**Demand and Supply-Side Determinants of Conditional Cash Transfer Program Effectiveness**

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**Abstract**

The Programa Nacional de Becas Estudiantiles is a conditional cash transfer program designed to promote long-term human capital accumulation and reduce poverty among Argentine youth. This study follows a 1999 cohort of students from 24 schools for five years to estimate the program's average and marginal impacts. Propensity score matching methods are used with a comparison group of students who were excluded due to quotas to estimate impacts, and multilevel methods investigate the contributions of Becas program management and school characteristics in explaining variation between schools in student outcomes. The results show significant effects of the Becas program in increasing attendance, reducing grade repetition and improving students' performance and positive responses on the part of students to program conditions requiring good attendance and academic progress in order to continue receiving the scholarship.

## Introduction

Conditional cash transfer programs are currently an important economic and social policy tool being used to address problems of poverty, inequality and human capital development in both developing and developed countries. A primary objective of conditional cash transfer programs is to provide short-term assistance to families in poverty, while at the same time promoting investments in long-term human capital development through conditions on benefit receipt. Other important goals of these programs include income redistribution and the promotion of social inclusion. The coverage of these programs is vast in some countries; for example, Brazil's Bolsa Família program that began in 2003 is expected to serve over 50 million poor persons.

Early evaluations of conditional cash transfer programs have reported some positive effects. The proxy means tests that are used in many of these programs to prioritize access to benefits appear to be effective in targeting the poor, and the electronic transfers of cash are more efficient (lower transaction costs) and less distortive (fewer errors of inclusion and price distortions) than in-kind transfers and general subsidies (Rawlings, 2004). Experimental evaluations of these programs have also reported positive impacts on school enrollment rates, consumption levels, immunization and nutrition monitoring, and reductions in child labor. In a number of countries, these programs are now being expanded, and "second-generation" models (or changes to the initial programs) are being considered or implemented.

One of the ways in which thinking about conditional cash transfer programs is advancing is the greater attention that is now being given to important aspects of program implementation. A primary challenge to successful program implementation has been limited institutional capacity and resources for basic program management responsibilities, including registration of beneficiaries, regular and timely benefit transfers, monitoring of compliance with program conditions, recordkeeping, and the prevention of fraud and mismanagement of program funds

(Tabor, 2002). In large countries like Argentina and Brazil, programs are administered at the municipal level, with local government, school and health authorities playing key roles.

This research focuses on Argentina's Programa Nacional de Becas Estudiantiles, a conditional cash transfer program that targets youth ages 13-19 years, who are entering their 8th and 9th years of study in public schools and are at risk of leaving school before completing their education. The primary objectives of the program are to support the retention, promotion and graduation of students from the third cycle of the Educacion General Basica (EGB)—equivalent to the high school years (i.e., grades 9-12)—thus increasing educational attainment and promoting human capital development among Argentine youth. The Becas program currently provides scholarships to approximately 350,000 economically vulnerable students each year (in the form of bi-annual payments to their families).

In this study, nonexperimental analyses are used to assess the impact of Argentina's Becas program on students' educational attainment and performance in school. The impact of the treatment on the treated is estimated for two different groups: Becas program beneficiaries compared to eligible students who received no scholarship, and Becas program beneficiaries who received the scholarship for only one year compared to those who received the scholarship for two or more years (the marginal program impact). In addition, the analysis goes one step further to explore school-level factors, including characteristics of the schools and the students attending them and various aspects of the Becas program implementation, and their role in explaining the variation in Becas program impacts between schools. Thus, this research aims to contribute to our understanding of both the demand- and supply-side determinants of the effectiveness of a large-scale conditional cash transfer program.

This study finds significant impacts of the Becas program in increasing students' attendance, reducing grade repetition and improving students' performance in school. The Becas

program also appeared to establish important dynamic incentive effects by linking receipt of the scholarship in subsequent years to students' academic performance in the first year of participation. In addition, student performance was higher in schools with greater institutional capacity, better conditions for learning and superior management.

In the next section, additional background information on conditional cash transfer programs is provided and findings from recent evaluations are briefly described, followed by discussion of the motivation for a focus on Argentina's human capital development initiatives and the Becas Estudiantiles program. The methodology for this study and the samples and data used are described next, and then empirical analyses and study findings are presented. The paper concludes with a discussion of the implications of the study findings for future human capital development programs of this type.

**Conditional cash transfer programs and schooling investments**

Conditional cash transfer programs were first initiated more than a decade ago, beginning with a pilot program in Mexico, and have since been widely implemented in Latin America and other countries.[1] The conditions that typically accompany cash transfers—requiring prenatal care, infant and children's health care, nutritional education, and minimum school attendance rates for children—are the key provisions that distinguish these programs' long-term objectives from a simple short-term income transfer program. In effect, they are intended to change the behavior of recipients, beginning a cycle of investments that will permanently change the health and well-being of poor families and break the intergenerational transmission of poverty. In this regard, they bear some similarity to U.S. welfare programs that require minimum levels of participation in work and/or training activities as a condition for receiving a monthly grant.

Conditional cash transfer programs are also described as a demand-side policy intervention, one that removes constraints to human capital development by reducing out-of-pocket expenditures (for schooling, health care, etc.) and opportunity costs (e.g., of the loss of children's labor income and time spent accessing services). Rawlings (2004) submits that the use of demand-side interventions to target assistance represents a "marked departure from traditional supply-side mechanisms such as general subsidies or investments in schools, health centers and other providers of social services." At the same time, there is general agreement in the development literature that the achievement of the long-term goals of conditional cash transfer programs is predicated on adequate supply-side investments (in schools, health care facilities, etc.) (Legovini and Regalia, 2001). Similar to this study of the Becas program, Handa (2002) was able to link household survey data to information on school infrastructure in rural Mozambique, and he found that dimensions of school quality and access (e.g., reduced travel time and costs) both affected primary school enrollment rates.

Among the numerous impact evaluations conducted of conditional cash transfer programs, the Progresa program in Mexico—an education, health and nutrition program introduced in rural communities (using random assignment)—is probably among the best known and most intensively studied. Like the Becas program in Argentina, a primary objective of Progresa was to increase youth enrollment and attendance in school and reduce their early labor force participation. Dubois et al. (2003) modeled the incentives generated by Progresa's cash transfers to change students' behavior and improve their performance in school (measured by success or failure to pass a grade). In their model, the static incentive comes from the reduced opportunity cost of attending school (due to the transfer payment), and the opportunity to receive future transfers if one stays in school produces the dynamic incentive effect. They demonstrated that if youth can choose their level of learning effort, the cash transfer will increase students'

effort and performance in school, as the value of completing an additional year of school will be higher for those in the program.

In their empirical analysis, Dubois et al. acknowledged that randomization in Progresa does not eliminate the problem of dynamic selection in modeling grade transitions and performance, although *average* program impact estimates should be unbiased by dynamic selection.[2] They found strong positive effects of Progresa on school enrollment and continuation for both primary and secondary school students, but they found significant improvements in school performance only for primary students. Skoufias and Parker (2001) used nonexperimental methods to analyze the Progresa data (e.g., differences-in differences) and similarly found significant increases in school attendance (and large reductions in workforce participation) for Progesa beneficiaries. Behrman et al. (2001) reported that the impact of Progresa on grade progression is largest for youth between the ages of 12 and 15 years, with a peak at 14 years, the approximate initial target age of the Becas program. Other evaluations of these programs have likewise reported positive impacts on school enrollment and attendance rates (see International Food Policy Research Institute, 2002 and Rawlings, 2004), although few others have examined these programs' effects on students' performance in school.

*The Becas Estudiantiles program in Argentina*

Argentina has undergone dramatic economic and social changes over the last three decades, paralleling global trends. Economic analyses suggest that Argentina's increased economic openness has led to structural economic change, reducing labor demand in the low-skilled, labor-intensive sectors and shifting it toward higher-skilled, technical sectors (Gasparini, 2003). These changes have in turn contributed to increasing returns to education (and widening wage gaps between those with a post-high school education and lower educational levels), while reducing

employment among the low-skilled. Another resulting effect has been unprecedented increases in economic inequality, exacerbated by periods of economic volatility and crisis.[3]

Resources from spells of substantial economic growth, particularly in the early 1990s, were not used effectively to combat these growing distributional problems, and labor market and education policies did not adequately address the problem of unskilled workers. The change in the share of aggregate labor for workers with less than a high school education declined by one-third between 1974 and 2002, and unskilled workers experienced particularly large losses in both hourly wages and hours of work in the 1990s (Gasparini, 2003). At the same time, Gasparini's analysis using Mincer equations (to compute wage-education profiles) showed that returns to formal education were always positive over this period, including during economic downturns. As the poverty rate climbed over the 1990s, the lack of a concerted public policy response to the growing demand for a more highly educated workforce was increasingly troubling.

