Three Proposals to Improve Education in Latin American and the Caribbean: Estimates of the Costs and Benefits of Each Strategy

Report to the Copenhagen Consensus Center and the Inter-American Development Bank

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Abstract

This paper briefly describes the progress and problems of education in Latin American and Caribbean countries, and then proposes three types of policies to increase education outcomes: nutrition programs for infants and very young children; conditional cash transfer programs; and vouchers that can be used to attend private schools. The paper calculates benefit-cost ratios for each type of policy, based on the best studies available, using several alternative sets of assumptions. Studies of early childhood nutrition programs from three different countries indicate that the benefits of those programs appear to greatly exceed the costs. Research on conditional cash transfers from three other countries suggests that the benefits usually exceed the costs if a low discount rate (3%) is used, but this is often not the case if a higher discount rate (6%) is used. Finally, a single study of a voucher program at the secondary school level in poor urban areas of Colombia suggests that the benefits greatly outweigh the costs, but one should be cautious about generalizing to other countries from a single study. The paper concludes with recommendations for further research on education policies in developing countries.

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I. Introduction

Many macroeconomists have claimed that increased levels of education lead to increased economic growth (Lucas, 1988; Barro, 1991; Mankiw, Romer and Weil, 1992), although others have questioned these findings (Bils and Klenow, 2000; Pritchett, 2001). Among microeconomists, many studies have provided evidence of the impact of education on individuals' incomes (see Glewwe, 2002, for a review). Education is also seen as a means to improve health and reduce fertility (Schultz, 1997 and 2002; Strauss and Thomas, 1995) and is seen as an intrinsic good in itself (Sen, 1999, pp.292-97).

This support for education among economists is matched by even greater enthusiasm among, and financial support from, international development institutions (UNDP, 1990; World Bank, 2001). As discussed below, developing countries have massively expanded their education systems in the last 40 years, perhaps in response to the enthusiasm of donors. One example of the focus policymakers have placed on education is that two of the eight Millennium Development Goals (MDGs) adopted at the United Nations Millennium Summit in September 2000 focus on education: first, for all children to complete primary school by 2015, and second, to achieve gender equality at all levels of education by 2015.

These claims about the value of education are not necessarily correct. And even if they were correct, they do not provide any advice on which policies are most effective at raising educational outcomes such as years of completed schooling and skills learned while in school. Finally, most of the discussion has focused on developing countries in general, without specific attention to the Latin American and Caribbean (LAC) countries. This paper presents three proposals for improving education outcomes in the LAC region and assesses their impact on education outcomes and, more specifically, their value in terms of the economic returns they generate by raising individuals' incomes when they are adults. The three policy proposals are: 1. Nutrition programs for infants and preschool age children; 2. Conditional cash transfer programs, which provide cash payments to parents if their children are regularly attending school; and 3. Vouchers that can be used to pay for most of the cost of attending private schools. For each proposal, the estimated value of these benefits is then compared to the costs. For three different countries, Bolivia, Guatemala, and the Philippines, the early childhood nutrition programs generated benefits that far exceeded the costs. In contrast, the benefits produced by conditional cash transfer programs in three different countries (Honduras, Mexico and Nicaragua) consistently exceeded the costs only if a 3% discount rate is used; using a 6% discount rate often produced benefits that were less than the costs. Finally, a study of a voucher program in Colombia appears to have produced benefits that greatly exceed the costs, although one should be cautious about results from a single country. A final point is that some benefits, such as health benefits, could not be easily evaluated, so the benefits from all of these studies may well underestimate the true benefits.

This rest of this report is organized as follows. Section II provides an overview of education in the LAC region. Section III provides a brief review of the determinants of education outcomes, and the impact of education on income and other socio-economic phenomena. The three policy proposals are presented and evaluated in Section IV. Section V discusses the benefits of undertaking more randomized evaluations to strengthen the knowledge base for education policies. The final section summarizes the findings and draws several conclusions.

II. Progress and Problems with Education in Latin America and the Caribbean

Latin American and Caribbean (LAC) countries have made great progress since 1960, and especially since 1980, in ensuring that all children complete primary school and most children enroll in secondary school. This is seen in Table 1. In 1960, most – but not all – children enrolled in primary school but less than one third were enrolled in secondary school. By 1980, almost all children in Latin American and the Caribbean were enrolled in primary school, and about one half were enrolled in secondary school. In recent years (2000 and 2004), virtually all children enroll in primary school and complete the primary cycle. Pre-primary enrollment has also increased dramatically, from about one fourth in 1980 to about two thirds in 2004. In addition, a large majority of children were enrolled in secondary school (although the exact percentage of children who complete secondary school has not been documented for most LAC countries). Grade repetition rates were not high, on average, and have come down in recent years to about 5% at the primary level and 11% at the secondary level. Finally, participation in post-secondary education has increased rapidly, to almost one third of the population.

These generally favorable trends mask fairly large differences across the 31 countries in the LAC region. Table 2 presents detailed information, by country, for 2004 (the most recent data available). Pre-primary enrollment rates vary from 28% in Belize and Guatemala to over 100% in Cuba, Guyana and St. Kitts and Nevis. Primary enrollment rates (both net and gross rates) are close to 100%, although there are a few exceptions (discussed in the next paragraph).[1] Repetition rates are generally low, with one important exception: primary repetition rate in Brazil is 25%, double or more than double the rate in all other countries. Secondary enrollment rates, both gross and net, show a large amount of variation. The gross rates (which cover more countries) range from a low of 49% (Guatemala; Haiti is presumably lower but no data are available) to close to 100% (Barbados, Brazil, Dominica, Grenada, Guyana, and Uruguay).[2] Tertiary enrollment rates also vary widely, from a low of 3% in Belize to slightly over 50% in Argentina and Cuba.

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[1] The gross enrollment rate is the ratio of the number of children enrolled in a given level of schooling divided by all children in the age range associated with that level. Net rates include as enrolled only those children in the associated age range, excluding children outside that range. Thus gross enrollment rates are almost always larger then net enrollment rates, and they can exceed 100% if many "overage" children are enrolled in a given level of schooling due to late enrollment in primary school or grade repetition.

[2] Note that Brazil's *net* secondary enrollment rate (69) is much lower than its *gross* rate (104), and that the net rate is not particularly high compared to the net rates in other LAC countries. This large different between Brazil's net and gross rate reflects the unusually high rate of grade repetition in Brazil.

A few countries in Table 2 stand out as low performers. The lowest performer is Haiti, for which very little data are available. The sole statistic available, the primary completion rate, is only 40%, much lower than that of any other country (the next lowest rate is Guatemala's 70%). Other countries with weak performance are Paraguay and three Central American countries, Guatemala, Honduras and Nicaragua; the primary school completion rates for these four countries vary from 70 to 79 percent. Guatemala also had the lowest secondary enrollment rates: a net rate of 34% and a gross rate of 49%. (Haiti probably has even lower rates, but no data are available.)

The progress in education in recent years, as seen in Table 1, suggests that the education levels in Latin American and Caribbean countries are moving closer to those of high income countries, with almost universal primary school enrollment, a large majority of students enrolled (and presumably a large majority finishing) secondary school, and a tertiary (gross) enrollment rate of 28%. However, there are serious problems regarding how much children actually learn in school that cannot be seen in these statistics. International comparisons of learning from three recent international studies are shown in Tables 3 (TIMSS and PIRLS studies) and 4 (PISA study), focusing on the results for LAC countries and several developed countries and developing countries outside of the LAC region.

The four developed countries in Table 3 (France, Japan, United Kingdom and the United States) have grade 8 mathematics and grade 4 reading scores that range from 502 to 579. This range can be seen as goal for developing countries to achieve. Yet the four LAC countries in Table 3 (Argentina, Chile, Belize and Colombia) have scores that fall far short of this goal, ranging from 327 (grade 4 reading score in Belize) to 422 (grade 4 reading score in Colombia). This performance is particularly worrisome because two of these four countries (Argentina and Chile) are relatively well off LAC countries, with above average education performance (as seen in Table 2). It is also important to note that students in one Middle Eastern and several East Asian developing countries (Indonesia, South Korean, Malaysia, Thailand and Turkey) seem to perform better than all four of these LAC countries. (Note: These four LAC countries are the only countries from that region that participated in the TIMSS and PIRLS studies.)

