop-outs is given by $\alpha_{6k} + \alpha_{7k}$. Hence, the difference in the program's impacts on non-drop-outs and drop-outs, is equal to α_{7k}.

7 Maximum Likelihood estimation of PROGRESA impact

In order to estimate the parameters we have to take into account two characteristics of this equation. First, it is a probability model, and second, there is an unobserved fixed effect.

A fixed effects conditional logit model allow us to consistently estimate the parameters using a non-linear model and without any assumptions on how η_i is correlated with the exogenous variables. This approach is desirable for at least three reasons. The estimated probabilities are between 0 and 1, marginal effects are individual specific and it allows for the most flexible specification of the unobserved heterogeneity.

However, such a model cannot be applied to the equation above since there is not enough variation in the data. A fixed effects non-linear estimation strategy can only considers observations for which the dependent variable has time variation. Applying this restriction to the PROGRESA panel we are left with 9,036 observations. Of those observations only 1,632 refer to drop-outs. This is not enough data to identify the effect of interest.

Another alternative would be to use a fixed effects linear model. It also has the most flexible specification for the fixed effect, so consistency is not an issue. Nevertheless, it has problems associated with the estimation of a probability using a linear model. The main concern is about the marginal effects that in this model are assumed to be constant among individuals. In the context of schooling decision this assumption is not realistic. Moreover, this procedure leads to lower precision (high standard errors) in the estimated parameters.

Hence, the most flexible specification for the unobserved factor that can still identify the effect of the program in a non-linear probability model, is the one proposed by Chamberlain (1980) and Mundlak (1978), known as Correlated Random Effects Probit model. This model explicitly allows the individual specific unobservable term η_i to be correlated with time variant regressors assuming a conditional normal distribution with linear expectation and constant variance. The specification assumed for η_i is:

$$\eta_i = \psi + \xi \bar{x}_i + a_i \tag{6}$$

where $\bar{x}_i$ is a vector including the average of: i)daily mean agricultural wage for men, ii)head of households' health and work status and iiii)grant amount interacted with the drop-out dummy[12].

The complete set of assumptions for the enrollment decision equation estimation is the following:

1. $e_{it} | \eta_i, P_i, T_i, D_i, grant_{kit}, C_{kit}, X_{jit} \sim \Phi \qquad \forall i, \forall t, \forall k, \forall j$

[12]This correlation is only allowed between time variant variables and the fixed effect. A potential source of bias in this model is the existence of correlation between the unobserved term and some time constant variables. In the model presented so far the dummy D_i may be correlated with η_i, since some unobserved factor could have determined the decision of dropping out of school. I considered this fact in the model including the grant amount multiplied by the drop-out dummy in the vector $\bar{x}_i$. Additionally, I estimated the equation using a fixed effects linear model. Results are presented in Table 11 and Table 12 of the Appendix. Estimated parameters and marginal effects are, at least qualitatively, equivalent to the ones obtained with the correlated probit model.

where Φ stands for the standard normal distribution

2. $S_{i1}...S_{iT}$ are independent conditional on $\eta_i, P_i, T_i, D_i, grant_{kit}, C_{kit}, X_{jit}$ $\forall i, \forall t, \forall k, \forall j$

3. $\eta_i | P_i, T_i, D_i, grant_{kit}, C_{kit}, X_{jit} \sim N(\psi + \bar{x}_i \xi, \sigma_a^2)$

Since coefficients can only be interpreted qualitatively I present here the results for the marginal effects. A complete report of the estimation results can be found in Table 14 of the Appendix[13]. I chose to present the average values of estimated marginal effects across treated individuals. They are defined as follows:

Let Z_{kit} be the vector of explanatory variables:

$$\overline{Z}_{kit} \equiv \left(1, \bar{x}_i, \overline{grant}_k, \overline{grant}_k * D_i, X_{1it}...X_{Jit}\right)'$$

for each $k = 2...8$.

Let Z^0_{kit} be the same vector with the only difference that $grant_{ki} = 0$, for all individuals in all time periods:

$$Z^0_{kit} \equiv (1, \bar{x}_i, 0, 0, X_{1it}...X_{Jit})'$$

Let $\hat{\pi}_k$ be the vector of estimated parameters.

Finally, the average values of estimated marginal effects across treated individuals are calculated using the following expression:

$$\sum_{i:\ grant_i > 0} \sum_{t=2}^{4} [\Phi(\hat{\pi}_k * \overline{Z}_{kit}) - \Phi(\hat{\pi}_k * Z^0_{kit})] \tag{7}$$

where Φ stands for the normal distribution function. I calculated the average of the change in enrollment probabilities due to the implementation of the grant for children in conditions of receiving a grant (treated individuals). These averages were obtained for non-drop-outs (i with $D_i = 0$) and drop-outs (i with $D_i = 1$) separately.

Table 5 presents the average values of estimated marginal effects across treated individuals.

[13] A full description of the variables is presented in Table 13 of the Appendix.

Table 5: Average values of estimated marginal effects across treated individuals

Years of schooling completed in previous year	Non-drop-outs Female	Non-drop-outs Male	Drop-outs Female	Drop-outs Male
From 2 to 5	0.0087*	0.0015	-0.0518	0.1071
	(0.0037)	(0.0029)	(0.0955)	(0.0732)
6	0.0530**	0.0189	0.0103	0.1141**
	(0.0214)	(0.0158)	(0.1005)	(0.0483)
7 or more	0.0159**	-0.0009	-0.1957***	-0.0224
	(0.0075)	(0.0095)	(0.0621)	(0.0965)
Mean grant:				
Primary school	118.2	118.4	118.2	118.4
Secondary school	261.7	244.4	261.7	244.4
Sample size:				
Primary school	8,118	8,893	352	474
Secondary school	3,344	3,918	1,083	815

Standard errors calculated by bootstrap with 1000 replications reported in parentheses. * Statistical significance = 10%. ** Statistical significance = 5%. *** Statistical significance = 1%. Cluster at family level.

Consider non-drop-out girls that have completed 6 years of schooling and are receiving the grant. The average probability of enrollment for a girl in this group is 5.3% higher when she is receiving the mean grant compared to when she is not receiving it. The probability of being enrolled is 5.3% higher due to the grant. With this kind of interpretation in mind, we can derive several conclusions.

In general the grant effect is positive. In four cases the effect is negative but insignificant due to huge standard errors, so the effect of interest in those cases is not clearly identified (as it happens with girls in primary school). The impact of the program is higher in secondary school than in primary school. This is an expected result because grants in secondary school are more than twice the amount of grants in primary school. Additionally, since enrollment rates are lower in the secondary level of education the program has more scope to work at this level.

The average effect of the grant for girls is higher than for boys in the non-drop-out group. This is due to the fact that girls in secondary school are receiving higher grants than boys. Surprisingly, the same is not true in the group of drop-outs. Drop-out boys react more strongly to the grant, even though they receive less money than girls.