Internal documents of the Inter-American Development Bank indicate that although nearly all Argentine children ages 6-13 years have access to primary school, only three-fourths complete nine years of basic education, and only half make it to the last year of high school.[4] Furthermore, there are large discrepancies in who completes high school by household income. As of 1999, only 27 percent of 19-20 year olds in the lowest income quintile completed high school, whereas the comparable number for those in the top income quintile was 83 percent.

The Programa Nacional de Becas Estudiantiles began in the late 1990s and was identified as one of the priority social programs meriting support and protection following the 2001 economic emergency in Argentina. The Argentine government and international lenders were concerned that the economic crisis would increase student dropout rates, given the out-of-pocket costs of children's school attendance—i.e., school supplies, clothing, transportation, etc.—that further strain tight family budgets in difficult economic times. Each annual Becas scholarship

totals 400 pesos (approximately US $140), paid in two equal installments of 200 pesos each (during May and September).[5] Eligible students come from families with a monthly total income of less than 500 pesos (and cannot receive any similar benefit from another source). The current program goal is to reach approximately one quarter of indigent children ages 13-18 years. The cost of the 2003 Becas program (scholarships and operations) was estimated at $US46 million.[6]

Recent research by Carneiro and Heckman (2004) and others argues that human capital development policies should target the young. Carneiro and Heckman point to evidence, albeit limited, that the returns to investments in children at earlier ages are considerably higher than those aimed at the low- and unskilled adult population who are being displaced in the labor market by structural economic change. Hanushek, Leung, Yilmaz (2003) similarly argue that investments in individuals are most important at the primary and secondary education levels, due to the sizeable externalities generated through increases in aggregate educational levels (that improve the productivity of others). In addition, Bedi and Edwards (2002) show that as aggregate educational attainment increases (and incomes rise), educational expansion follows and tends to be associated with a more equal distribution of income. Thus, public investments to promote increased educational attainment among poor youth in Argentina might also contribute importantly to reducing the growing inequalities in the distribution of income.

**Study Samples, Data and Methodology**

A condition of international lenders' support for the priority social programs in Argentina was an evaluation of the programs' effectiveness in targeting benefits, delivering services, and improving outcomes for the poor. Random assignment was not an option for the evaluation, as the program was expanded after the economic emergency to provide benefits to all eligible youth. However, a baseline survey that collected very detailed information on students and their

families to determine applicants' eligibility for the program—Encuesta de Los Aspirantes de Becas—had been a standard application requirement since the initiation of the program in 1997.[7] This study takes advantage of the fact that in the early program years (prior to 2001), many more youth (and their families) completed baseline surveys and were determined eligible for the program than there were scholarships available.

*Samples and data*

In accord with the program objectives, the following student outcomes were of primary interest in the impact evaluation: student attendance (and retention) in school, absences, grade repetition, performance (grades) and school completion rates. In order to evaluate student outcomes for five years (through the expected year of graduation), a random stratified sample of cases from among the 8th grade eligible students in 1999 was selected to form the treatment and comparison groups. In 1999, there were approximately 300,000 applicants to the program; among the 265,000 students determined eligible to receive the scholarship in 1999, 149,000 were excluded due to quota restrictions that limited the number of Becas beneficiaries by school. The criteria used in selecting the random stratified sample included: geographic location (province or the City of Buenos Aires); the total number of Becas beneficiaries and eligible students who were not Becas beneficiaries (at the school level); the ratio of program participation to demand for the benefit in schools, and "cabecera" (head) and "non-cabecera" schools. The ratio of Becas beneficiaries (treatment group) to non-beneficiaries (comparison group) in the selected sample was approximately 2:1.[8]

Following the selection of treatment and comparison group members (3490 students) from the baseline survey records, the Argentina-based evaluation team went to the 24 schools to recover the administrative data (school records) for each student in the evaluation. The school records included the following information: student identification number, school year, home

address, continuation in school, left for another school, left the school registrar, courses in school, completion of course material, course grades, absences, sanctions, and repetitions.[9]

A follow-up survey was also administered in the spring of 2004 to collect data comparable to that obtained in the baseline survey and to gather supplemental information about the Becas students' experiences in the program. A total of 2,586 students and their families completed the survey. The ratio of Becas beneficiaries (treatment group) to non-beneficiaries (comparison group) among the survey respondents was consistent with the full sample at approximately 2:1. The follow-up survey data include information on student demographics, family background, students' behavior, receipt of the Becas scholarship and their perceptions of the effects of the program. As the baseline and follow-up surveys were too extensive to list all of the measures, Appendix A describes only those used in the empirical analyses.

A final source of data for the evaluation came from a survey administered to school officials in each of the 24 schools selected for the evaluation. School administrators provided basic information about the schools (grade levels, number of school days per year, school resources, educational priorities, etc.) and specific information about the implementation of the Becas Estudiantiles program in their school (e.g., ratings of different aspects of the program's functioning, changes made in implementing the program or as a result of the program, etc.). Administrative data from the Ministry of Education on all students in the study schools was also used to create several student population measures (e.g., overall grade average or performance, average distance to school, percentage of student households without a telephone, proportion of eligible families receiving Becas scholarships). Data from this survey that were used in the empirical analyses are also described in Appendix A.

The data from these four sources—baseline survey, school records, follow-up survey and school administrator survey—were linked to facilitate analysis of the program's outcomes and

impact.[10] Prior to undertaking these analyses, however, the treatment and comparison group members were compared (to test for statistical equivalence), and the youths' status as Becas beneficiairies or non-beneficiaries was verified with administrative data and information from the follow-up survey to check for contamination problems. In addition, the cases with missing follow-up survey data were compared to those with complete information to check for statistically significant differences between these groups.[11]

Although the sample verification analyses indicated that there was no bias associated with treatment group contamination, there were statistically significant differences in the baseline characteristics of the treatment and comparison group members that would not have been expected if the quotas had served as an effective instrument for randomly assigning eligible students to receive the Becas scholarship (see Table 1). For each of these observed differences—in average family income per capita, number of household members, number of dependents, living conditions, overcrowding, and risk/vulnerability—the treatment group members were a poorer, higher-risk group. It is also important to point out, however, that there were no large differences between the two groups in their baseline schooling characteristics, i.e., age-grade difference, repetitions, number of times left school, and number of absences.

Ravela (2000) explains that the quota system used in the Becas Estudiantiles program was not a simple exclusion mechanism; rather, it was designed with the explicit objective to first enroll those applicants with higher indicators of need (i.e., those with higher scores on the index of need/risk). The higher levels of need among the treatment group members were also confirmed in multivariate analyses predicting treatment status.[12] These findings have important implications for the evaluation methodology used in this study.

*Methodology*

In the presence of these observable differences between the treatment and comparison group members, econometric matching methods are used to adjust for potential bias due to nonrandom selection into the program and to estimate the effect of treatment on the treated. There is a large and growing literature on the use of econometric matching methods that explores and challenges Rosenbaum and Rubin's (1983) early finding that matching on the propensity score (i.e., the estimated probability of program participation) removes any bias associated with pre-treatment differences between the treatment and comparison groups, as long as there are no unobservable variables that influence selection into the program and the estimated outcomes (see, for example, Imbens, 1999, 2004; Mueser, Troske and Gorislavsky, 2003; Heckman and Navarro-Lorenzo, 2004 and Smith and Todd, 2004).

Some of these recent studies investigate the data requirements, conditions, and assumptions under which matching methods are more (or less) likely to reduce bias in the estimation of treatment effects. The findings of these studies generally imply that the Becas program evaluation is a good candidate for the application of the propensity score matching methodology. There are rich pre-treatment data available for use as the conditioning set (e.g., the index of need and other observable variables that were explicitly used to select Becas participants), and given (or in addition to) this set, there is also a "randomization device" that determines treatment status (i.e., the quotas that excluded more than one half of the eligible Becas applicants from the program).