The international comparisons in the PISA study shown in Table 4 present a similarly sobering assessment of learning in the LAC region. The scores for the developed countries range from 493 to 557, and the percent with very low reading skills in those countries varies from 2.7% to 6.4%. In contrast, the scores in the five Latin American countries (Argentina, Brazil, Chile, Mexico and Peru) range from 292 (math score in Peru) to 422 (reading score in Mexico), and the percent of children with very low reading skills ranges from 16.1% (Mexico) to 54.1% (Peru). Finally, the three East Asian countries in Table 4 (Indonesia, South Korea, Thailand) scored as well as, and often much better than, the top performing LAC countries.

It is also useful to look at trends in education finance. Table 5 shows that spending per student (as a proportion of GDP per capita) has steadily increased at the primary and secondary levels since 1980, while spending per student at the tertiary level increased slightly from 1980 to 2000 and dropped sharply from 2000 to 2004. Total spending on education (as a percent of total GDP) has changed little since 1980, except for a small decline from 1980 to 2000.

There is also substantial variation among LAC countries in spending on education. This is shown in Table 6. Relative to GDP per capita, government spending on primary and secondary education is highest in Barbados, Cuba and St. Vincent and the Grenadines. It is lowest in Dominica, Peru and Uruguay. As a percent of total GDP, government spending on education at all levels is highest in Cuba and St. Vincent and the Grenadines and lowest in the Dominican Republic and Venezuela. Table 6 also shows primary and secondary student-teacher ratios, which are an (admittedly crude) indicator of school quality. The lowest ratios in primary school are in Barbados and Cuba, while the highest ratios are in Guatemala, Honduras and Nicaragua. At the secondary level, the lowest levels are Cuba, St. Kitts and Nevis, Paraguay and Ecuador, while the highest are in the Dominican Republic, Honduras and Nicaragua.

Latin America and the Caribbean (LAC) countries have made notable progress in achieving gender equity at all education levels. Duryea and others (2007) report that the gender gap closed starting with the 45 year old age cohort and has since reversed with girls receiving higher average years of education than boys. More specifically, women born between 1940 and 1942 on average received 5 years of education while males in this cohort received 5.8. However, women born between 1979 and 1981 received 9.6 years of schooling, while their male counterparts received 9.3. On average the gender gap declined by 0.27 years of schooling per decade. This reversal is primarily explained by increased educational attainment by females at higher education levels, as opposed to changes in primary education. Within the LAC region there is considerable diversity in educational attainment. Four countries (Bolivia, Guatemala, Mexico, and Peru) within LAC still have a significant gender difference favoring boys. However, this disparity is found only in the lowest income quintile and primarily among the indigenous populations.

Indigenous populations in the Latin American and Caribbean region have lagged behind the non-indigenous populations in terms of educational attainment, gender parity and test scores. In Peru, Duryea and others found that indigenous males and females attend school at lower rates than non-indigenous people in the same age cohort, and that the years of schooling of indigenous females, on average, is two years less than that of their male counterparts. Similar trends were found for indigenous populations in Bolivia, Guatemala and Mexico. For example, Hernandez-Zavala and others (2006) found that indigenous adults in Guatemala had attained only half the years of schooling that non-indigenous adults attain. In Mexico this disparity is even wider, indigenous adults attain only three years of education, versus eight years for non-indigenous adults. There are many reasons for this disparity; some have suggested high rates of poverty in indigenous communities, low quality of the educational environment at home, and failure to accommodate linguistic differences in the classroom.

Turning to disparities in test scores, Hernandez-Zavala et al. (2006) compared math and reading scores between indigenous and non-indigenous populations using 3rd and 4th year primary school students in Guatemala and Peru, and 5th grade students in Mexico. For

(Spanish) language testing, they found standardized gaps between indigenous and non-indigenous students of 0.77, 0.73, and 1.06 standard deviations for Peru, Mexico, and Guatemala, respectively. They also found similar gaps (0.69 in Peru and Mexico and 0.89 in Guatemala) for math scores. An analysis of the contributing factors to this gap reveals that family and school characteristics explain between 41 percent (Guatemala, language test) and 75 percent (Mexico, language test) of this gap.

In summary, Latin American and Caribbean countries have been very successful in recent years in ensuring that almost all children complete primary school and that most children obtain at least several years of secondary education. Yet some serious problems remain. First, a few countries, particularly three in Central America, are lagging behind. Second, the skills attained per year of schooling are much lower than the skills obtained by children in high income countries, and even in some other developing countries. Third, in many countries the indigenous population has much lower educational outcomes than the non-indigenous population, and in a few countries substantial gender gaps remain. What can these countries do to improve the educational outcomes for their children? The remainder of this paper attempts to answer this question.

III. Economic Analysis of the Causes and Consequences of Education Outcomes

Policy recommendations for education should be based on sound research. This research involves analyzing education data from the country or countries in question. Such data are used to estimate relationships that can then be used to assess the impact of education policies on education outcomes, and of education outcomes on income, health status, and other objectives of economic development. Unfortunately, there are many potential estimation problems that can confound attempts to assess the impacts of education policies. This section reviews these issues, using standard economic theory. For further discussion of estimation issues and reviews of the literature, see Glewwe (2002) and Glewwe and Kremer (2006). This section begins by presenting a simple economic model of schooling attainment and learning. It then expands the model to incorporate more general types of government education policies, after which it discusses the impacts of schooling on individuals' incomes and their health. The last subsection explains how estimates of the impacts of education policies on education outcomes and estimates of the impacts of education outcomes on individuals' incomes can be used to calculate rates of return and benefit-cost ratios for specific education policies or programs.

A. A Simple Economic Model of Schooling and Learning. To assess the effectiveness of education policies, one needs to understand the causal impacts of those policies on education outcomes. Estimation of these impacts is quite difficult. Before examining problems of estimation regarding some causal relationship that one may want to estimate, it is important to be very clear about what that relationship is. This subsection presents a simple model of household behavior that leads to well defined causal relationships that one can attempt to estimate. These estimates can serve as the basis for assessing the impact of various education policies on outcomes of interest.

For simplicity, assume that parents have a utility function that they attempt to maximize, and one of the decisions they must make concerns the education for their children. Again for simplicity, assume that the household has only one child, and that there are only two time periods, the first when the child is of school age and the second when the child is an adult of working age. The utility function is assumed to have only three variables, consumption in time period 1 (C_1), consumption in time period 2 (C_2), and the academic skills that the child acquires from his or her schooling (A):

$$U = U(C_1, C_2, A) \qquad (1)$$

Parents attempt to maximize this utility function subject to a time constraint and the production function for cognitive skills.

The production function for cognitive skills is a structural (technological) relationship between various "inputs", all factors that determine learning, and the "output", academic skills attained. It can be specified as follows:

$$A = A_p(\mathbf{EI}, PS, \alpha, \mathbf{SC}, YS) \qquad (2)$$

where the "p" subscript indicates that this is a production function. Every variable in equation (2) refers to the first time period. There are five types of causal factors that determine academic skills: **EI** is a vector of educational inputs provided by parents (e.g., school supplies, books, education toys, and—perhaps most importantly—time spent by parents with the child that has pedagogical value) in the first time period, PS is parental schooling, which can make parents' time (one of the components of **EI**) more valuable, α is the child's innate intelligence ("ability"), **SC** is a vector of school (and teacher) characteristics, which can be thought of as specific aspects of school quality, and YS is years of schooling attained in time period 1. All variables in equation (2) have positive impacts on A.

The other constraint faced by parents is the intertemporal budget constraint. Let W_0 be the initial wealth of the household, and assume that the household can borrow and lend between the two time periods at an interest rate r. Normalizing the price of the consumption good to equal 1 in time period 1, the budget constraint is:

$$W_0 = C_1 + p_{C,2}C_2/(1+r) + p_{EI}EI + p_SYS \qquad (3)$$

where $p_{C,2}$ is the price of the consumption good in time period 2, p_{EI} is the price of educational inputs, and p_S is the price of a year of schooling. Note that, for simplicity, this budget constraint assumes that parents do not receive any transfers from their children after their children finish school and start working; to the extent that such transfers do occur they will, in effect, increase parental demand for schooling via the A term in the utility function (assuming that the transfers received increase with the level of schooling of the child).