The effects are different when we compare drop-outs with non-drop-outs. Since the standard errors of the estimated effects for drop-outs in primary school are quite high, I do not made conclusions on these groups and, in what follows, all comments refers to secondary school children. For those children that have to enter in secondary school (6 years of schooling completed) the results are conclusive enough. There is no effect of grants in the re-enrolment decision of drop-outs girls while for non-drop-outs grants increase their enrolment probability by more than 5%. Drop-out boys react more to the incentive given by grants than non-drop-outs. After receiving the grant the enrolment probability of both groups increase, but for drop-outs this increase is almost 10% higher than for non-drop-outs.

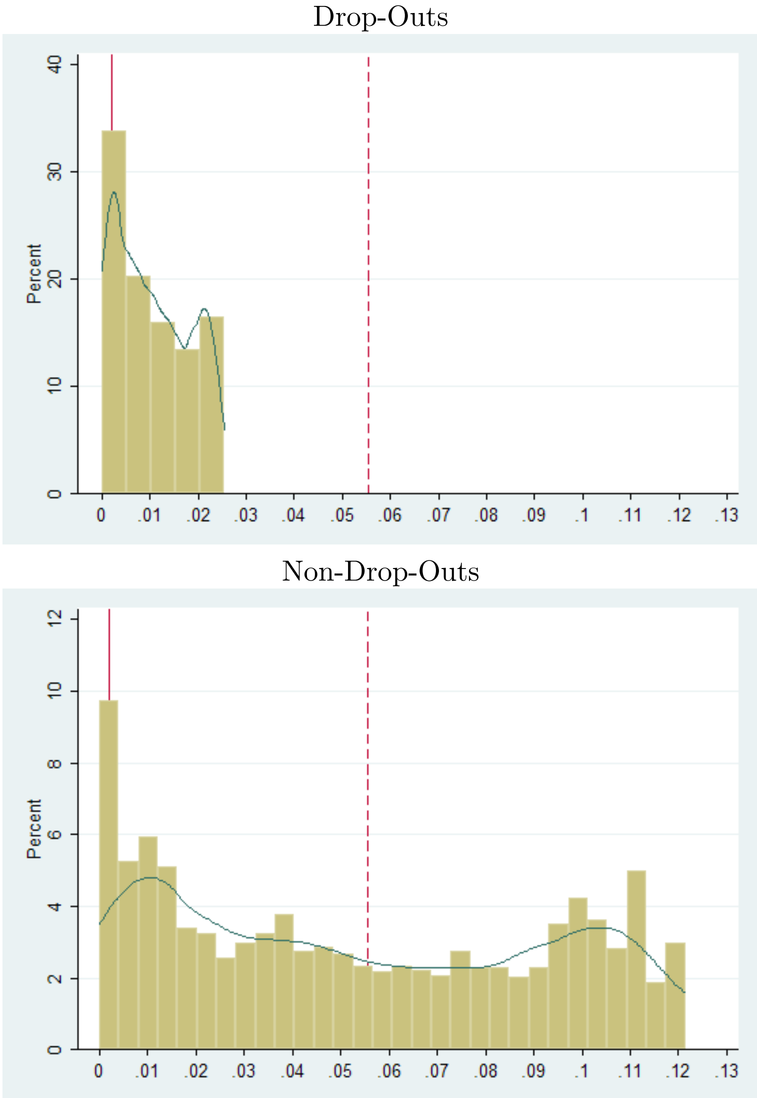
Even though the equality of average marginal effects between drop-outs and non-drop-outs cannot be rejected at standard levels of significance[14], 25, 50 and 75 percentiles and the distribution of marginal effects between both groups[15] show notable differences. Moreover, p-values from kolmogorov-smirnov tests of equality of distributions of marginal effects between drop-outs and non-drop-outs are always bellow 0.001, so the null hypothesis of equality is in all cases rejected even at 1% of significance. Figures 2 and 3 below depict marginal effects distributions stressing this conclusion.

For girls that are about to enter in secondary school, the average impact is 5% for non-drop-outs while the corresponding figure for drop-outs is only 1% and statistically zero. Main characteristics of the distributions are a smaller range for drop-outs, from 0.0 to 0.025, and for non-drop-outs a high dispersion with almost all frequencies below 5%. Thus, for girls who have to decide whether to enter in secondary school grants are more convincing for those who were at school before the implementation of the program. PROGRESA education grants are not a strong enough incentive to persuade drop-out girls to start secondary school. Notice that for this group the conclusion does not support the initial hypothesis that was made simply considering observable characteristics.

[14] I tested differences in the averages of marginal effects by bootstrap (1000 replications) and most of the p-values obtained are higher than 0.15. All test results are reported in Table 16 of the Appendix.

[15] Reported in Table 15 of the Appendix.

Figure 2: Marginal effects distribution: female primary school completed (grade 6 completed)