At the same time, it is important to make clear that there are two stages or processes of selection in the Becas program that will require two different approaches to the matching estimation. In the first stage of initial selection into the program (in 1999), it is assumed that selection is based on the explicitly defined eligibility criteria (e.g., monthly family income less

than 500 pesos) and the index of need/risk that was used to prioritize among applicants when filling the quotas. All treatment and comparison group members in this study met the Becas program basic eligibility criteria, and descriptive analyses confirmed considerable overlap between these groups in their need/risk scores. Again, the assumption made is that there are no unobservable variables that influence selection into the program and program outcomes; that is, conditional on observable characteristics X, the expected outcome in the absence of treatment ($Y_0$) does not depend on one's treatment status (D):

$$E(Y_0 \mid D = 1, X) = E(Y_0 \mid D = 0, X) \text{ for } X \varepsilon S,$$

where S is defined as the overlapping support among the treatment and comparison groups, i.e. $S = Supp(X \mid D=1) \cap Supp(X \mid D=0)$. The average treatment effect ($\Delta_{ATE}$), simply written, is:

$$\Delta_{ATE} = 1/n \sum [E(Y_1 \mid D = 1, X) - E(Y_0 \mid D = 0, X)]$$

The second stage of selection determines the duration of participation or length of Becas scholarship receipt. Approximately one half of those youth who participated in the program received the Becas scholarship for just one year; others in the treatment group received the scholarship for 2 to 5 years.[13] Officially, continued scholarship receipt was made conditional on students' regular school attendance and grade progression, and individuals knowledgeable about the Becas program administration confirmed that students' behavior and performance in school (e.g., records of attendance and grades) influenced the duration of their participation. At the same time, interviews with school teachers produced anecdotal evidence that suggests some Becas scholarship recipients may have been allowed to pass to the next grade even when their performance was below the minimum expected, because the teachers knew that they were very poor. Therefore, it was expected that *among the participants* (i.e., conditional on their selection into the program), selection into additional years of scholarship receipt would be based not only

on characteristics indicating their need for financial support, but also those associated with their performance in school.

Following Behrman, Cheng and Todd (2004), a marginal matching estimator was employed to estimate the marginal treatment effect of an additional year of participation in the Becas program. As Behrman et al. demonstrate, because this estimator does not require assumptions about the process used in initially selecting students into the program (i.e., the first stage of selection), any selection on unobservable characteristics in the first stage should not bias the marginal impact estimates. At the same time, the marginal matching estimator does assume that any nonrandom selection into alternative program durations (the second stage of selection) is also based on *observable* characteristics. The estimation of the marginal treatment effect ($\Delta_{MTE}$) of increasing the number of years of Becas scholarship receipt, from $\ell_1$ to $\ell_2$ years, uses only treatment group members (i.e., D=1 for all cases in the estimation):

$$\Delta_{MTE} = 1/n \sum [E(Y_1(\ell_2) \mid X) - E(Y_1(\ell_1) \mid X)],$$

where $\ell_1, \ell_2 > 0$. $\Delta_{MTE}$ is the effect of increasing the duration of scholarship receipt from $\ell_1$ to $\ell_2$ years for the subset of students who participated at least the length of $\ell_1$.

A third methodological approach used in this study, multilevel modeling, takes advantage of the availability of both student- and school-level data that can be linked to analyze the variation in student outcomes between schools. Unconditional models estimated with these linked data show that there is, in fact, substantial (statistically significant) variation in student outcomes between schools; 21.6-30.5 percent of the total variation in student grade averages for the years 1999 to 2002 is between schools, and 10.2-19.7 percent of the total variation in grade repetition is between schools.[14] The presence of significant intra-class correlations in hierarchical data violates basic assumptions of the ordinary least squares regression, e.g., the

assumption of independence of observations and that the number of independent observations is equal for all variables (Bryk and Raudenbush, 1992).

A random intercept specification of the multilevel model attempts to explain the variation in outcomes ($Y_{ij}$) between schools with school-level measures (e.g., resources, educational priorities, program implementation, etc.):

$Y_{ij} = \beta_{0j} + \beta_{1j}X_{1j} + ...+ \beta_{nj}X_{nj} + r_{ij}$ (level 1) student-level academic outcome submodel

$\beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + ...+ \gamma_{0n}W_{nj} + u_{0j}$ (level 2) school-level random intercept submodel
$\beta_{1j} = \gamma_{10}$ , . . . , $\beta_{nj} = \gamma_{n0}$

where X are student-level predictors; W are school-level variables; r and u and are student- and school-level error terms, respectively; and $\beta$ and $\gamma$ are estimated coefficients. A more complex (random coefficient) specification models the estimated effect of participation in the Becas program as a function of the school-level variables, i.e., to assess whether variation in the impact of the program across schools can be explained by these factors:

$\beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + ... + \gamma_{0n}W_{nj} + u_{0j}$
$\beta_{1j} = \gamma_{10} + \gamma_{11}W_{1j} + ... + \gamma_{1n}W_{nj} + u_{1j}$ (level 2) school-level random coefficient submodel
… $\beta_{2j} = \gamma_{10}$ , . . . , $\beta_{nj} = \gamma_{n0}$

These analyses are described in greater detail in the following section.

**Empirical analyses of program impacts**

*Predicting treatment status and duration of scholarship receipt*

As discussed above, a rich set of pre-treatment measures was available to use in predicting the probability of treatment or Becas scholarship receipt (i.e., the propensity scores). In addition, the choice of variables to use in predicting participation was informed by careful study and documentation of the application/intake criteria and decision processes for the Becas program (see Ravela, 2000). Based on this prior knowledge, it was expected that the two most important predictors (or determinants) of any program participation would be family income (per capita) at

application and applicants' scores on the index of need/risk. Per capita income was measured categorically, with the lowest income rank=9 (0-15 pesos/month) and the highest income group=1 (more than 120 pesos/month). The models include two income variables: one indicating an income of less than 45 pesos per month, and the other the ranked ordinal measure. Other variables included in the propensity score estimation of treatment status were either observed prior to enrollment, are stable characteristics, or are deterministic with respect to time (e.g., student age at application)—see Table 2 for additional measures. In predicting the propensity to receive the Becas scholarship more than one year (for use in the marginal impact analysis), measures of students' school performance—grade averages and number of absences in the first year of participation—were added to these other explanatory variables to account for the conditions placed on youths' continued receipt of the scholarship.

The results of the models predicting participation for the two different stages of selection, i.e., any treatment (including all treatment group and comparison group members), and receipt of Becas scholarship for 2 or more years (including only treatment group members), are shown in Table 2. The results from predicting any scholarship receipt (the first model) show that older children were significantly less likely to be Becas scholarship recipients, which is consistent with the goal of the program to intervene early in the third cycle of the EGB (i.e., at the time of entry to high school) and with subsequent findings that the duration of scholarship receipt was relatively short for many. Also consistent with the explicit selection criteria, those who scored higher on the index of need (i.e., suggesting greater need or higher risk of not completing school) were significantly *more* likely to receive the Becas scholarship; in terms of log-odds ratios (not shown in the table), for each additional point higher on the need score, the odds of a student receiving a scholarship were 34.3 percent higher. Those students from families with per capita incomes below 45 pesos per month were also more likely to participate (significant at $\alpha$=0.06),

although after controlling for the index of need and those with the lowest incomes, the relationship between income and participation reversed (i.e., students from families with lower per capita incomes were less likely to participate). It should also be noted that students in the City of Buenos Aires (the omitted geographical area in the propensity score model) were more likely to be scholarship recipients than students from other provinces in the samples, while those who lived farther away from school were significantly less like to participate.

In general, the positive link between indicators of greater need and participation in the program is what program administrators like to see. In this first model, the index of need and income measures together account for about two-thirds of the variation in the probability of initial scholarship receipt, with the index of need being the most influential predictor. The second model in Table 2 predicting receipt of Becas scholarship for two or more years alternatively suggests that a different set of criteria were more important in determining *continuing* program participation. In this second model, students scoring higher on the index of need were again more likely to receive the scholarship (for more than one year), although now each additional point on the need score increases the odds of receiving a scholarship by just 6 percent. The most powerful predictors of *additional years of scholarship receipt* were measures of students' academic background and performance in school. Students' grade average in 1999 (i.e., their performance during their first year of program participation) was a strong, statistically significant predictor of a higher probability of scholarship receipt. For example, for each grade point higher achieved, a student would increase the odds of continuing to receive the scholarship by 51 percent. On the other hand, students with a larger age-grade difference in the year they entered the program (i.e., a larger difference implying that the student started late or was held back) and those who indicated that they left school to participate in the labor market were significantly less likely to continue participation in the Becas program. In other words, it

appears that the determination of additional years of scholarship receipt was a more selective process, taking into account (or rewarding) student performance and compliance with the scholarship conditions, as intended by the program's designers.

*Matching analysis: average and marginal program impacts*

The estimation of the propensity score, $P(X)$, reduces the matching problem to a single dimension. That is, the distribution of the propensity score (or probability of participation) is compared for treatment and comparison group members in making the matches. In this study, radius matching is used with a caliper of 0.05 to remove matches for which the difference in propensity scores exceeds this threshold.[15] A common support is also imposed to preclude poor matches between treatment and comparison group members.[16] All standard errors for the impact estimates were computed using bootstrapping methods.