Optimizing the utility in equation (1) with respect to the constraints in equations (2) and (3) gives the following standard demand functions for the four endogenous variables that can be purchased in the market:[3]

$$C_1 = C_{1,D}(W_0; r, p_{C,2}, p_{EI}, p_S; \mathbf{SC}, PS; \alpha, \sigma) \qquad (4)$$

$$C_2 = C_{2,D}(W_0; r, p_{C,2}, p_{EI}, p_S; \mathbf{SC}, PS; \alpha, \sigma) \qquad (5)$$

$$\mathbf{EI} = \mathbf{EI}_D(W_0; r, p_{C,2}, p_{EI}, p_S; \mathbf{SC}, PS; \alpha, \sigma) \qquad (6)$$

$$YS = YS_D(W_0; r, p_{C,2}, p_{EI}, p_S; \mathbf{SC}, PS; \alpha, \sigma) \qquad (7)$$

where the "D" subscript indicates that these are standard demand functions, and σ is parental tastes for child education (which determine the shape of the utility function). Note that all of the variables on the right hand side of these demand functions are exogenous; that is, none of them are under the control of the parents.[4] A final point regarding these demand functions is that they do not explicitly account for parents' time preference for consumption; in general, "impatient" parents will have higher demand for C_1, lower demand for C_2, and no clear effect on the demand for **EI** and YS (as long as parents do not face credit constraints).

A final important relationship is the demand for the child's academic skills. This can be obtained by inserting equations (6) and (7) directly into (2):

$$A = A_D(W_0; r, p_{C,2}, p_{EI}, p_S; \mathbf{SC}, PS; \alpha, \sigma) \qquad (8)$$

where the "D" subscript indicates that this is a demand equation, and as in the other demand equations all the variables on the right-hand side are exogenous in the sense discussed above.

It is very important to understand the difference between equation (2), the production function for academic skills, and equation (8), the demand function for academic skills. Consider what happens when some aspect of school quality, call it SC_j, increases. Equation (2) shows how that increase in school quality affects academic skills, *holding constant all other variables in equation* (2). This can be depicted as $\partial A_p/\partial SC_j$. In contrast, equation (8) shows how this increase in school quality affects academic skills *after the household adjusts educational inputs and years of schooling*. The derivative for this relationship is:

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[3] The term "endogenous" is used here in terms of its meaning in an economic model: endogenous variables are variables that can be influenced by household behavior. Whether these variables are endogenous in an *econometric* sense, that is correlated with the error term in an equation to be estimated, is a separate question, which will be discussed below.
[4] Whether these variables are exogenous in the econometric sense of being uncorrelated with the error term in an equation to be estimated is a separate question; this is discussed below.

$$\partial A_D/\partial SC_j = \partial A_p/\partial SC_j + (\partial A_p/\partial YS)(\partial YS_D/\partial SC_j) + (\partial A_p/\partial \mathbf{EI})(\partial \mathbf{EI}_D/\partial SC_j) \quad (9)$$

The first term in equation (9) is the structural impact of school quality on academic achievement, which is what is measured in equation (2), but there are also the "indirect" effects via changes in the demand for years of schooling and educational inputs, which are the second and third terms in equation (9). One possibility is that parents reduce their demand for YS and **EI** in response to an improvement in school quality; if all three arguments in the utility function are normal goods, the household will have an incentive to reduce YS and **EI** in order to "balance" the increase in A that comes from an increase in school quality with increases in C_1 and C_2 (which can be increased if YS and **EI** are reduced). Yet even if all arguments in the utility function are normal goods the direction of this adjustment is uncertain because the increase in SC_j in effect reduces the implicit price of academic skills (A); this price effect will raise demand for those skills and raises the possibility that $\partial A_D/\partial SC_j$ will be greater than $\partial A_p/\partial SC_j$. For further discussion of these points see Glewwe and Miguel (2007).

Many economists and education researchers have attempted to estimate the determinants of years of schooling as given in equation (7). These attempts have been only partially successful due to a variety of estimation problems, including omitted variable bias, measurement error in the explanatory variables, and potential problems of endogenous program placement. Omitted variable bias occurs if some of the variables in that equation are not in the data, and so in effect they end up in the error term in the regression equation. If these "omitted" variables are correlated with one or more of the observed variables, the observed variables are endogenous in the econometric sense that they are correlated with the error term, and the estimated impacts of *all* of the observed variables are likely to be biased estimates of the true impacts. For example, suppose that one is interested in the impact of various school and teacher characteristics (the variables in **SC**), many of which can be changed by introducing a new education policy. Schools and teachers that are "above average" are likely to be above average in many ways. If some of those ways are not measured by any of the variables in the data set, and they are positively correlated with the school and teacher characteristics that are in the data set, the impacts of the variables that are in the data set are likely to be overestimated because they are positively correlated with the error term in the regression model (that error terms includes the unobserved school characteristics) and thus they are endogenous in the econometric sense. Similarly, if parents with higher "tastes" for their children's education (higher σ) are more likely to send their children to better quality schools, then the variables in **SC** will be positively correlated with the error term (if σ is not observed, which is usually the case); those parents encourage their children to stay in school and thus the positive correlation will lead to overestimation of the impact of school quality.

Random measurement error in the explanatory variables in any regression equation will tend to lead to underestimation of the impacts of those variables that are measured with error. For example, if data on the tuition and fees charged by schools (p_S) are measured with error (which often appears to be the case when such data are collected from household surveys and/or schools surveys), then the estimated impact of tuition and fees on years of schooling is likely to be underestimated.

Bias from endogenous program placement occurs if government ministries introduce new educational programs or policies in areas where conditions are particularly poorly suited for raising educational outcomes. This will tend to lead to underestimation of the impact of those programs or policies on educational outcomes. For example, suppose that parents' attitudes toward (tastes for) education are rather negative in a particular area. In order to raise educational outcomes in that area, and in others like it, the government may provide additional support to or programs for education in those areas. But if these attitudes toward education are not observed, regression estimates of the impact of this type of policy will tend to underestimate the true impact because the policy variable would be negatively correlated with the error term (which includes tastes for education) in the regression equation. A final point is that another form of endogenous program placement bias could lead to overestimation of the impacts of government programs; this is possible if "elite" groups, who may have higher tastes for education and higher unobserved educational inputs, are able to pressure the government to implement new policies in the schools their children attend.

These estimation problems have led researchers to use more careful methods in recent years to avoid these types of biases. Methods include use of instrumental variables (although finding credible instruments can be very difficult), panel data methods, "natural" experiments and randomized trials. For a detailed discussion, see Glewwe and Kremer (2006). The **five [??]** proposals presented in Section IV are based on studies that have used these methods to estimate the impact of school characteristics or other variables on years of schooling. The estimation methods used are explained in more detail in Section IV.

Policymakers are interested not only on factors that determine years of schooling, but also in factors that determine how much children learn while in school. As explained above, there are two relationships to consider, the production function in equation (2) and the demand relationship in equation (8). Focusing on variables that are most relevant for policy decisions, equation (2) shows how learning changes when school and teacher characteristics change *if there are not changes in years of schooling or in educational inputs provided by parents*. On the other hand, equation (8) shows how changes in school and teacher characteristics, as well as changes in school fees (p_S) and the price of educational inputs (p_{EI}), will change learning *after parents' behavioral responses have taken place*. Both of these relationships are of interest. Equation (8) shows exactly what will happen in the real world when a policy is implemented, because in the real world households will adjust their behavior after the policy is implemented. Yet equation (2) is also if interest because it better captures the full benefit to society as a whole, since equation (8) does not measure the benefits households receive when they readjust their demand for educational inputs (**EI**) and years of schooling (YS) in response to the program. That is, if a household decides to reduce spending on educational inputs in response to the program or policy change, it raises its utility by spending more on other items (C_1 and C_2), but this benefit is ignored in equation (8). See Glewwe et al. (2004) for a more precise explanation of this point.