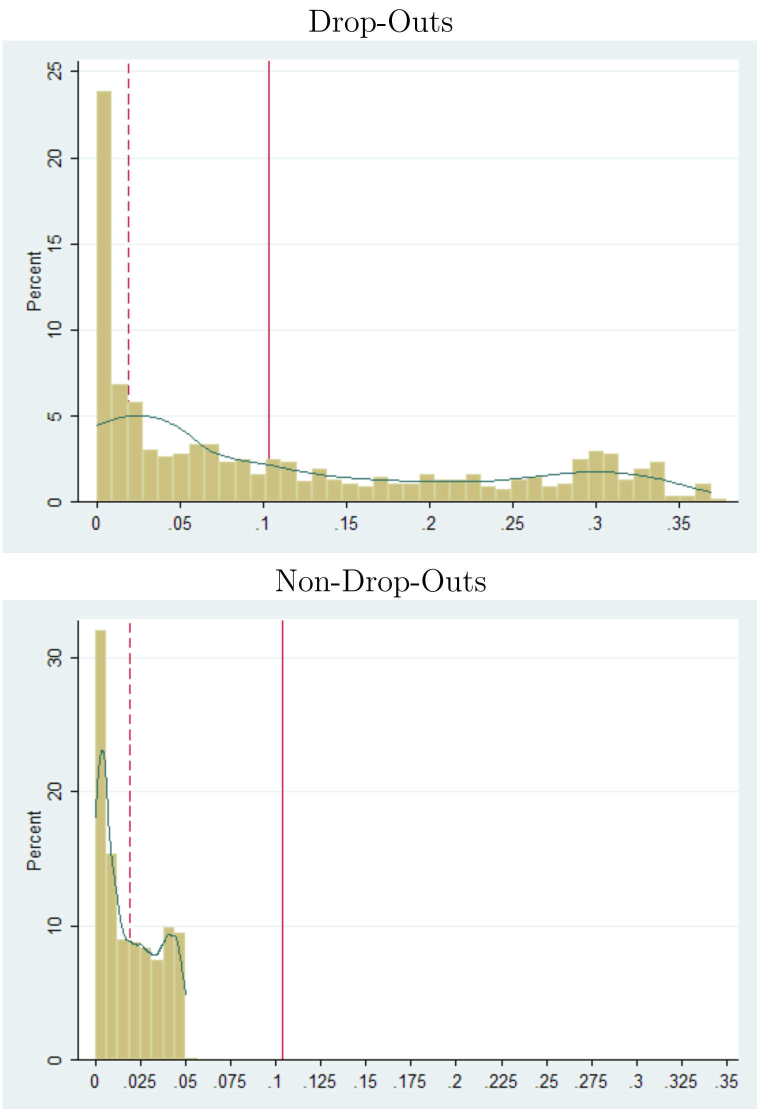


- - - (dashed line) Average marginal effect for non-drop-outs

—— (continuous line) Average marginal effect for drop-outs

Turning to boys that have completed 6^{th} grade, there is an important and statistically significant difference in average marginal effects, more than 9% higher for drop-outs (2% for non-drop-outs, 11% for drop-outs). For non-drop-outs the distribution has a small range, from 0 to 0.05 with the highest frequency, more than 30%, between 0 and 0.002. The distribution for drop-outs, on the other hand, is highly dispersed between 0 and 0.37 with frequencies in general below 5%. 25, 50 and 75 percentiles are all higher for drop-outs. The message is clear. The program has a stronger effect on boys about to start secondary school who dropped-out in 1997 or before than on those who stayed on school.

Figure 3: Marginal effects distribution: male primary school completed (grade 6 completed)



- - - (dashed line) Average marginal effect for non-drop-outs

—— (continuous line) Average marginal effect for drop-outs

Summing up, the estimated results presented above allow us to conclude that there exists a differential effect of the grant between children that dropped out of school before the program started and those who did not. The direction of differential effects in secondary school is not uniform for girls and boys. Drop-outs boys react more strongly to the program's incentives than non-drop-outs. Non-drop-outs girls have stronger grants' effects than drop-outs. Therefore, I found the expected result of a higher effect of the grants on drop-outs in secondary school only for boys. In general the program is effective for children that dropped out of school before they started receiving any grants. But when they have to decide to enter secondary school PROGRESA grants provide a better incentive for boys than for girls.

8 Conclusions

There exist evidence of differences in the effects of the PROGRESA program effects on the overall target population and on the children who face a re-enrollment decision. These difference are observed in all groups analyzed. But the direction of the difference varies across groups. The expected result of a higher program effect on drop-outs was found for boys in conditions of attending primary or secondary school. For girls in secondary school who dropped out in 1997 or before, the grant is not as good incentive to enroll in school as it is for non-drop-out girls. Among drop-outs in secondary school the impact of the education grants is lower for girls even though they receive more money than boys. The different responses of girls and boys to the grant in secondary school should be studied in more detail.

The last finding motivates the design of a particular model of schooling decision for girls. Individual variables such as marital state, pregnancy and number of children should be considered. Moreover, it can be argued that girls face a third option other than schooling or working. They may stay at home and take care of the children in the family. A model of schooling decisions should reflect this third option for girls. Additionally, there exist some perception that in the poorest rural communities girls are discriminated, so a monetary incentive like the PROGRESA grants may not be effective.

An important point in the evaluation of the program's impact is if it is better to model the schooling decision as an individual or as a family decision. In fact, the program limits aid to a maximum amount per family. This may affect family decisions about children schooling and the allocation of resources among them. This feature of the program cannot be reflected in the reduced form equation presented so far.

At a methodological level, the estimation of PROGRESA effects and the differential impact over drop-outs can be improved by constructing a structural model of schooling. With the design of such a model, we might obtained a more conclusive answer to the question "Did PROGRESA send drop-outs back to school?". Moreover, the estimation of a structural model will allow for the identification of a more effective and efficient policy that can send drop-outs back to school.

References

Angrist, J. D. (1998): "Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants," *Econometrica*, 66, 249–288.

Angrist, J. D., G. W. Imbens, and D. B. Rubin (1996): "Identification and Causal Effects Using Instrumental Variables," *Journal of the American Statistical Association*, 91, 444–455.

Attanasio, O., C. Meghir, and A. Santiago (2005): "Education choices in Mexico: using a structural model and a randomized experiment to evaluate Progresa," *Institute for Fiscal Studies, Working Paper*, EWP05/01.

Behrman, J., and P. Todd (1999): "Randomness in the Experimental Samples of PROGRESA (Education, Health, and Nutrition Program)," *International Food Policy Research Institute, Washington, D.C. Research Report.*

Chamberlain, G. (1980): "Analysis of Covariance with Qualitative Data," *Review of Economic Studies*, 47, 225238.

Coady, D. P. (2000): "The application of social cost-benefit analysis to the evaluation of Progresa. Final Report," *International Food Policy Research Institute, Washington, D.C. Research Report.*

Heckman, J. J. (1992): "Randomization and Social Program Evaluation," *In Evaluating Welfare and Training Programs, ed. C. F. Manski and I. Garfinkel. Cambridge, MA: Harvard University Press*, pp. 201–230.

——— (1997): "Instrumental Variables: A Study of Implicit Behavioral Assumptions Used in Making Program Evaluations," *Journal of Human Resources*, 32, 441–462.

Heckman, J. J., H. Ichimura, and C. Taber (1997): "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme," *Review of Economic Studies*, 64, 605–654.

Imbens, G. W., and J. Angrist (1994): "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, 62, 467–475.

Manski, C. F. (1996): "Learning about Treatment Effects from Experiments with Random Assignment of Treatments," *Journal of Human Resources*, 31, 709–733.

Mundlak, Y. (1978): "On the Pooling of Time Series and Cross Section Data," *Econometrica*, 46, 69–85.

Oportunidades (1999): "Reglas de operacion vigentes," *Secretaria de Desarrollo Social del Gobierno de Mexico downloadable from www.oportunidades.gob.mx.*

Schultz, P. (2004): "School subsidies for the poor: evaluating the Mexican Progresa poverty program," *Journal of Development Economics*, 74, 199–250.

Skoufias, E., B. Davis, and J. Behrman (1999a): "A. Final Report: An Evaluation of the Selection of Beneficiary Households in the Education, Health, and Nutrition Program (PROGRESA) of Mexico," *International Food Policy Research Institute, Washington, D.C. Research Report.*

——— (1999b): "B. An Addendum to the Final Report: An Evaluation of the Selection of Beneficiary Households in the Education, Health, and Nutrition Program (PROGRESA) of Mexico. Targeting the Poor in Mexico: Evaluation of the Selection of Beneficiary Households into PROGRESA," *International Food Policy Research Institute, Washington, D.C. Research Report.*

Todd, P., and K. I. Wolpin (2003): "Using a social experiment to validate a dynamic behavioral model of child schooling and fertility: assessing the impact of a school subsidy program in Mexico," *Penn Institute for Economic Research, Working Paper Series*, 03-022.