Balancing tests were conducted to check the assumption that after conditioning on the variables shown in Table 2, the independence condition required to uphold matching was satisfied (i.e., no additional conditioning variables predict receipt of the scholarship, either initial or continuing). The results of these tests for both the average and marginal impact estimation (partially reported in Table 3)[17] strongly support the use of matching with these propensity score models. For each student outcome, after conditioning on the set of variables used in propensity score estimation, the means of the predictor variables for treatment and comparison group members were statistically equivalent. In the majority of the tests, the percent reduction in bias was over 90 percent, with bias reduction as high as 99.4 percent. Thus, although there are no definitive tests to confirm that the propensity score matching models have not left out important, unobserved factors determining participation at either stage, the balancing test results suggest that it is unlikely that the estimated impacts are driven *only* by selection effects.

*Impacts on school attendance*. Since a primary objective of the Becas program is to increase the number of poor students completing school (i.e., attending school a full 4-5 years from 8th or 9th grade to 12th grade), a key outcome measure used in the impact analysis is based on students' school attendance records and reported attendance in the follow-up survey. A measure was constructed that indicates for each year (1999-2003) if the students attended school all of the year, (with the null category indicating that they began school and then left that year or did not attend school at all in that year). From these data, the dependent variable—the number of years attended a full school year—was created (for 2586 cases with school record and follow-up data). Among these cases, 58.9 percent attended all of their high school years.

Simple descriptive statistics (i.e., a chi-square test) showed that members of the treatment group were significantly more likely ($p<.0001$) to attend all years of school than those in the comparison group, and a strong, statistically significant ($p<.0001$) and positive association between the number of years of Becas scholarship receipt and the number of years students attended a full school year was also confirmed. Of course, these simple descriptive statistics don't adjust for the observed differences between the treatment and comparison groups.

Table 4 summarizes the results of the matching estimation of Becas program impacts on high school attendance and completion. The first two rows present the average impact of treatment on the treated (for any program participation) and the marginal impact of treatment on the treated for those with two or more years of scholarship receipt, respectively. The ordinary least squares (OLS) regression estimates are also presented for comparison. The matching result in the first row, first column shows no statistically significant average impact of the Becas program on the number of full school years attended. Alternatively, the marginal impact estimate shown in the second row, first column suggests a small, statistically significant impact of the program on full school year attendance for those receiving the scholarship for two or more

years (compared to those receiving it only one year). This group of scholarship recipients (with a longer program duration) attended school about one-fifth of a year longer than students who participated in the Becas program for just one year. However, the matching results presented in the final two rows of Table 4 suggest that this small increase in school attendance was not large enough to affect high school completion rates (for students with any scholarship receipt or for those participating in the program for more than one year.)[18]

*Impacts on academic performance.* As described above, an objective of conditional cash transfer programs like the Becas program is to change students' behavior, i.e., the dynamic incentive effect. That is, students are expected to be motivated by the opportunity to receive future transfers (or scholarships) if they stay in school, and in the case of the Becas program, if they keep up their grade averages, too. Dubois et al. (2003) explain that this presumes that students can choose to increase their level of learning effort. A series of questions on the follow-up survey asked the Becas program participants if, *due to receipt of the Becas scholarship*, they: (1) put more effort into their studies; (2) tried not to be absent from school, (3) made an effort not be sanctioned, (4) felt more pressure to do well in school, and (5) felt more pressure to have better conduct in school.

Simple statistical (chi-square) tests were performed to determine if students' behavior was different for those receiving the scholarship for two or more years compared to those who did not continue in the program after their first year of participation. The results showed that those receiving the Becas scholarship for two or more years were significantly more likely to report that they had put more effort into their studies (65.2% vs. 60.6%, p=0.002) and tried not to be absent from school (64.6% vs. 60.1%, p=0.006). Although these are reported rather than observed changes in effort, information is available from the students' school records to assess whether or not their performance in school was affected by receipt of the scholarship.

Two measures of student academic performance are available for each school year: students' average grades in their coursework and grade repetition.[19] Matching methods were again used to estimate the average impacts of the Becas program (on the scholarship recipients) for these academic performance outcomes. The results of these analyses are shown in Table 5, Panel A. As in the analysis of school attendance and high school completion, a number of cases were excluded from the average impact estimation due to a lack of common support. Estimates of average program impacts produced by multilevel models (that do not exclude any cases) are also reported in Table 5.[20]

These findings suggest that participation in the Becas program (compared to no scholarship receipt) contributed to significantly reduced grade repetitions and increased student grade averages in several years. Although the average impacts on *grade repetitions* produced in the matching analysis are noticeably larger than those estimated by the multilevel models, the estimates of average impacts on *grade averages* are fairly comparable between these two methods of estimation. The effects of the program on reducing grade repetition do not appear until 2000, and they begin to diminish after 2001 (that is, the estimate for 2002 is smaller and statistically significant at $\alpha<0.10$ but not $\alpha<0.05$). In addition, no statistically significant average impacts on students' grades are found for the years 2001 and 2002. This latter finding is not unexpected, given that the majority of the treatment group members received the scholarship in only one year (i.e., 1999 or 2000).

Panel B in Table 5 presents the results of the marginal impact estimation (of receiving the Becas scholarship for more than one year compared to scholarship receipt in only one year) for these two outcomes (grade repetitions and grade averages) for the years 2000-2002. These models were not estimated for academic outcomes in 1999, given that information on students' academic performance in 1999 was used to predict (in the propensity score estimation) whether

or not they continued to receive the scholarship. In the matching estimations, there were no more than two cases that were excluded from the analysis (i.e., off the common support), and the results of the matching and multilevel analyses are very comparable. These results suggest that although receiving the scholarship for more than two years did not significantly reduce grade repetitions (compared to students with only one year of scholarship receipt), continuing participation did appear to have a positive and statistically significant impact on student grade averages in at least one year. In 2001, grades for continuing scholarship recipients were higher by about 0.12 of a point (with a median grade average of approximately 7.28 for students over this period). The multilevel estimation produced statistically significant estimates of impact on grade averages for each of the years that are comparable in size to the matching estimates.

In considering the significance of these findings, it is important to bear in mind that the program conditions required students to achieve good attendance and progress academically in order to continue in the scholarship program. As indicated earlier, students reported studying more in response to the opportunity to receive the scholarship. Although one might still argue that these improvements in student outcomes were driven primarily or solely by unobserved changing student profiles, the balancing tests suggested that the selection process into additional years of scholarship receipt was modeled fairly well in the propensity score estimation (and these same controls were entered into the multilevel models). Perhaps more importantly, follow-up interviews with both program administrators and teachers did not suggest the presence of any additional factors that were likely influencing selection into continued scholarship receipt. And if some teachers did allow some poorly performing students to continue in the program because of concerns about their well-being (not captured in the measures shown in Table 2), this would imply the estimates of impacts are likely biased downward.

*Multilevel analysis with school-level variables*

As discussed in the introduction, "second-generation" efforts to improve the design and effectiveness of conditional cash transfer programs are focusing on the implementation and management of programs, in addition to typical design considerations such as the size and targeting of transfers, the types of conditions imposed on recipients, and the frequency and duration of transfers. Average program impacts estimates obtained through experimental evaluations may be less useful if decisions made in implementation, or local resources available to support program development and their management, contribute importantly to variation in program impacts across communities or implementation sites.

Table A.2 in Appendix A describes a subset of variables from the school-level data that were collected for the Becas Estudantiles evaluation and used in the analyses presented in this paper. These variables were selected in part because of the substantial variation across schools in these measures and also for their representation of important implementation and management factors or decisions, e.g., general school policies/management strategies and functioning, changes in strategies or institutional conditions due to the Becas program implementation, and school resources and population characteristics.

Table 6 presents a final subset of results from these estimations for the analysis of the average impact of the Becas program on student performance (grade repetition and grade average) for four school years (1999-2002).[21] The first line in each set of results shows the average impact estimates from these multilevel models, which correspond very closely to those presented in Table 5 *without school-level variables*. Also included in these models are school-level variables that were fairly consistent and sometimes statistically significant predictors of the variation in student outcomes between schools: the grade average of all enrolled students (a measure of peers'/student body academic achievement); a rating (1-10) of the effectiveness of

communication and the execution of program procedures by school administrators; a rating (1-4) of the contributions of the Becas program to retention of students (for the grade repetition outcome), and ratings (1-4) of the importance of schools attributes that contributed to effective functioning of the Becas program, including the institutional climate and the role of teachers/teacher support (again, as reported by school administrators in surveys).