B. Expanding the Model to Include Government Policies. The discussion thus far has been rather narrow in that it assumes that education policies can be measured in terms of changes in teacher and school characteristics, and changes in schools fees and in the prices of educational inputs. Fortunately, this framework can be extended to examine policies that do not directly change **SC**, p_S and p_{EI} but instead change them indirectly by changing the way schools are organized. This allows for the analysis education policies such as decentralization, promoting competition by removing restrictions on private schools, or developing incentive schemes that link teacher pay to student performance. In principle, these types of policies affect schooling outcomes by changing what happens in the classroom. For example, increased competition may change the behavior of teachers, and these behaviors can be included as components of the vector **SC**. Formally, education policies, denoted by **EP**, may interact with local community characteristics, denoted by **CC**, to determine the quality of a school and even the prices of educational inputs in some cases (*e.g.* policies that allow communities to set school fees):

$$\mathbf{SC} = \mathrm{sc}(\mathbf{CC}, \mathbf{EP}) \qquad (10)$$

$$p_S = p_S(\mathbf{CC}, \mathbf{EP}) \qquad (11)$$

$$p_{EI} = p_{EI}(\mathbf{CC}, \mathbf{EP}) \qquad (12)$$

Estimating equations (10), (11) and (12) would require very detailed data on what happens in schools such as the many dimensions of teacher behavior. An alternative is to substitute (10), (11) and (12) into (7) and (8) to obtain the reduced form relationships:

$$YS = YS_I(W_0; r, p_{C,2}, PS; \mathbf{CC}, \mathbf{EP}; \alpha, \sigma) \qquad (13)$$

$$A = A_I(W_0; r, p_{C,2}, PS; \mathbf{CC}, \mathbf{EP}; \alpha, \sigma) \qquad (14)$$

where the “I” subscript indicates that this reduced form relationship focuses on institutional aspects of how schools are organized. Knowledge of the relationships in equations (13) and (14) would directly link education policies to the main outcomes of interest to policymakers.

Estimating the impact of education policies on years of schooling and on learning, that is estimating equations (13) and (14), faces many of the estimation problems discussed above. For example, policies such as offering teacher incentives or decentralizing control of schools are not randomly introduced in some schools and not others, but instead are implemented in schools that are chosen for a particular reason, or who volunteer to participate. Thus, just as in the problem of bias from non-random program placement, schools that have the policy of interest may differ from schools that do not in systematic and unobserved ways. This will cause the education policy variable to be correlated with the error term in the regression equation and thus to be endogenous in the econometric sense, leading to biased estimates. One way to get around many of these estimation problems, which is discussed more in Section V, is to implement new education policies in a random sample of schools.

C. The Impact of Schooling on Income. The discussion thus far has been limited to the relationships that determine years of schooling and the learning that takes place within school. But to assess the merits of any education policy one must also consider the value of the schooling, in terms of both its income and non-income benefits. This information can then be used to calculate benefit-cost ratios for specific education policies.

Economists and other social scientists have conducted a large amount of research on the impact of schooling on the incomes of individuals, both in developed and developing countries. Unfortunately, as with the literature on the determinates of learning and years of schooling, there are many estimation problems that can lead to biased estimates. On a more positive note, a large amount of research has been done on how to overcome these estimation problems, including some research done in developing countries. This subsection presents a brief review of the most relevant issues, beginning with wage earners and then turning to farmers and other self-employed individuals.

In a well functioning competitive labor market, employers will pay wage earners the marginal product of their labor. This marginal product will depend on their skills, broadly defined, which are primarily determined by their schooling and their experience. This can be depicted as follows:

$$w = w(\mathbf{A}) = w(\mathbf{A}_p(\mathbf{EI}, PS, \alpha, \mathbf{SC}, YS; EXP)) = w(\mathbf{EI}, PS, \alpha, \mathbf{SC}, YS; EXP) \qquad (15)$$

where **A** is a vector of the many kinds of skills learned, EXP is years of experience, and a modified version of equation (2) has been used to show how skills acquired from schooling evolve over time as individuals accumulate more years of work experience.

Among the determinants of wages in equation (15), it is relatively easy to collect information on years of schooling and on experience. It is harder, though not impossible, to collect data on educational inputs (**EI**), parental schooling (PS), innate ability (α), and school "quality" (**SC**). Many labor economists have, following the pioneering work of Gary Becker and Jacob Mincer, estimated the following log linearized functional form for equation (15):

$$\log(w) = \beta_0 + \beta_1 YS + \beta_2 EXP + \beta_3 EXP^2 + u \qquad (15')$$

$$= \beta_0 + \beta_1 YS + \beta_2 EXP + \beta_3 EXP^2 + u(\mathbf{EI}, PS, \alpha, \mathbf{SC})$$

where the error term u is some function of educational inputs provided by parents, parental schooling, learning ability and school quality, which are usually unavailable and this are relegated to the error term.

Most attempts to estimate equation (15′) use data sets that contain variables for wages (w) and years of schooling (YS). Years of work experience (EXP) is either directly measured or (more often) is calculated as current age minus years of education minus 6. The latter approach for measuring work experience assumes that individuals start schooling at age 6, do not repeat any years of schooling, and start working full time immediately after finishing schooling and continue working full time up until the time of the interview; all of these assumptions could be erroneous in many developing countries, which will introduce measurement error (not necessarily random) in the work experience variable, which in turn is likely to lead to biased estimates.

A very serious problem with most estimates of equation (15) is that the error term, that is **EI**, PS, α and **SC**) are likely to be correlated with years of schooling (YS) and years of work experience (EXP), which introduces biases in the estimate of the impact of schooling on wages (β_1). For example, the model presented above (and common sense) suggests that parents will tend to increase their child's years in school if either the child is more talented (higher α) or the quality of the school is higher (higher **SC**). Both of these phenomena will cause u to be positively correlated with YS and thus will lead to overestimation of β_1. It is also possible that educational inputs (**EI**) are positively correlated with years of schooling. Parents with high "tastes" for schooling are likely to purchase more educational inputs and are likely to keep their children in schooling for more years, leading to positive correlation in YS and **EI** and thus positive correlation between YS and the error term in (15′). On the other hand, YS could be measured with random error, which will tend to lead to underestimation of β_1. Overall, it is hard to determine whether simple estimates of β_1 obtained from estimates of equations similar to (15′) overestimate or underestimate the true impact of schooling on wages.

When calculating the benefits of education, in particular the impact of schooling on wages, one should exercise caution. Many estimates of equation (15′) have been published that are likely to be biased. See Glewwe (1996) for an example from Ghana. Thus even published estimates need to be scrutinized, as opposed to blindly accepting their accuracy.

If doubt arises about estimates of β_1 for a particular country, the wisest approach may be to use an estimate of about 0.08 or 0.09. This is similar to very careful estimates of β_1 by Duflo (2001) for Indonesia, which use a "natural experiment" of rapid school construction as an instrumental variable for educational attainment of adult males.

A final issue is that many people in developing countries are not wage earners; instead they are self-employed, operating farms or small family-run businesses. This is particularly true in rural areas. This raises two problems. First, estimate of the impact of schooling on the earnings of wage earners could suffer from sample selection bias. Second, and more importantly, there is no reason to expect that the impact of education on wages is the same as the impact of education on self-employment income. Indeed, Duflo found that the impact of years of schooling on the incomes of the self-employed was smaller than the impact for wage earners. This suggests that, for countries with many self-employed individuals, it would be prudent to use estimates of β_1 ranging from 0.05 to 0.07. Based on these results, the benefit-cost ratios presented below use two different assumptions about the impact of an additional year of schooling on labor income, an "upper bound" rate of 10% and a "lower bound" rate of 5%.

D. The Impact of Schooling on Health and Other Outcomes. Education provides not only higher incomes but also improves the quality of life in other ways. Perhaps most importantly, better educated people are healthier and have healthier children (Glewwe, 1999;

Grossman, 2006). This benefit of education is not captured in estimates of the impact of education on income. Unfortunately, for most developing countries there are no reliable estimates of the impact of education on health outcomes, so this benefit is not included in this paper. Thus the benefit-cost ratio presented in Section IV are underestimates of the true benefits. Future research should attempt to measure these non-income benefits.