Appendix

Table 2 *(continued)*

Variable	Primary		Secondary	
	Female	Male	Female	Male
Years of schooling completed				
0	0.000	0.003		
1	0.170	0.150		
2	0.114	0.117		
3	0.439	0.401		
4	0.113	0.154		
5	0.164	0.176		
6			0.863	0.816
7			0.071	0.072
8			0.019	0.039
9 or more			0.047	0.073
Age of child				
8	0.070	0.070		
9	0.115	0.090		
10	0.091	0.086		
11	0.092	0.089	0.001	0.000
12	0.106	0.097	0.015	0.015
13	0.125	0.097	0.096	0.087
14	0.127	0.133	0.253	0.209
15	0.134	0.149	0.310	0.306
16	0.111	0.144	0.247	0.288
17	0.029	0.045	0.075	0.093
18	0.002	0.001	0.004	0.002

Table 6: Descriptive statistics for Non-Drop-outs (post-program surveys)

Variable	Primary		Secondary	
	Female	Male	Female	Male
Sample size	25,564	23,521	8,659	9,735
Enrollment rate	0.976	0.971	0.767	0.790
Percentage of treatment communities	60.79	62.20	60.85	62.10
Percentage of children belonging to a poor family	89.44	89.85	80.51	81.87
Percentage of children eligible for receiving a grant	31.8	30.8	38.6	40.2
Grant (for grant different from zero) (pesos)	118.2	118.2	265.2	245.8
	(29.7)	(29.8)	(28.1)	(20.4)
Mother's schooling (years)	3.0	3.0	2.9	2.9
	(2.6)	(2.6)	(2.5)	(2.5)
Percentage of children with head of household ill	5.96	6.26	7.10	7.14
Percentage of children with head of household employed	91.80	91.60	90.03	89.51
Percentage of children with father not living at home	9.83	10.11	10.50	11.07
Number of girls from 5 to 16	2.0	1.0	1.9	0.9
	(1.2)	(1.0)	(1.1)	(1.0)
Number of boys from 5 to 16	1.0	1.9	1.0	1.9
	(1.0)	(1.1)	(1.0)	(1.1)
Number of children under 5	0.9	0.9	0.5	0.5
	(1.0)	(1.0)	(0.8)	(0.8)
Number of adult women	1.5	1.5	1.8	1.6
	(0.8)	(0.9)	(1.0)	(0.9)
Number of adult men	1.5	1.5	1.7	1.8
	(0.9)	(0.9)	(1.0)	(1.0)
Number of siblings enrolled at school	2.9	2.7	2.8	2.7
	(1.3)	(1.4)	(1.3)	(1.4)
Distance to secondary school (km)	2.3	2.3	1.9	2.0
	(2.1)	(2.1)	(1.8)	(1.8)
Percentage of children that have a secondary school in their community	23.2	26.5	32.6	28.3
Distance to nearest metropolitan area (km)	148.7	150.4	152.3	154.1
	(76.8)	(77.0)	(77.4)	(77.5)
Distance to the main city of her/his municipality (km)	11.7	11.6	11.8	11.5
	(8.1)	(7.9)	(8.2)	(8.0)
Community daily agricultural wage (pesos)	30.6	30.5	31.8	31.2
	(10.6)	(10.5)	(10.8)	(10.4)
Years of schooling completed				
0	0.000	0.000		
1	0.200	0.207		
2	0.181	0.184		
3	0.279	0.271		
4	0.177	0.172		
5	0.164	0.166		
6			0.489	0.455
7			0.231	0.245
8			0.175	0.190
9 or more			0.105	0.110
Age of child				
6	0.073	0.069		
7	0.146	0.136		
8	0.155	0.151		
9	0.155	0.152		
10	0.151	0.148		
11	0.151	0.142	0.023	0.021
12	0.092	0.098	0.181	0.139
13	0.042	0.056	0.255	0.224
14	0.022	0.028	0.232	0.247
15	0.008	0.013	0.182	0.210
16	0.003	0.005	0.103	0.127
17	0.000	0.001	0.022	0.030
18	0.000	0.000	0.002	0.001

Standard deviations are in parenthesis

Table 7: Comparison with Schultz (2004) confidence intervals for post-program difference estimation

Years of schooling completed		This paper 95% Conf. Interval		Schultz (2004)[a] 95% Conf. Interval	
2	Female	0.0144	0.0352	-0.0111	0.0471
	Male	0.0054	0.0217	0.0209	0.0210
3	Female	-0.0026	0.0155	-0.0122	0.0382
	Male	0.0061	0.0274	0.0489	0.0490
4	Female	0.0035	0.0267	0.0279	0.0481
	Male	0.0108	0.0332	0.0439	0.0440
5	Female	0.0287	0.0582	0.0457	0.0643
	Male	0.0101	0.0407	0.0409	0.0410
6	Female	0.0910	0.1521	0.1479	0.1480
	Male	0.0481	0.1054	0.0531	0.0769

[a]The results are taken from Table 3 in Schultz (2004).

Table 8: Groups size

Years of schooling completed in previous year	Non-drop-outs				Drop-outs			
	Female		Male		Female		Male	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
From 2 to 5	8,118	6,317	8,893	6,832	352	372	474	393
6	1,889	1,678	2,050	1,710	956	814	688	476
7 or more	1,455	1,246	1,868	1,479	127	61	113	53

Table 9: p-values for test of randomization - Drop-out Observations

Variable	p-value (2,025 obs)	p-value based on community mean (440 obs)
Community population distribution	–	0.101 (3)
Distribution of communities over states	–	0.897 (3)
Age distribution of children under 16	0.892 (3)	0.925 (4)
Child's stock of education	0.107 (3)	0.340 (4)
Number of girls between 5 and 16 in the family	0.440 (3)	0.756 (4)
Number of boys between 5 and 16 in the family	0.426 (3)	0.336 (4)
Number of children under 5 in the family	0.099 (3)	0.856 (4)
Number of adult women in the family	0.002 (3)	0.456 (4)
Number of adult men in the family	0.180 (3)	0.720 (4)
Mother's schooling	0.000 (3)	0.955 (4)
Percentage of children with father not living at home	0.008 (2)	0.120 (4)
Percentage of children with head of household employed	0.019 (2)	0.321 (4)
Number of siblings enrolled at school	0.765 (1)	0.474 (4)
Community daily agricultural wage	0.000 (1)	0.914 (4)
Distance to metropolitan area	0.000 (1)	0.964 (4)
Distance to the main city of her/his municipality	0.001 (1)	0.742 (4)
Distance to secondary school	0.001 (1)	0.799 (4)

(1)Kolmogorov-Smirnov statistic for test of equality between two distribution functions. Ho: the distribution of the variable analyzed is equal in both groups
(2)T-test for equality of proportions. Ho: the variable analyzed has the same proportion of ones in both groups.
(3)Pearson's chi-squared statistic for the hypothesis that the frequencies in a two-way tabular are independent. Ho: the frequencies of the variable analyzed are independent.
(4)T-test for equality of means. Ho: the variable analyzed has the same mean in both groups.

Conclusion: At individual level several variables are different when comparing treatment and controls. At community level there exist statistical differences in a couple of variables. Hence, the random assignment of the program is lost when considering the group of drop-outs separately.