Each of the models shown in Table 6 is a random intercept specification. Specifying the coefficient on the treatment indicator (the impact estimate) in these models as random and interacting it with school-level variables generated few statistically significant findings; in other words, it does not appear that school-level factors explain much variation in *Becas program impacts* across the schools. However, the school-level variables shown in the random intercept models do explain (in all but one model) most variation in student *outcomes* between schools (i.e., see the row showing the percentage of variation between schools that is explained by the models).

The results suggest that the average level of (overall) student performance in the schools is positively related to better academic outcomes for students in the sample, although it is a statistically significant predictor in only a few of the models shown. A possible interpretation is that high-achieving peers (or possibly unobserved school factors associated with overall student body achievement) positively influence students' academic performance. More importantly for the purposes of this study, Table 6 also shows some positive, statistically significant effects of variables over which school administrators are likely to have some control. For example, more effective communication and management (execution of program procedures), institutional climate, and teacher support were positive (albeit weak) predictors of better student performance. In addition, administrators' ratings of the Becas program contributions to student retention were

significantly related to reduced grade repetition in 1999 (that is, a higher program rating predicted significantly reduced grade repetition).

These few school-level measures that were identified as potentially important predictors of the variation in student performance between schools are fairly general constructs of institutional capacity and management at the school level. Interestingly, the more specific information about strategies implemented in the schools to improve student and parent participation, leadership and teaching approaches, education materials and technical assistance, etc. did not emerge as statistically significant predictors in these models. At the same time, the small number of schools included in this study (n=24) limited the specification and explanatory power of these models, and thus, these results should be viewed as exploratory and suggestive of school-level factors or policies/strategies that should be investigated in future research on the supply-side determinants of conditional cash transfer program effectiveness.

**Conclusion**

The Programa Nacional de Becas Estudiantiles, a conditional cash transfer program in Argentina, was designed to increase school attendance and to motivate better school performance and retention among high-school aged youth who are poor and at risk of leaving school before completion of the third cycle of basic education (i.e., high school). This nonexperimental study found significant effects of the Becas program in increasing attendance, reducing grade repetition and improving students' performance (average grades). It also appears that the Becas program, as implemented, may have established some important dynamic incentive effects for improved student efforts by linking receipt of the scholarship in subsequent years to students' academic performance in the first year of participation. The models estimating selection into the program and into longer durations of scholarship receipt clearly showed that these processes

were distinct for initial and continued participation, with a strong role for academic performance in the latter decision. It is also important to reiterate that these positive impact estimates assume that selection is appropriately modeled and accounted for in the estimation.

The primary measure used in this study to evaluate student performance—students' average grades as reported in their school records—clearly has limitations as a proxy measure for student achievement and/or human capital development. There are no standardized tests that are regularly or universally administered to high school students in Argentina to evaluate students' skill attainment/achievement. Furthermore, the evaluation of the Becas program's impact on the more ambitious goals of promoting long-term human capital development, income redistribution and social inclusion would require a much longer follow-up period, and ideally would include measures of the students' earnings/income following the high school years. Thus, while the results of this study suggest some promise for these types of conditional cash transfer programs in increasing years of schooling completed and improving students' grades in school, no longer-term impacts of the program should be inferred from this study.

At the same time, there are some potentially useful policy implications for the Becas program and similar conditional cash transfer program initiatives that derive from this study. The multilevel analysis suggested that efforts to strengthen program management, the role and support of teachers, and the institutional climate for learning in the schools contributed to student performance (although no "best practices" or specific strategies were identified in this research). In general, this study confirms the findings of prior studies showing the promise of conditional cash transfer programs in increasing educational attainment among poor youth, and also those studies suggesting that attention to and investments in both demand-side and supply-side factors that influence student attendance and performance are important.

## References


Bedi, Arjun Singh and Edwards, John H. Y. (2002). "The Impact of School Quality on Earnings and Educational Returns—Evidence from a Low-income Country." *Journal of Development Economics* 68: 157-185.

Behrman, Jere, Segupta, Pilali and Todd, Petra. 2001. "Progressing Through *Progresa*: An Impact Assessment of a School Subsidy Experiment." Penn Institute for Economic Research Working paper 01-033.

Behrman, Jere, Cheng, Yingmei and Todd, Petra. (2004). "Evaluating Preschool Programs when Length of Exposure to the Program Varies: A Nonparametric Approach." *The Review of Economics and Statistics* 86(1): 108-132.

Bryk, Anthony S. and Raudenbush, Stephen. W. (1992). *Hierarchical linear models: applications and data analysis methods*. London: Sage Publications.

Cameron, Stephen and Heckman, James J. 1998. "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males." *Journal of Political Economy* 106(2): 262-333.

Carneiro, Pedro and Heckman, James J. 2004. "Human Capital Policy." Chapter 2 in *Inequality in America: What Role for Human Capital Policies?* James J. Heckman and Alan Krueger, editors, Massachusetts Institute of Technology Press.

Dubois, Pierre, de Janvry, Alain, and Sadoulet, Elisabeth. (2003). "Effects on School Enrollment and Performance of a Conditional Cash Transfers Program in Mexico." CUDARE Working Paper No. 981, University of California, Berkeley.

Gasparini, Leonardo. (2003). "Argentina's Distributional Failure: The Role of Integration and Public Policies." Working paper, CEDLAS, Universidad Nacional de la Plata, Argentina.

Handa, Sudhanshu. (2002). "Raising Primary School Enrollment in Developing Countries: The Relative Importance of Supply and Demand." *Journal of Development Economics* 69: 103-128.

Hanushek, Eric A., Leung, Charles Kai Yui, Yilmaz, Kuzey (2003). "Redistribution through Education and Other Transfer Mechanisms." *Journal of Monetary Economics* 50: 1719-1750.

Heckman, James J. and S. Navarro-Lozano (2004). "Using matching, instrumental variables, and control functions to estimate economic choice models." *The Review of Economics and Statistics* 86(1): 30-57.

Imbens, G.W. (1999). "The role of propensity score in estimating dose-response functions." National Bureau of Economic Research, Technical Working Paper No. 237.

Imbens, G.W. (2004). "Nonparametric estimation of average treatment effects under exogeneity: A review." *The Review of Economics and Statistics* 86(1): 4-29.

International Food Policy Research Institute. 2002. "Informe Final: Sistema de Evaluación de la Fase Piloto de la Red de Protección Social de Nicaragua: Evaluación de Impacto." Washington, DC.

Kreft, I.G. (1996). Are Multilevel Techniques Necessary? An Overview, Including Simulation Studies. Unpublished manuscript, California State University, Los Angeles.

Lee, H. (2000). "Poverty and Income Distribution in Argentina: Patterns and Changes." The World Bank.

Legovini, Arianna and Regalia, Ferdinando. (2001). "Targeted Human Development Programs: Investing in the Next Generation." Working paper, Inter-American Development Bank Sustainable Development Department Best Practice Series, POV-110.

Loan proposal: Program for Social Protection and Mitigation of the Impact of the Crisis on the Poor, AR-0295

Mueser, P., Troske, K. and A. Gorislavsky (2003). "Using state administrative data to measure program performance." Institute for the Study of Labor (IZA) Discussion Paper No. 786.

Ravela, Pedro A. (2000). Informe de Evaluacion del Program Nacional de Becas Estudantiles de la Republica Argentina. Final report to the Inter-American Development Bank.

Rawlings, Laura B. (2004). "A New Approach to Social Assistance: Latin America's Experience with Conditional Cash Transfer Programs." Social Protection Discussion Paper Series No. 0416, The World Bank.

Rosenbaum, P. and Rubin, D. (1983). "The central role of the propensity score in observational studies for causal effects." *Biometrika* 70(1): 41-55.

Skoufias, Emmanuel and Parker, Susan W. (2001). "Conditional Cash Transfers and their Impact on Child Work and Schooling: Evidence from the Progresa Program in Mexico." International Food Policy Research Institute FCND Discussion Paper No. 123.

Tabor, Steven R. (2002). "Assisting the Poor with Cash: Design and Implementation of Social Transfer Programs." Social Protection Discussion Paper Series No. 0223, The World Bank.