E. Using Estimates of Causal Relationships to Calculate Rates of Return and Benefit-Cost Ratios for Education Policies. Standard cost-benefit analysis uses estimates of the cost and of the expected benefits (which often accrue over many years) of a program or policy, to calculate either an economic rate of return or a benefit-cost ratio for that program or policy. Turn first to estimates of economic rates of return. Once one has the costs and benefits of the program or policy, both in monetary terms, for all years, the economic rate of return is the discount rate that sets the present discounted value of the cost of the project equal to the present discounted value of its benefits. For example, suppose that the cost of the project at time zero is C_0, and that there are no other costs, and that the benefits accrue steadily from year 1 to year 30. Denoting the benefits for each of these years as B_1, B_2, … B_{30}, the economic rate of return is the value of r that makes the following equality holds:

$$C_0 = \sum_{t=1}^{30} B_t/(1+r)^t \qquad (18)$$

Sometimes costs are incurred for more than one year, so the most general definition of the economic rate of return is the value of r that ensures that the following equality holds:

$$\sum_{t=0}^{T_c} C_t/(1+r)^t = \sum_{t=0}^{T_b} B_t/(1+r)^t \qquad (19)$$

where T_c is the last year for which costs are incurred and T_b is the last year for which benefits are generated. If the is no cost or no benefit for a given time period, then the corresponding C_t or B_t can be set equal to zero. Note also that in practice it is not necessary to go out beyond t = 50 because the value of $1/(1+r)^t$ becomes close to zero. For example. $1/(1+0.05)^{50} = 0.0872$.

Now turn to benefit-cost ratios. These are very easy to calculate. Instead of finding the value of r that sets both sides of equation (19) equal to each other, choose a "reasonable" r (i.e. a reasonable discount rate), and then calculate the benefit-cost ratio as:

$$\text{Benefit-Cost Ratio} = [\sum_{t=0}^{T_c} B_t/(1+r)^t]/[\sum_{t=0}^{T_b} C_t/(1+r)^t]$$

This is simply the present discounted value of the benefits divided by the present discounted value of the costs, for a given discount rate. In practice it is useful to use two or three different discount rates; Section IV uses discount rates of 3% and 6% for each intervention.

For most types of education policies, the direct costs are relatively easy to calculate. In addition, there is an important indirect cost to consider. If children go to school for a longer period of time because of a certain policy, the opportunity cost of that additional time spent in school must also be included as part of the cost. This is usually done by valuing that time in terms of the wages or income that would have been earned had the child worked during that additional period of time.

Assessing the monetary value of the benefits of an education policy is more complicated. In the simplest case, the policy has increased children's skills, which are measured the vector **A** in equation (15), and this in turn bring increases in wages. If most or all of the increases in skills occur by increases in years of schooling, than it is not necessary to measure **A** directly, but instead one can use estimates of β_1, β_2 and β_3 in equation (15′) to calculate the impact of the education policy, via its impact on years of schooling, on wages. On the other hand, if much of the benefit is in terms of increasing skills learned for a given number of years of schooling, the contribution of this increase in skills to labor productivity and thus to labor income should be calculated. One way to do so is to convert an increase in skills into the number of additional years of schooling required to obtain that increase in skills, and then use estimate of the impact of years of schooling on wages (or other types of labor income) to measure the value of the increase in skills.

While benefit-cost analyses can be important guides for policy, governments and development organizations must keep in mind several limitations that they have. First, they are only as reliable as the estimates on which they are based. As explained above, there are many problems with estimating the causal relationships (in particular, estimates of the impact of education policies on education outcomes, and of education outcomes on incomes) so those estimates need to be scrutinized with a critical eye. Second, strictly speaking, estimates of both costs and benefits of a particular program or policy apply only to that program or policy in that country, and seemingly minor changes in those programs or policies, or even the same program or policy in a different country, could have very different costs and benefits. Third, in principle, raising funds via taxes in order to fund a program or policy can lead to distortions in economic activity that, in effect, raise the social cost of implementing the project or program. Keeping these limitations in mind, the next section presents estimates of benefit-cost ratios for several different types of education policies.

IV. Estimates of Benefit-Cost Ratios for Three Types of Education Interventions

This section presents benefit-cost analyses of the three education interventions that seem most promising (in terms of high benefit-cost ratios) for Latin American countries, based on many recent studies. All three of these interventions operate by increasing the demand for education: nutrition programs for pre-school children; conditional cash transfers; and vouchers that can be used to attend private schools. For each specific program studied, benefit-cost ratios are presented using two different annual discount rates, 3% and 6% (these are the rates used by the Copenhagen Consensus Center).

Before turning to the specific interventions, it is important to point out an issue which limited the analysis, which is that benefit-cost analyses could be done only for interventions that have been rigorously evaluated. There are many other interventions that appear to be promising, but since no careful studies have been done of those interventions it is not possible to calculate reliable estimates of the benefits (calculation of the costs is usually less of a problem). Indeed, the benefit estimates of some of programs included in this paper may also suffer from serious biases, as explained in detail below.

A. Nutrition Programs for Pre-School Age Children. There are several studies that have presented credible evidence showing that children who are better nourished in the first years of life stay in school longer and learn more per year of schooling. For a detailed review, see Glewwe and Miguel (2007). This subsection presents estimates of benefit-cost ratios based on three recent, and rigorous, studies, two from Latin America (Bolivia and Guatemala) and one from Asia (the Philippines).

Perhaps the most well-known, and arguably the first, study of the impact of a child nutrition program on health and education outcomes in a developing country is the INCAP study that was initiated in four Guatemalan villages in 1969. In two villages, a nutritious porridge (*atole*) was provided to pre-school age children for a period of up to three years. In the other two villages, a much less nutritious cool drink (*fresco*) was provided for the same period of time. Assignment of the four villages to receive *atole* or *fresco* was random. The annual cost of the *atole* intervention, in U.S. dollars, was $18.25 per child. Primary medical care was also provided in all four villages, for an additional $5 per child per year, so the total annual cost of the program was $23.25 per child per year. Studies of the benefits (see below), have focused on children who were in the program for three years.[5] For children who participated in the program for three full years, the present discounted value of the cost of the program was $67.74 using a 3% discount rate and $65.88 using a 6% discount rate. (All benefit-cost ratios presented in this paper use the first year of program operation as the base year for discounting.)

Turning to the benefits of the INCAP child nutrition intervention, Maluccio et al (2006) estimate that the *atole* supplementation increased grade attainment by 1.2 years for girls, but there was no impact for boys. Technically speaking, this estimate is the benefit of the *atole* program relative to the *fresco* program, but the nutritional content of the *fresco* drink was small compared to the nutritional content of the *atole* porridge, so this estimate is fairly close to (though a slight underestimate of) the impact of the *atole* intervention relative to no intervention at all. The difference in the impact by sex is puzzling and may reflect random variation; perhaps the most reasonable conclusion is that this intervention increases the years of schooling of the average student by 0.6 years. Since the villages were assigned to *atole* or *fresco* randomly, there is a good reason to believe that the coefficient estimate of the impact of being exposed to the *atole* program is unlikely to be biased. Patrinos and Velez (1994) estimate that an additional year of schooling in Guatemala increases wages by

[5] Any child, and indeed any adult, was allowed to come to the feeding centers, which were open from about 10 a.m. to 2 p.m., for the entire eight years that they operated, but most analyses of the benefits focus on children who participated for three years.

about 10.7%, based on data from wage earners.[6] This may overestimate the actual benefit because no attempt is made to account for unobserved child ability and these estimates are based on a national sample, whereas the INCAP intervention was implemented in rural areas (which generally have lower rates of return, as discussed above). As explained in subsection III.C, because of this potential for overestimation of the impact of an additional year of schooling on wages, two scenarios are presented, one using an upper bound of 10% and the other using a lower bound of 5%, for calculating the benefits. Taking a 10% increase in wages as an upper bound, the present discounted value of the increase in wages from an increase of 0.6 years of schooling is $622 for a 3% discount rate and $261 for a 6% discount rate. The associated benefit-cost ratios are 9.19 and 3.96, respectively. Using a 5% increase in wages per year of schooling as a lower bound leads to an increase in wages of $312 for a 3% discount rate and $131 for a 6% discount rate, with associated benefit-cost ratios of 4.61 and 1.99.