Table 10: p-values for test of randomization - Non-drop-out Observations

Variable	p-value (19,649 obs)	p-value based on community mean (492 obs)
Community population distribution	–	0.119 (3)
Distribution of communities over states	–	0.781 (3)
Age distribution of children under 16	0.230 (3)	0.925 (4)
Child's stock of education	0.009 (3)	0.369 (4)
Number of girls between 5 and 16 in the family	0.001 (3)	0.789 (4)
Number of boys between 5 and 16 in the family	0.000 (3)	0.415 (4)
Number of children under 5 in the family	0.000 (3)	0.295 (4)
Number of adult women in the family	0.000 (3)	0.701 (4)
Number of adult men in the family	0.007 (3)	0.525 (4)
Mother's schooling	0.002 (3)	0.930 (4)
Percentage of children with father not living at home	0.266 (2)	0.794 (4)
Percentage of children with head of household employed	0.016 (2)	0.324 (4)
Number of siblings enrolled at school	0.000 (1)	0.957 (4)
Community daily agricultural wage	0.000 (1)	0.997 (4)
Distance to metropolitan area	0.000 (1)	0.989 (4)
Distance to the main city of her/his municipality	0.000 (1)	0.414 (4)
Distance to secondary school	0.000 (1)	0.615 (4)

(1), (2), (3) and (4) idem Table 9.

Conclusion: There exist even more relevant differences at the individual level than those presented in Table 9. The evidence of lack of randomization is stronger when considering the group of non-drop-outs separately.

Table 11: Fixed-effects (within) regression coefficients[a]

				Number of obs =		74,427
				Number of groups =		24,809
R-sq:	within =	0.3887		Obs per group:		min = 3
	between =	0.3643				avg = 3
	overall =	0.3580				max = 3
$F(86, 49{,}532)$ =	366.15					
corr(u_i,Xb) =	-0.4034				Prob > F =	0.0000
Percentage correctly predicted = 0.8486						

enrolled	Coefficient	Standard Error	t	$P > \|t\|$	95% Conf.	Interval
$grant_{fp}$	0.0000	0.0001	0.0900	0.9250	-0.0001	0.0002
$grantd_{fp}$	-0.0023	0.0005	-4.9700	0.0000	-0.0032	-0.0014
$grantc6_{fs}$	0.0001	0.0001	1.6900	0.0900	0.0000	0.0002
$grantd6_{fs}$	-0.0013	0.0002	-5.4300	0.0000	-0.0017	-0.0008
$grantc7_{fs}$	0.00003	0.0001	0.7600	0.4480	-0.0001	0.0001
$grantd7_{fs}$	-0.0012	0.0002	-6.0500	0.0000	-0.0016	-0.0008
$grant_{mp}$	0.0001	0.0001	1.6600	0.0970	0.0000	0.0003
$grantd_{mp}$	0.0002	0.0004	0.5700	0.5700	-0.0006	0.0011
$grantc6_{ms}$	0.0001	0.0001	1.1200	0.2640	0.0000	0.0002
$grantd6_{ms}$	0.0002	0.0002	0.7300	0.4660	-0.0003	0.0006
$grantc7_{ms}$	0.00003	0.0001	0.7300	0.4660	-0.0001	0.0001
$grantd7_{ms}$	0.0001	0.0002	0.2900	0.7700	-0.0004	0.0005
σ_u	0.2598					
σ_e	0.1574					
ρ	0.7315	(fraction of variance due to u_i)				
F test that all $u_i = 0$: $F(24{,}808, 49{,}532) = 4.37$ Prob > F = 0.0000						

Standard errors are clustered at family level 11.

[a] For a description of variables look at Table 13.

Table 12: Fixed-effects marginal effects

Years of schooling completed in previous year	Non-drop-outs Female	Non-drop-outs Male	Drop-outs Female	Drop-outs Male
From 2 to 5	0.0089	0.0152*	-0.2695***	0.0439
6	0.0250*	0.0153	-0.3051***	0.0572
7	0.0101	0.0094	-0.2964***	0.0247
Mean grant:				
Primary school	118.2	118.4	118.2	118.4
Secondary school	261.7	244.4	261.7	244.4

Standard errors and p-values are reported in Table 11.
* Statistical significance = 10%. ** Statistical significance = 5%.
*** Statistical significance = 1%.

Table 13: Description of variables included in Maximum Likelihood estimation

Variable name	Description
P	One if the child belongs to a poor family
T	One if the child resides in a community where PROGRESA grants were implemented in October 1998
D	One if the child was not enrolled in school in the October 1997 census
DP	Interaction between D (drop-out) and P (poor family)
DT	Interaction between D (drop-out) and T (treatment community)
grant	Grant amount (pesos)
grantd	Grant amount interacted with D (drop-out child) (pesos)
wrepeon	Community daily agricultural wage for men (pesos)
health	One if the head of household was ill in the four weeks previous to the survey
work	One if the head of household has a job in the week previous to the survey
fhogar	One if the child's father is living at home with his family
distsec	Distance from the community where the child resides to the nearest community with a secondary school (km)
distmetro	Distance from the community where the child resides to the nearest metropolitan area. For communities in Hidalgo(state), these are Queretaro, Puebla, Tampico, or Mexico City; in Michoacan(state) it is Morelia; in Puebla it is Puebla; in Queretaro it is Queretaro; in San Luis de Potosi it is San Luis de Potosi; in Veracruz it is Veracruz and in Guerrero it is Acapulco (km)
distcab	Distance from the community where the child resides to the main city of her/his municipality (km)
schoolm	Years of schooling completed by the child's mother
girl	Number of girls from 5 to 16 years old in the child's family
boy	Number of boys from 5 to 16 years old in the child's family
baby	Number of children aged less than 5 years old in the child's family
women	Number of adult women (aged more than 16) in the child's family
men	Number of adult men (aged more than 16) in the child's family
w3	One for observations in the first post-program survey collected in October 1998
w4	One for observations in the second post-program survey collected in May 1999
age	Age of the child
age2	Square of the age of the child
ck	One if the child has completed k years of education (k = 1 or less, 2,..., 9 or more)
ageck	Age interacted with the stock of education of the child
asistest	Number of child's siblings enrolled in school
distsecd	Distance to secondary school interacted with drop-out dummy D
distcabd	Distance to main city at municipality level interacted with drop-out dummy D
workd	Variable work (head of household working status) interacted with drop-out dummy D
schoolmd	Mother's stock of education interacted with drop-out dummy D
workm	Time average for variable work (3 post-program observations)
healthm	Time average for variable health (3 post-program observations)
wrepeonm	Time average for variable wrepeon (3 post-program observations)
grantdm	Time average for variable grantd (3 post-program observations)
X_{fp}	Variable X interacted with a dummy variable equal 1 for girls in primary school
X_{fs}	Variable X interacted with a dummy variable equal 1 for girls in secondary school
X_{mp}	Variable X interacted with a dummy variable equal 1 for boys in primary school
X_{ms}	Variable X interacted with a dummy variable equal 1 for boys in secondary school
	X stands for the complete set of variables described above