**Table 1: Baseline characteristics of treatment and comparison group members†**

*Treatment group N=2497, comparison group N=993*

| Variable | Mean-treatment Group | Mean-comparison Group | Std. Dev. (*unequal variance) | Std. Dev.-comparison | P-value |
|---|---|---|---|---|---|
| Age | 14.12 | 14.14 | 1.06 | 1.06 | 0.701 |
| Gender (% female) | 53.1% | 51.2% | | | 0.309 |
| **Income per capita** (9=lowest income, 1=highest) | **6.28** | **5.53** | **1.83** | **1.83** | **<0.0001** |
| **Number of household members** | **5.47** | **4.88** | **1.94*** | **1.68** | **<0.0001** |
| **Number of dependents (age 19 or under)** | **4.61** | **3.46** | **2.13*** | **1.60** | **<0.0001** |
| **Living conditions index** | **2.05** | **1.86** | **0.83*** | **0.64** | **<0.0001** |
| **Index of overcrowding** | **2.19** | **1.48** | **1.68*** | **0.97** | **<0.0001** |
| Parent education level | 5.28 | 5.14 | 1.45* | 1.65 | 0.033 |
| Distance to school center | 2.05 | 2.00 | 0.87 | 0.84 | 0.169 |
| Number of times left school | 1.06 | 1.06 | 0.25 | 0.24 | 0.976 |
| Absences from school | 1.76 | 1.39 | 4.80* | 3.52 | 0.033 |
| Grade repetitions | 1.64 | 1.68 | 1.02 | 1.03 | 0.384 |
| Age-grade difference | 1.35 | 1.34 | 0.73* | 0.68 | 0.797 |
| Index of work outside the home | 1.10 | 1.06 | 0.64* | 0.52 | 0.126 |
| Index of work inside the home | 2.26 | 2.14 | 1.39 | 1.37 | 0.016 |
| Daily hours in home tasks | 1.79 | 1.71 | 0.74* | 0.69 | 0.037 |
| **Index of need/risk** | **38.88** | **34.93** | **5.41*** | **3.00** | **<0.0001** |

†Cases in the original comparison group who reported in the follow-up survey that they received the Becas in at least one year (1999-2003) were reassigned to the treatment group (i.e., n=157 cases changed treatment status).

Variables shown in bold indicate statistically significant differences between treatment and comparison group members (at $\alpha<0.01$).

**Table 2: Determinants of Participation in the Becas Estudantiles Program**

| **Predictors** (*=statistically significant at α<0.05, standard errors in parentheses below coefficients) | **Any scholarship receipt** (n=2585) | **Beneficiary 2 or more years** (n=1341) |
|---|---|---|
| Intercept | **-5.285*** (1.334) | -2.078 (1.569) |
| Age | **-0.158*** (0.081) | -0.102 (0.084) |
| Sex (male=1) | 0.128 (0.103) | -0.123 (0.112) |
| Family income per capita | **-0.226*** (0.054) | 0.064 (0.060) |
| Income per capita < 45 pesos/month | 0.322 (0.173) | 0.219 (0.177) |
| Index of need/risk | **0.295*** (0.028) | **0.060*** (0.024) |
| Parent highest education level | 0.077 (0.041) | 0.047 (0.044) |
| Number in household | -0.020 (0.047) | -0.007 (0.046) |
| Number of dependents | -0.025 (0.054) | 0.005 (0.048) |
| Living conditions index | -0.096 (0.089) | 0.080 (0.076) |
| Family members per room | 0.050 (0.057) | 0.020 (0.044) |
| Distance to school | **-0.152*** (0.068) | -0.003 (0.066) |
| Work less than 1 day/week outside home | 0.011 (0.386) | 0.449 (0.358) |
| Work 2 hrs or less per day in home | 0.308 (0.167) | -0.154 (0.161) |
| Age-grade difference | -0.057 (0.107) | **-0.254*** (0.111) |
| Number of times student left school | -0.233 (0.227) | -0.213 (0.252) |
| Number of grade repetitions | -0.097 (0.065) | -0.072 (0.069) |
| Log of number of student absences (Absences in 1999 for model 2) | 0.017 (0.015) | -0.031 (0.057) |
| Grade average in 1999 | n.a. | **0.412*** (0.099) |
| Left school to work | n.a. | **-0.915*** (0.164) |
| Left school due to academic problems | n.a. | -0.047 (0.250) |
| Percent of eligible students receiving scholarship at school | n.a. | -0.020 (0.011) |
| Salta | **-1.908*** (0.215) | **-1.194*** (0.233) |
| Entre Ríos | -0.214 (0.368) | -0.505 (0.369) |
| Mendoza | **-1.476*** (0.200) | **-1.117*** (0.234) |
| Santa Fe | 0.019 (0.207) | **-0.611*** (0.190) |
| Tucumán | **-0.516*** (0.176) | -0.071 (0.169) |
| Corrientes | -0.164 (0.238) | -0.250 (0.203) |
| Cordoba | **-1.358*** (0.238) | **-1.437*** (0.268) |
| **Percent concordant/discordant** | 79.0/20.8 | 69.1/30.6 |

**Table 3: Balancing test results for average and marginal impact estimation**

*Notes: Results are not shown for all conditioning variables and outcomes; numbers in bold are means after conditioning. Results were similar for outcomes in other years and for other conditioning variables; all tests showed no statistically significant differences between groups after matching.*

| **Results from average impact estimation** | | | | | |
|---|---|---|---|---|---|
| **Conditioning variable** | | **Mean of variable** | | **Test results: Percent reduction in bias** | |
| *Outcome* | *Sample* | *Treatment* | *Comparison* | | |
| Index of need/risk | Unmatched | 38.56 | 34.88 | % bias | 85.8 |
| *School years completed* | Matched | **36.62** | **36.75** | % reduction | 96.3 |
| Index of need/risk | Unmatched | 38.13 | 34.54 | % bias | 83.5 |
| *Grade repetition 1999* | Matched | **35.71** | **35.91** | % reduction | 94.3[a] |
| Index of need/risk | Unmatched | 38.19 | 34.45 | % bias | 88.4 |
| *Grade average 1999* | Matched | **35.81** | **35.83** | % reduction | 99.4[b] |
| Income per capita | Unmatched | 6.26 | 5.69 | % bias | 31.3 |
| *Grade average 1999*[c] | Matched | **5.85** | **5.84** | % reduction | 98.0 |
| Number in household | Unmatched | 5.46 | 4.62 | % bias | 46.5 |
| *Grade average 1999* | Matched | **5.03** | **4.85** | % reduction | 77.6 |
| Number of dependents | Unmatched | 4.51 | 3.32 | % bias | 65.8 |
| *Grade average 1999* | Matched | **3.88** | **3.77** | % reduction | 90.2 |
| Living conditions index | Unmatched | 2.03 | 1.83 | % bias | 29.6 |
| *Grade average 1999* | Matched | **1.90** | **1.89** | % reduction | 94.1 |
| Index of overcrowding | Unmatched | 2.06 | 1.43 | % bias | 48.7 |
| *Grade average 1999* | Matched | **1.56** | **1.67** | % reduction | 82.3 |
| **Results from marginal impact estimation** | | | | | |
| Index of need/risk | Unmatched | 38.83 | 38.55 | % bias | 5.2 |
| *Grade average 1999* | Matched | **38.83** | **38.74** | % reduction | 66.1[c,d] |
| Age | Unmatched | 13.94 | 14.22 | % bias | -28.2 |
| *Grade average 1999* | Matched | **13.94** | **13.92** | % reduction | 94.7 |
| Age-grade difference | Unmatched | 1.23 | 1.42 | % bias | -27.9 |
| *Grade average 1999* | Matched | **1.22** | **1.22** | % reduction | 95.9 |
| Parent education level | Unmatched | 5.51 | 5.14 | % bias | 25.4 |
| *Grade average 1999* | Matched | **5.51** | **5.52** | % reduction | 97.6 |
| Distance from school | Unmatched | 2.08 | 1.99 | % bias | 11.5 |
| *Grade average 1999* | Matched | **2.08** | **2.10** | % reduction | 83.5 |
| Grade repetitions (in past) | Unmatched | 1.48 | 1.78 | % bias | -29.5 |
| *Grade average 1999* | Matched | **1.48** | **1.51** | % reduction | 90.1 |

[a]Corresponding reductions in bias for years 2000, 2001 and 2002, respectively: 93.3%, 89.2%, 92.8%
[b]Corresponding reductions in bias for years 2000, 2001 and 2002, respectively: 97.5%, 90.1%, 91.7%
[c]Results are the same for the outcomes "school years completed" and "grade repetition 1999."
[d]Corresponding reductions in bias for years 2000, 2001 and 2002, respectively: 44.3%, 39.6%, 46.6%

**Table 4: Econometric matching analysis results: Impacts of Programa Nacional de Becas Estudiantiles on number of years attended full school year and graduation**

| **Number of years attended full school year** | **Matching estimates** *(standard errors in parentheses)* | **OLS estimates** *(standard errors in parentheses)* |
|---|---|---|
| *Average impact*: treatment group members (n=1916) vs. comparison group members (n=670) | 0.036[a] (0.086) | 0.405* (0.061) |
| *Marginal impact*: treatment group members with 2 or more years of Becas scholarship receipt (n=830) vs. treatment group members reporting only 1 year of Becas scholarship receipt (n=893) | 0.204[b]* (0.065) | 0.410* (0.057) |
| **Completed third cycle of Education General Basica (high school completion)** | | |
| *Average impact*: Treatment group members (n=1916) vs. comparison group members (n=670) | 0.003[a] (0.030) | 0.111* (0.021) |
| *Marginal impact*: Treatment group members with 2 or more years of Becas scholarship receipt (n=830) vs. treatment group members reporting only 1 year of Becas scholarship receipt (n=893) | 0.022[b] (0.021) | 0.085* (0.022) |

*Indicates statistically significant at $\alpha<0.05$.