A second program from Latin America that has recently been evaluated is the PIDI (*Proyecto Integral de Desarrollo Infantil*) program that was implemented in Bolivia in the 1990s. This program included not only a nutritional component (the cost of which was about 40% of the cost of the program) but also educational activities; both nutrition supplementation and educational activities are common components of early child development (ECD) programs.[7] It was implemented in low income neighborhoods of urban areas, and children between 6 months and 72 months were eligible to enroll in it. It is much more expensive than the Guatemalan intervention, with an average cost of $516 per child per year. In their analysis of the program, Behrman, Cheng and Todd (2004) assume that the average child is enrolled in the program for three years, which implies that the present discounted value of the cost is $1394 for a 3% discount rate and $1256 for a 6% discount rate.

Behrman, Cheng and Todd using matching methods to estimate the impact of a typical child's participation in the program on several outcomes: 1. Child height; 2. Grades completed; 3. Cognitive skills, conditional on grade completed; and 4. Age of school completion, conditional on grades completed. The study provides estimates of the impact of the program on these outcomes. To assess the value of these four outcomes in terms of increased wages, the authors use previously published studies from different countries (Brazil for impact of height on wages and Pakistan for impact of cognitive skills on earnings). The authors estimate that the present discounted value of the benefits is $4647 using a 3% discount rate, and $2781 using a 6% discount rate. As seen in Table 7, the

[6] We use the estimate in Table A-6 that includes the largest number of control variables.
[7] The evaluation of the PIDI program, as in evaluations of almost all ECD programs, could not separate the impact of the nutritional component from that of the educational activity component. Grantham-McGregor et al. (1997) present evidence from Jamaica that both components contribute to children's cognitive development. See Schady (2006) for a recent review of the limited evidence from Latin America and the Caribbean on the impact of ECD programs on child development.

associated benefit-cost ratios are 3.33 for the 3% discount rate and 2.21 for the 6% discount rate.[8]

A third set of benefit-cost ratio figures combines estimates of the impact of child nutritional status on educational outcomes and estimates of the impacts of those outcomes on wages in the Philippines, with the estimated cost of a nutritional intervention program in India. The feeding program is the Narangwal Project, which operated in the Indian State of Punjab in the late 1960s and early 1970s. Kielman and associates (1983) estimate that this program increased child height by about 2 cms. The cost of the Narangwal Project program was about $100 per child.

The benefits of an increase in height of two centimeters were estimated, using data from the Philippines, by Glewwe, Jacoby and King (2001). The increase in test scores from better nutrition is equivalent to an increase of about six months of schooling for the average child. The authors estimate that a six month increase in schooling leads to an increase in wages of $57 per year (this is based on a wage regression similar to that shown in equation (15′), which finds that an additional year of schooling increases wages by 7%). Assuming that a child works for 45 years when an adult, the discounted value of this addition income is $929 using a 3% discount rate and $390 using a 6% discount rate. The associated benefit-cost ratios, again shown in Table 7, are 9.29 for the 3% discount rate and 3.90 for the 6% discount rate. An alternative approach is to assume that students achieve the same level of cognitive skills but can do so by leaving school six months earlier (and thus start their working life 6 months earlier). This leads to a one time benefit of $650 when the child is about 15 years old; the present discounted value of this figure is $417 using a 3% discount rate and $271 using a 6% discount rate. The associated benefit-cost ratios are 4.17 for the 3% discount rate and 2.71 for the 6% discount rate.

B. Conditional Cash Transfer (CCT) Programs. Several Latin American countries, and a few countries in other regions of the world, have implemented programs that provide monthly cash payments to poor households if the school age children in those households attend school regularly. Most of these programs have been carefully evaluated because they were implemented in a randomized way: from a sample of a large number of communities half or more than half were randomly selected to implement the program while the other communities served as controls. This greatly eases (but does not eliminate) many estimation problems regarding the impact of these programs on children's educational outcomes. While these programs increase enrollment and attendance in the program areas, CCTs generally do not address the often low quality of education. It is possible that combining CCTs with increases in school quality is more cost-effective than either intervention by itself; regrettably, there is little reliable evidence on whether this conjecture

[8] The calculations presented in the Behrman et al. paper were very complicated, and we were unable to replicate their results given the information in the paper. Thus we could not measure how the benefit-cost ratio changed when the increase in wages from an additional year of schooling was set to either 5% or 10%. Presumably the results are not very sensitive to altering this effect because years of completed schooling is only one of four pathways by which the program affected wages.

is correct. Keeping this in mind, this subsection presents benefit-cost ratios for conditional cash transfer (CCT) programs that have been implemented in Honduras, Mexico and Nicaragua.

The earliest, largest, and most well-known CCT program is the Progresa program that was implemented in 314 communities in rural Mexico in 1998 (another 181 rural communities served as a control group for the first two years of the program). (The program was later renamed Oportunidades and was expanded to rural areas.) For children of primary school age and lower secondary school age in poor households (about two thirds of the households in these communities were officially designated as poor), monthly payments were provided to families if their children attended school for 85% of the days that the schools were open. The families were initially told that the program would last only for three years, although in fact the program has continued to operate. If the program had only operated for three years, the (discounted) average cost per child would be about $391 for 3% discount rate and about $380 for a 6% discount rate. However, if parents had assumed that the program would operate indefinitely when making their enrollment decisions then the estimated benefit of the program pertains to a child going through the program for seven years (grades 3 – 9), NS the (discounted) average cost per child would be about $839 for 3% discount rate and about $754 for a 6% discount rate. Note that these costs are averaged over all eligible children, including those who did not fully participate because they dropped out of school, because the estimated benefits were for all children, not just those who fully participated. Thus the benefit-cost ratios presented below are for all children who had the opportunity to participate in the program, that is they are based on estimates of the impact of "offering" the program on the average years of schooling of all children in the "treatment" communities.

Schultz (2004) estimates that the cumulative impact of the Progresa program is to increase the years of schooling of the children in the "treatment" communities by 0.66 years. Note that this estimated impact is the impact of being offered the program, not the impact of participating in the program; the latter would be higher since some children in the communities where Progresa was implemented dropped out of school and thus did not fully participate in the program. Citing a study of estimates of the determinants of wages in urban areas of Mexico, he assumes that each additional year of schooling increases wages by 12%. This could over estimate the rate of return to years of schooling for two reasons. First, children with higher levels of schooling may have higher innate ability. Second, and more importantly, these estimates are for urban areas, and as discussed above the returns to schooling in rural areas is likely to be much lower. The results presented in Table 7 use two different assumptions, one is that an additional year of schooling raises wages by 10% (perhaps because many educated people in rural areas will eventually migrate to urban areas) and the other is that it raises wages by 5% (assuming most rural residents remain in rural areas). Based on wages of youth in the Progresa data set, Schultz estimates an average wage of US$ 1002 per year, so an increase in 0.66 years of schooling implies a wage increase of $66 per year (1200*0.10*0.66) if an additional year of schooling raises wages by 10%, or $33 per year of an additional year of schooling raises wages by 5%. Assuming that the typical rural youth in Mexico will work from age 15 to age 60, the present discounted value of the wage gain from the Progresa program, assuming that of a year of schooling raises wages by 10%, is estimated to be $1,081 using a 3% discount rate and $453 using a 6% discount rate. The more conservative assumption that one more year of schooling raises wages by only 5% leads to values: $541 using a 3% discount rate and $227 using a 6% discount rate.

Combining the estimates of the discounted costs and benefits yields four sets of results. If one assumes that the impact estimated by Schultz corresponds to operating the program for only three years and that a year of schooling raises wages by 10%, then the benefit-cost ratios are 2.8 for a 3% discount rate and 1.2 for a 6% discount rate. In contrast, if one assumes that Schultz's estimates correspond to a permanent program, in which case an individual child is eligible to receive benefits for seven years, then the benefit-cost ratios are lower, 1.3 for a 3% discount rate and 0.6 for a 6% discount rate (continuing to assume that each year of schooling increases wages by 10%). If a more conservative assumption about the impact of schooling on wages is used, namely that each year increases wages by 5%, then the benefit-cost ratios (assuming that the estimated effects are for a three year program) are 1.4 for a 3% discount rate and 0.6 for a 6% discount rate. The lowest benefit-cost ratios result from assuming that a year of schooling increases wages by only 5% and that the estimated effects reflect a program that has operated for seven years: they are 0.6 for a 3% discount rate and 0.3 for a 6% discount rate.