Table 14: Probit estimates of enrollment probabilities

			Number of obs =	74,427
			Wald $\chi^2(166)$ =	7,636.54
Log-pseudolikelihood =	-9565.1793		Prob > χ^2 =	0.0000
			Pseudo R^2 =	0.6688
Percentage correctly predicted = 95.34%				

enrolled	Coefficient	Standard Error	z	$P > \|z\|$	95% Conf.	Interval
P_{fp}	-0.06012	0.12335	-0.49	0.626	-0.30188	0.18164
T_{fp}	0.036389	0.096795	0.38	0.707	-0.15333	0.226104
D_{fp}	-1.78776	0.439293	-4.07	0.000	-2.64876	-0.92676
DP_{fp}	0.539533	0.345394	1.56	0.118	-0.13743	1.216493
DT_{fp}	0.233085	0.198013	1.18	0.239	-0.15501	0.621183
$grant_{fp}$	0.002198	0.000881	2.5	0.013	0.000471	0.003925
$grantd_{fp}$	-0.00452	0.003856	-1.17	0.242	-0.01207	0.003042
age_{fp}	0.329558	0.160167	2.06	0.04	0.015638	0.643479
$age2_{fp}$	-0.02601	0.007755	-3.35	0.001	-0.04121	-0.01081
$c2_{fp}$	2.228879	0.497638	4.48	0.000	1.253527	3.204232
$c3_{fp}$	1.676924	0.655976	2.56	0.011	0.391236	2.962613
$c4_{fp}$	1.73503	0.744903	2.33	0.02	0.275047	3.195013
$c5_{fp}$	1.829776	0.769984	2.38	0.017	0.320634	3.338917
$agec2_{fp}$	-0.22695	0.049548	-4.58	0.000	-0.32407	-0.12984
$agec3_{fp}$	-0.16305	0.057249	-2.85	0.004	-0.27525	-0.05084
$agec4_{fp}$	-0.14192	0.063374	-2.24	0.025	-0.26613	-0.01771
$agec5_{fp}$	-0.14879	0.06407	-2.32	0.02	-0.27436	-0.02322
$wrepeon_{fp}$	-0.00322	0.003184	-1.01	0.312	-0.00946	0.003019
$distsec_{fp}$	0.028863	0.016966	1.7	0.089	-0.00439	0.062116
$distcab_{fp}$	0.001253	0.00405	0.31	0.757	-0.00668	0.00919
$distmetro_{fp}$	0.001298	0.000486	2.67	0.008	0.000346	0.00225
$schoolm_{fp}$	-0.00521	0.014298	-0.36	0.715	-0.03324	0.02281
$health_{fp}$	-0.21307	0.083881	-2.54	0.011	-0.37747	-0.04867
$work_{fp}$	-0.09014	0.113698	-0.79	0.428	-0.31298	0.132706
$fhogar_{fp}$	0.40628	0.137486	2.96	0.003	0.136812	0.675747
$girl_{fp}$	-0.44548	0.048201	-9.24	0.000	-0.53995	-0.35101
boy_{fp}	-0.53084	0.04877	-10.88	0.000	-0.62642	-0.43525
$baby_{fp}$	-0.00321	0.034287	-0.09	0.925	-0.07041	0.063991
$women_{fp}$	0.005986	0.047786	0.13	0.9	-0.08767	0.099645
men_{fp}	0.024404	0.038311	0.64	0.524	-0.05068	0.099491
$asistest_{fp}$	1.505614	0.059769	25.19	0.000	1.38847	1.622758
$distsecd_{fp}$	-0.05231	0.03061	-1.71	0.087	-0.1123	0.007689
$distcabd_{fp}$	0.019577	0.009987	1.96	0.05	2.31E-06	0.039151
$workd_{fp}$	0.535823	0.254472	2.11	0.035	0.037067	1.034579
$grantdm_{fp}$	-0.00262	0.004232	-0.62	0.536	-0.01091	0.005676
$wrepeonm_{fp}$	0.006664	0.004662	1.43	0.153	-0.00247	0.015802
$workm_{fp}$	0.28682	0.195492	1.47	0.142	-0.09634	0.669977
$healthm_{fp}$	0.521563	0.215596	2.42	0.016	0.099003	0.944122
$workdm_{fp}$	-0.35971	0.353035	-1.02	0.308	-1.05165	0.332224
$asistemst_{fp}$	-0.66512	0.053696	-12.39	0.000	-0.77037	-0.55988
$w3_{fp}$	0.093972	0.049281	1.91	0.057	-0.00262	0.19056
$w4_{fp}$	-0.05902	0.044302	-1.33	0.183	-0.14585	0.027812
$cons$	0.17941	0.851053	0.21	0.833	-1.48862	1.847444

(continued on next page)

Table 14*(continued)*

enrolled	Coefficient	Standard Error	z	$P > \|z\|$	95% Conf.	Interval
P_{fs}	-0.33882	0.095044	-3.56	0.000	-0.5251	-0.15254
T_{fs}	0.120591	0.088996	1.36	0.175	-0.05384	0.29502
D_{fs}	8.186298	5.750446	1.42	0.155	-3.08437	19.45696
DP_{fs}	0.075007	0.202451	0.37	0.711	-0.32179	0.471803
DT_{fs}	-0.0103	0.197861	-0.05	0.958	-0.3981	0.377501
$grantc6_{fs}$	0.001144	0.000435	2.63	0.009	0.000292	0.001997
$grantdc6_{fs}$	-0.0009	0.002183	-0.41	0.679	-0.00518	0.003375
$grantc7_{fs}$	0.001022	0.000473	2.16	0.031	9.41E-05	0.00195
$grantdc7_{fs}$	-0.00545	0.001853	-2.94	0.003	-0.00908	-0.00182
age_{fs}	-0.71461	0.461384	-1.55	0.121	-1.61891	0.189682
$age2_{fs}$	0.016453	0.014813	1.11	0.267	-0.01258	0.045486
$c6_{fs}$	1.629472	1.315147	1.24	0.215	-0.94817	4.207113
$c7_{fs}$	5.006646	1.351812	3.7	0.000	2.357142	7.656149
$agec6_{fs}$	-0.11693	0.086412	-1.35	0.176	-0.28629	0.052434
$agec7_{fs}$	-0.24183	0.088076	-2.75	0.006	-0.41445	-0.0692
$wrepeon_{fs}$	0.004344	0.00267	1.63	0.104	-0.00089	0.009577
$distsec_{fs}$	-0.05119	0.013887	-3.69	0.000	-0.07841	-0.02397
$distmetro_{fs}$	0.002178	0.000368	5.91	0.000	0.001456	0.0029
$distcab_{fs}$	0.000799	0.003078	0.26	0.795	-0.00523	0.006831
$schoolm_{fs}$	0.032229	0.013253	2.43	0.015	0.006254	0.058204
$health_{fs}$	-0.15281	0.065867	-2.32	0.02	-0.28191	-0.02372
$work_{fs}$	0.008876	0.079652	0.11	0.911	-0.14724	0.164991
$fhogar_{fs}$	0.512864	0.123557	4.15	0.000	0.270697	0.755031
$girl_{fs}$	-0.64605	0.05665	-11.4	0.000	-0.75708	-0.53501
boy_{fs}	-0.69022	0.057308	-12.04	0.000	-0.80254	-0.5779
$baby_{fs}$	-0.06231	0.028582	-2.18	0.029	-0.11833	-0.0063
$women_{fs}$	-0.00992	0.027727	-0.36	0.72	-0.06427	0.04442
men_{fs}	-0.0307	0.024896	-1.23	0.217	-0.0795	0.018092
$asistest_{fs}$	1.651837	0.065212	25.33	0.000	1.524023	1.779651
$aged_{fs}$	-1.2938	0.793451	-1.63	0.103	-2.84893	0.261335
$age2d_{fs}$	0.046772	0.027289	1.71	0.087	-0.00671	0.100257
$schoolmd_{fs}$	-0.07881	0.031583	-2.5	0.013	-0.14071	-0.01691
$grantdc6m_{fs}$	0.000432	0.002275	0.19	0.849	-0.00403	0.004891
$grantdc7m_{fs}$	0.008237	0.002846	2.89	0.004	0.002658	0.013815
$wrepeonm_{fs}$	-0.00456	0.003939	-1.16	0.247	-0.01228	0.00316
$workm_{fs}$	0.286502	0.175365	1.63	0.102	-0.05721	0.630211
$healthm_{fs}$	0.244266	0.215016	1.14	0.256	-0.17716	0.66569
$asistemst_{fs}$	-0.67138	0.047703	-14.07	0.000	-0.76488	-0.57789
$w3_{fs}$	0.378933	0.049531	7.65	0.000	0.281854	0.476012
$w4_{fs}$	0.35171	0.042589	8.26	0.000	0.268237	0.435182
fs	5.345003	3.769465	1.42	0.156	-2.04301	12.73302