[a] 245 treatment group members are not on the common support
[b] 2 treatment group members are not on the common support
[†] All standard errors reported in the table for the matching analysis are estimated through bootstrapping and are bias-corrected.

**Table 5: Analyses of average and marginal impacts of Programa Nacional de Becas Estudiantiles on grade repetition and grade averages (student performance)**

| **Outcome** Estimation method | **Panel A: Becas beneficiaries vs. nonbeneficiaries** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **n** [a] | **1999** | **n** | **2000** | **n** | **2001** | **n** | **2002** |
| **Grade repetition: differences in probability (standard errors)** | | | | | | | | |
| Matching | | | | | | | | |
| *n and cases* | *2340*[b] | 0.027 | *975* | -0.126* | *716* | -0.157* | *595* | -0.082 |
| *excluded* | *245*[c] | (0.019) | *408* | (0.044) | *289* | (0.051) | *236* | (0.044) |
| Multilevel | | -0.016 | | -0.076* | | -0.093* | | -0.044 |
| estimation | *2585*[d] | (0.016) | *1383* | (0.031) | *1005* | (0.035) | *831* | (0.038) |
| **Grade average: average differences (standard errors)** | | | | | | | | |
| Matching | | | | | | | | |
| *n and cases* | *2340* | 0.122* | *1079* | 0.186* | *890* | -0.061 | *700* | -0.150 |
| *excluded* | *245* | (0.026) | *438* | (0.058) | *278* | (0.096) | *209* | (0.094) |
| Multilevel | | 0.127* | | 0.159* | | 0.058 | | -0.035 |
| estimation | *1871* | (0.036) | *1517* | (0.044) | *1168* | (0.056) | *909* | (0.070) |

| **Outcome** Estimation method | **Panel B: Beneficiaries two or more years vs. beneficiaries one year** | | | | | |
|---|---|---|---|---|---|---|
| | **n** | **2000** | **n** | **2001** | **n** | **2002** |
| **Grade repetition: differences in probability (standard errors)** | | | | | | |
| Matching | | | | | | |
| *n and cases* | *1047* | -0.042 | *789* | -0.054 | *662* | -0.044 |
| *excluded* | *2* | (0.031) | *1* | (0.037) | *2* | (0.035) |
| Multilevel | | -0.031 | | -0.052 | | -0.024 |
| estimation | *1049* | (0.024) | *790* | (0.027) | *664* | (0.041) |
| **Grade average: average differences (standard errors)** | | | | | | |
| Matching | | | | | | |
| *n and cases* | *1141* | 0.070 | *908* | 0.123* | *711* | 0.111 |
| *excluded* | *2* | (0.056) | *1* | (0.052) | *2* | (0.070) |
| Multilevel | | 0.065* | | 0.115* | | 0.120* |
| estimation | *1143* | (0.028) | *909* | (0.039) | *713* | (0.047) |

*Statistically significant at $\alpha < 0.05$

[a] Number in subsample (treatment + comparison group members)

[b] Total number of cases in matching estimation (Stata ps2match)

[c] Number of cases excluded from matching due to failure of common support

[d] Estimates from estimation of multilevel models of program impacts (SAS proc mixed)

**Table 6: Multilevel models of student grade averages (performance) with school-level predictors†**

| **School-level predictors (n=24)** (standard errors in parentheses) | Average impact estimation **Outcome: Grade repetition** | | | |
|---|---|---|---|---|
| *Year*<br>*Number of student-level cases* | *1999*<br>*n=1958* | *2000*<br>*n=1040* | *2001*<br>*n=775* | *2002*<br>*n=646* |
| Becas scholarship recipient (impact estimate) | -0.016<br>(0.017) | -0.072*<br>(0.037) | -0.093*<br>(0.042) | -0.033<br>(0.043) |
| Grade average (all students in school) | 0.075<br>(0.068) | -0.321*<br>(0.107) | -0.355§<br>(0.154) | 0.449<br>(0.257) |
| Becas program management/execution *(Rating: 1=lowest to 10=highest)* | 0.016<br>(0.009) | 0.011<br>(0.014) | 0.028<br>(0.020) | 0.024<br>(0.035) |
| Program contributed to retention of students *(Rating: 1=nothing to 4=much)* | -0.081*<br>(0.083) | -0.024<br>(0.048) | -0.024<br>(0.070) | -0.021<br>(0.121) |
| Attributes/aspects of school that contributed to effective functioning of the Becas program *(Rating: 1=not important to 4=most important):*<br>Role of teachers/teacher support | -0.030§<br>(0.013) | -0.004<br>(0.019) | -0.026<br>(0.028) | 0.001<br>(0.049) |
| *% of total variation in grade averages between schools* | 10.2% | 17.9% | 17.6% | 19.7% |
| *% of variation between schools explained by model* | 94.3% | 96.9% | 88.9% | 44.2% |
| | **Outcome: Grade average** | | | |
| *Year*<br>*Number of student-level cases* | *1999*<br>*n=1765* | *2000*<br>*n=1437* | *2001*<br>*n=1116* | *2002*<br>*n=867* |
| Becas scholarship recipient (impact estimate) | 0.129*<br>(0.028) | 0.141*<br>(0.050) | 0.062<br>(0.068) | -0.050<br>(0.079) |
| Grade average (all students in school) | 0.516*<br>(0.134) | 0.182<br>(0.195) | 0.197<br>(0.223) | 0.030<br>(0.381) |
| Becas program management/execution *(Rating: 1=lowest to 10=highest)* | 0.024<br>(0.015) | 0.075*<br>(0.025) | 0.048<br>(0.029) | 0.061<br>(0.050) |
| Attributes/aspects of school that contributed to effective functioning of the Becas program *(Rating: 1=not important to 4=most important)*<br>Institutional climate | 0.049§<br>(0.023) | 0.044<br>(0.033) | 0.002<br>(0.047) | 0.016<br>(0.067) |
| Role of teachers/teacher support | 0.053§<br>(0.028) | 0.010<br>(0.039) | 0.019<br>(0.044) | -0.059<br>(0.076) |
| *% of total variation in grade averages between schools* | 21.6% | 30.2% | 27.9% | 30.5% |
| *% of variation between schools explained by model* | 94.1% | 95.7% | 96.0% | 83.8% |

*=statistically significant at $\alpha<0.05$; §=statistically significant at $\alpha<0.10$

† Student-level variables included in these models were the same set as the determinants of participation (beneficiary) model shown in Table 1.

## APPENDIX A: VARIABLES USED IN THE EMPIRICAL ANALYSES

### Table A.1: Baseline survey, school records and follow-up survey measures

| Variable | Range, mean | Variable definition/construction |
|---|---|---|
| *Outcome measures* | | |
| Number of years attended full school year | 0-5, 3.99 | From follow-up survey question asking (for each year, 1999-2003) if students attended school all of the year |
| Grade repetition | 0-1, 0.19 | If student repeated a grade, from student records (1999-2003) |
| Completion of high school | 0-1, 0.59 | If the student completed the third-cycle of the EGB (high school) |
| Average subject material (grade) performance | 1-10. 7.35 | Students' average performance in coursework (in 17 subjects), quantified 10 (excellent) to 1 (poor), from student records by year |
| *Control variables* | | |
| Age | 13-17, 14.1 | Students' age in years (baseline) |
| Sex | 0-1, 0.48 | Male=1, Female=0 student (baseline) |
| Family income per capita; Low income indicator (=1 if income per capita < 45) | 0-9, 6.16 | Total monthly income divided by number in household, 9 categories: 0-15 (=9), 15-39, 30-44, 45-59, 60-74, 75-89, 90-104, 105-120, greater than 120 pesos per month (=1) (baseline and follow-up) |
| Number in household | 0-13; 5.38 | Number of persons living in household (baseline) |
| Number of dependents | 0-8; 4.34 | Number of household members age 19 or less, or with a sickness/incapacity that makes them dependent (baseline) |
| Living conditions index | 0-6; 1.99 | Average of values of four intermediate indicators: construction material, floors, bathrooms and appearance or condition (baseline) |
| Household members per room | 0-6; 1.95 | Number of household members divided by number of rooms in the home (baseline) |
| Parent education level | 0-10; 5.25 | Years of education of head of household (baseline) |
| Distance to school | 1-4; 2.02 | Distance from student's home to central school—less than 1 km, 1-5 km, 6-10 km, or more than 10 km (baseline) |
| Number of student absences | 0-89; 1.66 | Number of student absences from school administrative records (in year before application and 1999-2003) |
| Number of times students left school | 1-3; 1.06 | Number of times students left school from school administrative data (baseline) and from school records by year |
| Number of grade repetitions | 1-5; 1.65 | Number of times students repeated a grade from school administrative data (baseline) and grade repetition from school records by year |
| Age-grade difference | 1-5; 1.35 | Difference between students' age and the age in grade year from school administrative data (baseline) |
| Daily hours of work outside the home | 1-8; 1.08 | Hours per day worked outside the home (0-2, 3-4, 5-6, 7 or more) by student (baseline) |
| Number of days worked inside the home | 1-4; 2.21 | Time worked in the home (occasionally, 2-3 days per week, 4-5 days per week, all days) by student (baseline) |
| Hours per day worked inside the home | 1-5; 1.77 | Hours per day worked inside the home (0-2, 3-4, 5-6, 7 or more) by student (baseline) |
| Index of need/risk (higher score=higher need/risk) | 23-58; 37.61 | Constructed using 20 measures: family income per capita, number of dependents, household head occupation, household head pregnant, type of home, tenancy, living conditions index, household members per room, distance to school, averages years of education of all household members, student hours worked outside home, number of tasks performed inside home, student age-grade difference, illness or disability, pregnant, parent, head of household, lives alone, in institution or with employer |