Two Central American countries, Honduras and Nicaragua, have followed Mexico's lead and also implemented CCT programs, and they have also done so in a randomized way that facilitates assessment of the impact of those programs on schooling outcomes. Nicaragua's program is called *Red de Protection Social*. The implementation of the first phase of this program began in 2000 and ended in 2003. The education component of the program focused on providing cash payments to families with children age 7-13 who were in grade 1-4 (the health and nutrition component provided benefits for families with pre-school age children). As in Mexico, the child had to attend at least 85% of the days that school was open to receive the transfer. These transfers were provided every other month.

The average annual payment for participating students was about $136. The first phase of the program, which is all that has been analyzed so far, lasted for two years. Thus the present discounted value of the cost of the program is $268 for a 3% discount rate and $264 for a 6% discount rate.

Turning to the benefits, Maluccio and Flores (2005) estimate that the program increased school enrollment rates by 13 percentage points and increased attendance, conditional on enrollment, by 20 percent. Since these estimates are based on the randomized design of the program, they are fairly credible. For simplicity, one can assume that the 13 percentage point increase in enrollment leads to a 13 percentage point increase in eventual years of schooling attained. Average years of schooling of adults in Nicaragua is 4.58 years, which is similar to the education levels of 15-20 year olds in the control communities in the second year of the study. Thus a 13% increase in years of schooling corresponds to a 0.59 increase in years of schooling. An increase of 0.59 years of schooling implies an income increase from the RED program, assuming that one additional year of schooling increases wages by 10%, of $145 (0.59×240) per year[9]. Discounting this increase in income by 3% implies a present discounted value of $2377, while using a 6% discount rate leads to a lower figure, $997. The more conservative estimate that a year of schooling raises wages by only 5% implies an increase in wages of $73. Discounting this increase in income by 3% implies a present discounted value of $1189, while using a 6% discount rate leads to a lower figure, $498.

A more optimistic scenario can be constructed by noting that the RED program also increased daily attendance by 20 percentage points. Assuming that this augments human capital by 20% for a given number of years of schooling, this is equivalent to an additional 20% increase in years of schooling without any change in daily attendance, which adds 0.92 years to the 0.59 "direct" increase in years and so leads to an increase of 1.51 years (for a total increase of 33% in years of schooling). Assuming that each addition year of schooling raises wages by 10%, this implies an increase in wages of $362 (1.51×240) per year. Discounting this increase in income by 3% yields a present discounted value of $6084, while using a 6% discount rate leads to a lower figure, $2551. The assumption that another year of schooling raises wages by only 5% per year implies an annual wage increase of $181, and discounting this increase in income by 3% implies a present discounted value of $3042, while using a 6% discount rate gives a lower figure, $1275.

Finally, consider the cost-benefit ratios. Assuming a program impact equivalent to an increase in 0.59 years of schooling, comparing the costs and benefits gives a benefit-cost ratio of 8.9 when using the 3% discount rate and 3.8 when using the 6% discount rate, if one also assumes that an additional year of schooling increases wages by 10%. The more pessimistic assumption that each year of schooling raises wages by only 5% implies a benefit-cost ratio of 4.4 for the 3% discount rate and 1.9 for the 6% discount rate. Even higher benefit-cost ratios arise when the program is assumed to increase years of schooling by 1.51 years. If an additional year of schooling increases wages by 10%, then one obtains a benefit-cost ratio of 22.7 given the 3% discount rate and 9.7 using the 6% discount rate. On the other hand, if an additional year of schooling increases wages by only 5%, the corresponding benefit-cost ratios are 11.3 for a 3% discount rate and 4.8 for a 6% discount rate.

The last CCT program considered in this paper is Honduras' *Programa de Asignacion Familiar* (PRAF). In its current form, known as PRAF II, the education component provided cash transfers to families of children age 6-12 who were enrolled in the first four years of primary school. (PRAF II also had a health and nutrition program for pre-school children, which is not analyzed here; there was also a plan to provide assistance to schools, but that plan was never implemented). Families were supposed to receive the transfer only if their child's daily attendance rate was 85% or higher, but in fact this

[9] Using the rough approximation that labor income equals 60% of GDP per worker, wage income for a worker in Nicaragua is $2,461. Therefore an increase of 12.1% per year of education means an increase of $297 per year or schooling, or $123 for a 5% return to education, or $246 for a 10% return to education.

attendance requirement was not enforced. As in Mexico and Nicaragua, the program was implemented as a randomized trial. It is not clear how long parents expected the PRAF program to last, but a reasonable compromise is to assume that they expected it to last 3 years, which was the length of the pilot program (even if the program lasted longer, any given child can stay in the program only four years, since it covers only children in grades 1-4).

The PRAF cash transfers for school attendance were smaller than those in Mexico and Nicaragua. They amounted to $5 per month, or $45 per year (school is in session for 9 months of the year). Assuming that the beneficiaries made decisions on the assumption that the program would operate for three years, the present discounted value of the costs per child are $131 using a 3% discount rate and $128 using a 6% discount rate.

Taking advantage of the experimental design of the study, Glewwe, Olinto and de Souze (2004) estimate that the PRAF II program increased children's completed years of schooling from 4.2 to 4.9 years, that is by 0.7 years. Psacharopoulos and Patrinos (2004) cite a 1991 study for Honduras that estimates that an increase of 1 year of education increases wages by 9.3 percent. Since Honduras and Nicaragua are neighboring countries, it is useful to use the same set of assumptions about the impact of an additional year of education on wages, i.e. that is increases in wages by 10% (if most children in rural areas migrate to urban areas) or by 5% (if most children remain in rural areas). The 10% figure implies that a 0.7 increase in years of education increases wages by 7 percent, while the 5% figure implies that such an increase will increase wages by 3.5%. Bedi and Gaston (1997) report that a typical monthly wage in Honduras is $63, which implies an annual wage of $763. Thus a 7 % increase in annual wages implies an annual increase in wages of $53.44 and a 3.5% increase would raise annual wages by $26.72. A more optimistic scenario is to note that the PRAF II program also increased daily attendance by 4.6%. Assuming that this augments human capital by 4.6% for a given number of years of schooling, this is equivalent to an additional 4.6% increase in years of schooling without any change in daily attendance, which adds 0.19 years to the 0.7 "direct" increase in years and so leads to an increase of 0.89 years. This implies increases in wages per year of $67.95 (assuming that a year of schooling raises wages by 10%) or, more conservatively, $33.97 (assuming a year of schooling raises wages by 5%).

Finally, consider benefit-cost ratios, which are shown in Table 7. Turning to the more pessimistic scenario that PRAF II increased years of schooling by only 0.7 years, but the more optimistic assumption that an additional year of schooling raises wages by 10%, the present discounted value of the benefits is $875 using the 3% discount rate and $367 using the 6% discount rate. Given the cost estimates discussed above, the implied benefit-cost ratios are 6.7 for the 3% discount rate and 2.9for the 6% discount rate. The more optimistic scenario converts higher attendance rates into an equivalent amount of years of schooling, so that the program increases "effective" years of schooling by 0.89 years. The present discounted value of the benefits is $1,113 using the 3% discount rate and $467 using the 6% discount rate, and the implied benefit-cost ratios are 8.5 for the 3% discount rate and 3.7 for the 6% discount rate. All of these figures drop when the more pessimistic assumption is imposed that an additional year of schooling raises wages by only 5%. In particular, using this assumption with the more pessimistic scenario of the impact of the program (that it increase years of schooling by only 0.7 years) yields a present discounted value of the benefits of only $438 using the 3% discount rate and only $183 using the 6% discount rate, and the implied benefit-cost ratios are 3.3 and 1.4, respectively. On the other hand, combining this lower assumption about the contribution of schooling to wages with the scenario that the program raises years of schooling by 0.89 yields a present discounted value of the benefits of $557 using the 3% discount rate and $233 using the 6% discount rate, and the implied benefit-cost ratios are 4.2 and 1.8, respectively.

To summarize the results for the CCT programs, under most sets of assumptions the benefits exceed the costs. However, in the case of PROGRESA benefits only barely exceed costs using a 3% discount rate, but when the 6% discount rate is used benefits only exceed the costs under the most optimistic assumptions. The Nicaraguan CCT program seems to have the highest benefit-cost ratio, but it is not clear why this is the case.