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Table 14*(continued)*

enrolled	Coefficient	Standard Error	z	$P > \|z\|$	95% Conf.	Interval
P_{mp}	0.0019842	0.1115879	0.02	0.986	-0.216724	0.2206924
T_{mp}	0.1787204	0.0759595	2.35	0.019	0.029843	0.3275982
D_{mp}	3.9781890	2.4427500	1.63	0.103	-0.809512	8.7658900
DP_{mp}	-0.2495031	0.2543473	-0.98	0.327	-0.748015	0.2490085
DT_{mp}	0.2368955	0.1807437	1.31	0.190	-0.117356	0.5911466
$grant_{mp}$	0.0003683	0.0007122	0.52	0.605	-0.001028	0.0017642
$grantd_{mp}$	0.0045421	0.0035240	1.29	0.197	-0.002365	0.0114490
age_{mp}	0.4517245	0.1438856	3.14	0.002	0.169714	0.7337351
$age2_{mp}$	-0.0293674	0.0068852	-4.27	0.000	-0.042862	-0.0158727
$c2_{mp}$	2.0547600	0.4078813	5.04	0.000	1.255328	2.8541930
$c3_{mp}$	2.7626040	0.5830192	4.74	0.000	1.619907	3.9053000
$c4_{mp}$	2.6819920	0.6220860	4.31	0.000	1.462726	3.9012580
$c5_{mp}$	2.1837420	0.7014966	3.11	0.002	0.808834	3.5586500
$agec2_{mp}$	-0.1899496	0.0392167	-4.84	0.000	-0.266813	-0.1130863
$agec3_{mp}$	-0.2544400	0.0485934	-5.24	0.000	-0.349681	-0.1591988
$agec4_{mp}$	-0.2101065	0.0499493	-4.21	0.000	-0.308005	-0.1122077
$agec5_{mp}$	-0.1773750	0.0550845	-3.22	0.001	-0.285339	-0.0694115
$wrepeon_{mp}$	-0.0038323	0.0033377	-1.15	0.251	-0.010374	0.0027095
$distsec_{mp}$	-0.0003181	0.0134879	-0.02	0.981	-0.026754	0.0261176
$distmetro_{mp}$	0.0025447	0.0004920	5.17	0.000	0.001580	0.0035091
$distcab_{mp}$	0.0006364	0.0038155	0.17	0.868	-0.006842	0.0081146
$schoolm_{mp}$	0.0178968	0.0132084	1.35	0.175	-0.007991	0.0437848
$health_{mp}$	0.0215211	0.1050984	0.20	0.838	-0.184468	0.2275102
$work_{mp}$	0.0301827	0.0868495	0.35	0.728	-0.140039	0.2004046
$fhogar_{mp}$	0.4758867	0.1065015	4.47	0.000	0.267148	0.6846258
$girl_{mp}$	-0.5780486	0.0397477	-14.54	0.000	-0.655953	-0.5001446
boy_{mp}	-0.4682509	0.0404441	-11.58	0.000	-0.547520	-0.3889820
$baby_{mp}$	0.0172073	0.0294409	0.58	0.559	-0.040496	0.0749103
$women_{mp}$	0.0573411	0.0347276	1.65	0.099	-0.010724	0.1254059
men_{mp}	0.0066312	0.0296029	0.22	0.823	-0.051390	0.0646518
$asistest_{mp}$	1.6161750	0.0665607	24.28	0.000	1.485718	1.7466310
$aged_{mp}$	-0.7478791	0.3750563	-1.99	0.046	-1.482976	-0.0127824
$age2d_{mp}$	0.0271769	0.0145600	1.87	0.062	-0.001360	0.0557140
$wrepeond_{mp}$	0.0129225	0.0072253	1.79	0.074	-0.001239	0.0270837
$schoolmd_{mp}$	-0.1354224	0.0340484	-3.98	0.000	-0.202156	-0.0686886
$grantdm_{mp}$	-0.0056409	0.0036899	-1.53	0.126	-0.012873	0.0015912
$wrepeonm_{mp}$	0.0077109	0.0044644	1.73	0.084	-0.001039	0.0164610
$workm_{mp}$	-0.2277633	0.1669524	-1.36	0.172	-0.554984	0.0994573
$healthm_{mp}$	0.1251161	0.2103195	0.59	0.552	-0.287103	0.5373348
$wrepeondm_{mp}$	-0.0077973	0.0093024	-0.84	0.402	-0.026030	0.0104351
$asistem_{s}t_{mp}$	-0.6956268	0.0626527	-11.10	0.000	-0.818424	-0.5728298
$w3_{mp}$	0.1979129	0.0510996	3.87	0.000	0.097760	0.2980662
$w4_{mp}$	0.0023492	0.0438664	0.05	0.957	-0.083627	0.0883257
mp	-1.0594210	1.1248610	-0.94	0.346	-3.264109	1.1452670

(continued on next page)