**Table A.2: School Level Variables and Descriptive Information**

| **Ratings of program/school (1=lowest—10=highest/best)** | **Mean** | **Standard deviation** | **Minimum** | **Maximum** |
|---|---|---|---|---|
| General program functioning | 6.95 | 1.73 | 4.0 | 10.0 |
| Communication/execution of program procedures | 6.23 | 1.90 | 2.0 | 10.0 |
| Technical assistance | 7.55 | 2.28 | 3.0 | 10.0 |
| Educational materials | 7.24 | 2.59 | 1.0 | 10.0 |
| **Ratings of program contributions** | **4=Much** | **3=Some** | **2=Little** | **1=Nothing** |
| Contribution to institutional conditions for learning | 29% | 46 | 12.5 | 12.5 |
| Contribution to student retention | 9.6% | 54.9 | 22.3 | 7.4 |
| **Attributes/aspects of school that contributed to effective program functioning** | **4=Most important** | **3=Some** | **2=Little** | **1=Not important** |
| Institutional climate | 23.2% | 21.0 | 31.5 | 24.3 |
| Role of teachers/teacher support | 28.1% | 40.8 | 23.7 | 7.4 |
| **Changes made through program implementation** | **1=better** | **2=no change** | **3=worse** | |
| Role of teacher in class | 54.3% | 45.7 | 0.0 | |
| Participation of students | 63.1% | 36.9 | 0.0 | |
| Leadership in school | 60.7% | 39.3 | 0.0 | |
| Participation of parents | 34.0% | 62.8 | 3.2 | |
| **School strategies/policies adopted since 1999** | | | **(% of schools)** | |
| Address income/poverty problems | | | 70.8% | |
| Educational priorities of institution oriented toward lower income students | | | 87.5% | |
| Integration of Becas students | | | 83.3% | |
| Changes in the work of teachers | | | 37.5% | |
| Changes in the hours/activities of students | | | 41.7% | |
| **School population characteristics** | **Mean (or %)** | **Standard deviation** | **Minimum** | **Maximum** |
| Days of classes held in year | 142.4 | 40.4 | 40 | 177 |
| Grade average of all students in school | 7.32 | 0.38 | 6.64 | 8.23 |
| Annual amount of scholarship considered adequate for beneficiaries ($) | 606 | 155 | 400 | 1000 |
| Percent of students eligible for scholarship who get it | 44.2% | 5.9 | 34.0 | 55.8 |
| Percent of students more than 5 kilometers from school | 23.1% | 15.7 | 0 | 73.5 |
| Percent of students with no telephone at home | 67.4% | 12.3 | 37.9 | 96.3 |

## Endnotes

[1] Some examples of these programs include *Progresa* and *Opportunidades* in Mexico; *Bolsa Familia, Bolsa Escola* and *Bolsa Alimentacao* in Brazil; *Red de Proteccion Social* in Nicaragua; *Program de Asignacion Familiar* in Honduras; *Subsidio Familiar* in Venezuela; *Apoyo Familiar* in Colombia; *Program of Advancement Through Health and Education (PATH)* in Jamaica; Ecuador's *Bono de Desarrollo Humano*; Chile's *Subsidio Unitario Familiar*, Bolivia's *Beca Futuro*; *Programa Superémonos* in Costa Rica and *Fonds de Parrainage National* in Haiti.

[2] Specifically, they note that although random assignment assures that unobserved factors influencing enrollment decisions are distributed independently of observed characteristics in the first year of the program, this will not be the case in the second year due to selection of students based on first-year educational outcomes (i.e., where treatment status affects students' learning effort and performance). For example, they expect that if the program has a positive effect on the propensity of continuing schooling, it will select individuals with lower unobserved characteristics (such as unobserved ability), on average, contributing to a downward bias in the probability of academic success and school continuation in subsequent years. See also Cameron and Heckman, 1998.

[3] Between 1974 and 2002, the Gini coefficient for household per capita income increased from 34.5 in 1974 to 53.8 in 2002, the poverty rate increased from 5% to over 50% over the same period (Lee, 2000; Gasparini, 2003).

[4] Loan proposal: Program for Social Protection and Mitigation of the Impact of the Crisis on the Poor, AR-0295.

[5] This amount compares to an average monthly transfer of $55 in the Progresa program.

[6] Argentina Plan de Emergencia Social, April 10, 2003.

[7] The Becas program was initially launched as a pilot (test) program in 1997 and then expanded coverage.

[8] Additional information about the distribution of treatment and comparison group members by schools within provinces is available upon request from the author.

[9] The availability of the entirety of this information varied from school to school. For additional details, see the report by UNTREF-CINEA, Diciember 31, 2003: Evaluación del Impacto del Programa Nacional de Becas Estudiantiles: 1º Informe de Avance.

[10] The assembly of these data was completed by UNTREF-CINEA and is thoroughly documented in two major reports: Evaluación del Impacto del Programa Nacional de Becas Estudiantiles: 1º Informe de Avance (December 31, 2003), and 2º Informe de Avance (February 15, 2004).

[11] Detailed results of these analyses are available upon request from the author.

[12] Ravela (2000) reports that the range of values on this index for all applicants in 1999 was 21-66; the range for the sample in this study is 23-58.

[13] The measure of the number of years the Becas scholarship was received by students and their families was based on administrative records and the follow-up survey questions (that asked if the Becas scholarship was received in each year, 1999-2003). This measure excludes the 904 cases with missing data in the follow-up survey.

[14] As a general rule of thumb, Kreft (1996) defines a "high" intra-class correlation as one that is larger than $\rho = 0.25$, (i.e., more than 25 percent of the variation between groups or schools).

[15] There are a number of different techniques that may be used in the matching procedure, e.g., one-to-one matching (nearest neighbor, within caliper), k-nearest neighbors, radius, kernel, local linear regression and Mahalanobis matching. Other specifications were tested, including local linear regression and nearest neighbor methods, but the results were not sensitive to the method used.

[16] An examination of the distribution of the propensity scores in the treatment group and the comparison group of nonbeneficiaries showed that those in the treatment group have higher estimated propensities to participate, driven primarily by their higher scores on the index of need. It is this uppermost segment of the treatment group that is excluded when a common support is imposed in the matching estimation of average program impacts.

[17] Balancing tests were performed for each outcome (number of years attended full school year, completed high school, grade repetition and grade averages), for each outcome year, and for each covariate. The results presented in Table 3 focus on the covariates that were shown to be unbalanced between the treatment and comparison groups in Table 1, and for those characteristics that differed to a greater extent between students who received the Becas scholarship for only one year and those who received it for 2-5 years.

[18] The OLS estimates of Becas program impacts on high school attendance and completion were larger and statistically significant in each of these models, suggesting the importance of adjusting for potential bias due to nonrandom selection into the program and imposing a common support through matching.

[19] Within the cohort of students in this study (that began the Becas program in 1999), these academic performance data are available for fewer students each year, in part because some of these students leave school.

[20] These models include the same set of predictor variables that were used in the propensity score matching analyses, but as in the OLS estimation, they do not exclude any cases.
[21] The student-level predictors and province indicators included in these models were the same set as used in the propensity score estimation (see Table 2).