Table 14*(continued)*

enrolled	Coefficient	Standard Error	z	$P > \|z\|$	95% Conf.	Interval
P_{ms}	-0.35897	0.079264	-4.53	0.000	-0.51433	-0.20362
T_{ms}	0.119921	0.077159	1.55	0.12	-0.03131	0.27115
D_{ms}	-1.11906	0.215512	-5.19	0.000	-1.54146	-0.69667
DP_{ms}	0.354124	0.207761	1.7	0.088	-0.05308	0.761328
DT_{ms}	0.263892	0.204407	1.29	0.197	-0.13674	0.664523
$grantc6_{ms}$	0.000491	0.000407	1.21	0.227	-0.00031	0.001289
$grantdc6_{ms}$	0.003254	0.00192	1.69	0.09	-0.00051	0.007018
$grantc7_{ms}$	-5.1E-05	0.000481	-0.11	0.916	-0.00099	0.000893
$grantdc7_{ms}$	-0.00036	0.001714	-0.21	0.833	-0.00372	0.002997
age_{ms}	-0.80319	0.406263	-1.98	0.048	-1.59945	-0.00693
$age2_{ms}$	0.019289	0.012876	1.5	0.134	-0.00595	0.044525
$c6_{ms}$	2.651963	1.256475	2.11	0.035	0.189318	5.114608
$c7_{ms}$	3.685036	1.233131	2.99	0.003	1.268144	6.101929
$agec6_{ms}$	-0.17643	0.081999	-2.15	0.031	-0.33714	-0.01571
$agec7_{ms}$	-0.16052	0.079794	-2.01	0.044	-0.31691	-0.00412
$wrepeon_{ms}$	-0.00493	0.002574	-1.91	0.056	-0.00997	0.00012
$distsec_{ms}$	-0.04974	0.01343	-3.7	0.000	-0.07606	-0.02341
$distmetro_{ms}$	0.002609	0.000382	6.82	0.000	0.001859	0.003358
$distcab_{ms}$	0.000743	0.003112	0.24	0.811	-0.00536	0.006842
$schoolm_{ms}$	0.014608	0.011231	1.3	0.193	-0.0074	0.036619
$health_{ms}$	0.021708	0.08097	0.27	0.789	-0.13699	0.180406
$work_{ms}$	0.106334	0.07132	1.49	0.136	-0.03345	0.246118
$fhogar_{ms}$	0.682057	0.11782	5.79	0.000	0.451135	0.912979
$girl_{ms}$	-0.8378	0.052616	-15.92	0.000	-0.94092	-0.73467
boy_{ms}	-0.72726	0.050609	-14.37	0.000	-0.82645	-0.62807
$baby_{ms}$	-0.06182	0.027068	-2.28	0.022	-0.11487	-0.00876
$women_{ms}$	0.000452	0.029253	0.02	0.988	-0.05688	0.057786
men_{ms}	-0.05032	0.026325	-1.91	0.056	-0.10191	0.001278
$asistest_{ms}$	1.83169	0.062904	29.12	0.000	1.708399	1.95498
$schoolmd_{ms}$	-0.06732	0.032089	-2.1	0.036	-0.13021	-0.00442
$grantdc6m_{ms}$	-0.00508	0.00197	-2.58	0.01	-0.00894	-0.00121
$grantdc7m_{ms}$	0.002296	0.002065	1.11	0.266	-0.00175	0.006343
$wrepeonm_{ms}$	0.000636	0.003678	0.17	0.863	-0.00657	0.007845
$workm_{ms}$	0.056352	0.155714	0.36	0.717	-0.24884	0.361547
$healthm_{ms}$	-0.28532	0.187619	-1.52	0.128	-0.65305	0.082409
$asistemst_{ms}$	-0.73616	0.052679	-13.97	0.000	-0.83941	-0.63291
$w3_{ms}$	0.267694	0.047753	5.61	0.000	0.174099	0.361288
$w4_{ms}$	0.223197	0.040794	5.47	0.000	0.143243	0.303151
ms	6.435053	3.395908	1.89	0.058	-0.22081	13.09091

Table 15: More estimated marginal effects

Years of schooling completed		Percentile	Marginal effect	Standard Error	p-value	95% Conf. Interval	
from 2 to 5	Female	25	0.0001	0.0001	0.1164	-0.0001	0.0002
		25d	-0.0846	0.1137	0.4565	-0.3076	0.1383
		50	0.0009	0.0004	0.0400	0.0000	0.0017
		50d	-0.0451	0.0777	0.5618	-0.1976	0.1074
		75	0.0058	0.0027	0.0307	0.0005	0.0110
		75d	-0.0120	0.0691	0.8617	-0.1477	0.1236
	Male	25	0.0000	0.0006	0.9880	-0.0010	0.0011
		25d	0.0200	0.0289	0.4891	-0.0367	0.0767
		50	0.0001	0.0002	0.6003	-0.0002	0.0004
		50d	0.0916	0.0606	0.1308	-0.0273	0.2106
		75	0.0008	0.0012	0.5148	-0.0015	0.0030
		75d	0.1717	0.1136	0.1309	-0.0513	0.3946
6	Female	25	0.0150	0.0076	0.0491	0.0000	0.0299
		25d	0.0034	0.1118	0.9759	-0.2160	0.2228
		50	0.0476	0.0205	0.0202	0.0073	0.0877
		50d	0.0092	0.0935	0.9219	-0.1743	0.1927
		75	0.0914	0.0355	0.0101	0.0216	0.1611
		75d	0.0169	0.1023	0.8690	-0.1838	0.2175
	Male	25	0.0039	0.0079	0.6208	-0.0115	0.0193
		25d	0.0106	0.0137	0.4376	-0.0162	0.0375
		50	0.0145	0.0122	0.2353	-0.0094	0.0385
		50d	0.0695	0.0260	0.0075	0.0184	0.1205
		75	0.0332	0.0251	0.1872	-0.0161	0.0825
		75d	0.2084	0.0829	0.0119	0.0458	0.3710
7	Female	25	0.0007	0.0005	0.1943	-0.0003	0.0017
		25d	-0.3394	0.1042	0.0011	-0.5439	-0.1349
		50	0.0046	0.0026	0.0763	-0.0004	0.0096
		50d	-0.1634	0.0634	0.0099	-0.2878	-0.0390
		75	0.0185	0.0094	0.0496	0.0000	0.0370
		75d	-0.0378	0.0278	0.1739	-0.0923	0.0167
	Male	25	-0.0013	0.0077	0.8638	-0.0163	0.0137
		25d	-0.0392	0.1015	0.6993	-0.2384	0.1600
		50	-0.0004	0.0033	0.9150	-0.0068	0.0061
		50d	-0.0245	0.1038	0.8137	-0.2280	0.1791
		75	-0.0001	0.0074	0.9934	-0.0146	0.0145
		75d	-0.0053	0.1018	0.9581	-0.2050	0.1943

25 stands for 25 percentile for non-drop-outs, while 25d stands for 25 percentile for drop-outs
Standard errors calculated by bootstrap with 1000 replications.

Table 16: Test for differences in marginal effects

Years of schooling completed in previous year	Drop-out minus Non-drop-out Female	Male
From 2 to 5	-0.0606	0.1056
	(0.0902)	(0.0731)
6	-0.0426	0.0953
	(0.1005)	(0.0501)
7	-0.2116	-0.0214
	(0.0619)	(0.0959)

Standard errors calculated by bootstrap with 1000 replications, reported in parenthesis.