C. Voucher Programs. Two Latin American countries, Chile and Colombia, have implemented voucher programs that allow students to use government funds to pay for the cost of private schooling. The underlying motivation for these programs is that competition among schools will increase school quality, and providing vouchers is one way to promote competition among schools.

The Colombian voucher program, *Programa de Ampliacíon de Cobertura de la Educatión Secundaria* (PACES), was implemented in a quasi-randomized way, which reduces many estimation problems. It awarded scholarships to over 125,000 students from poor urban neighborhoods from 1992 to 1997, which could be used to attend private schools. In most communities where the demand for vouchers exceeded the supply, voucher eligibility was determined by a lottery, hence the natural experiment.

Following Angrist et al. (2001), the cost to society as a whole of the PACES program is the following. First, providing a student with a voucher cost the government $24 per year more than the cost of enrolling the student in a public school. Second, although households of lottery winners were able to reduce spending on their child’s education by $22, they also reduced the amount of time that their children worked, which had an opportunity cost of $41. Thus the net cost to parents was $19 per year. Thus the net cost to society as a whole was $43 per lottery winner per year. In fact, this cost needs to be increased because it is based on data from the survey year, in which only 49% of winners were using vouchers, while 88% of voucher winners eventually use the vouchers, so these costs need to be multiplied by 0.88/0.49. Doing this, and applying a discount rate of 3% gives a present discounted value of $193 for the cost using a 3% discount rate, and $188 using a 6% discount rate.

Angrist et al (2001) estimate that poor urban students who received scholarships completed 0.12 more years of schooling than did poor urban students who were randomly denied scholarships. In urban areas of Colombia, it is reasonable to assume that an additional year of schooling raises wages by 10%, so an increase of 0.12 years would raise wages by 1.2%. The parents of the children in the sample had annual earnings of about

$2400 and an average of 5.9 years of schooling. The children have an average of about 7.5 years of schooling, which suggests an average income of $3000. Thus an increase in wages of 1.2% amounts to a benefit per year of $36. The present discounted value of this benefit over the lifetime of the child is $1215 using a 3% discount rate and $872 using a 6% discount rate, which imply benefit-cost ratios of 6.3 and 4.6, respectively.

In fact, the benefits of these vouchers may be higher because students who received them performed 0.2 standard deviations higher on standardized tests, which is equivalent to attaining about one additional year of schooling. The implied increase of one year of schooling suggests that vouchers raised incomes by $300 per year, the present discounted value of which is $4914 at a 3% discount rate and $2060 at a 6% discount rate. The corresponding benefit-cost ratios are quite high, at 25.5 and 10.9, respectively. These results are summarized in Table 7.

In contrast, an analysis of a voucher program in Chile by Hsieh and Urquiola (2006) found no effect of vouchers on students' test scores, repetition rates and years of schooling. Indeed, the main effect of the program seems to have been to encourage the "best" students in public schools to switch to private schools. Overall, then, the evidence on the impact of vouchers on education in LAC countries is mixed.

D. Programs that Could not Be Evaluated. Many readers of this report are likely to ask why other education programs and policies were not evaluated. This subsection explains why specific programs, some of which are well known, were excluded.

1. Decentralized Management. The World Bank and other aid organizations have encouraged many developing countries to decentralize the administration and decision-making in primary and secondary schools, in order to allow those schools to be more flexible to respond to local needs and to give local communities more power of schools decision making. Two examples of this are the EDUCO program in El Salvador, which was analyzed by Jimenez and Sawada (1999), and the autonomous schools program in Nicaragua, which was studied by King and Ozler (2000). However, as explained in Glewwe (2002), both of these studies have serious shortcomings which raise the possibility that their estimates of the impact of these programs on education outcomes suffer from serious biases. Thus there are no reliable studies that have assessed these types of programs.

2. Deworming. Miguel and Kremer (2004) found that providing medicine to control infections of intestinal worms increased school enrollment and attendance at very little cost, which implies very high benefit-cost ratios. However, the intervention examined an area in Kenya with very high levels of helminth infections and, more general, Latin American and Caribbean countries have much lower levels of helminth infections than do countries in Sub-Saharan Africa. This it is not clear that benefit-cost ratios derived from this study are applicable to LAC countries.

3. Bilingual Education. A recent paper by Shapiro and Trevino (2004) examined the impact of the CONAFE program in Mexico. This program is difficult to evaluate because it combines bilingual education with decentralized education. Moreover, there is also a potential problem of underestimation of the impacts due to endogenous program placement given that the program was targeted to disadvantaged areas. Finally, Shapiro and Trevino's estimated impacts of the program are quite small; for example it decreased the dropout rate by only 0.13 percentage points.

4. Teacher Incentives and Professional Training. Some LAC countries have implemented programs that provide teachers monetary incentives and professional training to improve their teaching, but there are no reliable studies showing that they have sizeable impacts on student outcomes. An example is Carrera Magisterial program, which is one component of a larger educational decentralization reform that was implemented in Mexico in 1992. The goal of this program was to raise the quality of basic education through professional training and improved working conditions. It tied salary increases with teacher performance as assessed by voluntary evaluation in the classroom. Lopez-Acevedo (2004) found no significant impact of this program on student outcomes.

V. Recommendations to Strengthen the Knowledge Base for Education Policy

The previous section provides several pieces of evidence that early childhood nutrition programs, and to a lesser extent conditional cash transfer programs, are worthwhile investments in the sense that the benefits are much larger than the costs, although benefit-cost ratios show a fair amount of variation depending on the assumptions made and the program evaluated. There is also one study that shows that vouchers to attend private secondary schools are a worthwhile investment, but one should be cautious about basing policies on a single study. Perhaps the most frustrating conclusion is that there are many other education policies, some of which may be even more effective investments than these, for which there is little or no reliable evidence on the impact of the policy on education outcomes. Until more rigorous evidence is available on these other policies, many effective policies may go unfunded and many less effective policies may be implemented, wasting government resources.

From the authors' viewpoint, the biggest blind spot in our current knowledge is the impact of various education policies on education outcomes. Many studies are done every year, but most do not address in a convincing manner the serious econometric problems raised in Section III. In our view, the best way to reduce this gap in current knowledge is to conduct more randomized experiments similar to the ones that were done for conditional cash transfer programs in Honduras, Mexico and Nicaragua. Economists and other social scientists have increasingly conducted such studies in Africa, Asia and Latin America, but it is difficult to know whether results for African or Asian countries would apply to Latin American and Caribbean countries.

Although some LAC countries have conducted randomized trials of education interventions, others have not, and many governments may be reluctant to do so because it is embarrassing if an evaluation shows that a program is ineffective. In contrast, nongovernmental organizations (NGOs) in developing countries may be very well placed to conduct randomized evaluations. Unlike governments, NGOs are not expected to serve entire populations. Also unlike governments, financial and administrative constraints often lead NGOs to phase in programs over time, and randomization will often be the fairest way of determining the phase-in order. However, while NGOs are well placed to conduct randomized evaluations, expecting them to finance the research is less reasonable, as the results are global public goods.

This suggests that large international aid organizations, such as the World Bank and the Inter-American Development Bank, should finance more randomized evaluations and, more general, more program evaluations. After all, such evaluation are a global "public good" that will be undersupplied if no efforts are made to finance them. The results of these evaluations should be broadly disseminated, which will not be easy for these organizations because many studies will find that existing programs do not work as intended. Finally, randomized studies should always compare their findings with standard cross-sectional or panel data estimates based on the control group data,

A final point regarding randomized evaluations is that they may also have problems of sample selection bias, attrition bias, and spillover effects. just as retrospective evaluations do. Yet correcting for these limitations is often easier than when conducting retrospective studies. For example, sample selection problems could arise if factors other than random assignment influence program allocation. For example, parents may attempt to move their children from a class (or a school) without the program to a class with the program. Conversely, individuals allocated to a treatment group may not receive the treatment (for example, because they decide not to take up the program). Even if randomized methods have been employed and the intended allocation of the program was random, the actual allocation may not be. This problem can be addressed through intention to treat methods or by using random assignment as an instrumental variable for actual assignment. It is much harder to address in retrospective studies, since it is often difficult to find factors that plausibly effect exposure to the program that would not affect education outcomes through other channels.

VI. Summary and Conclusions

This paper has examined three proposals for improving education outcomes in the LAC region and assesses their impacts on education outcomes. More importantly, this paper has presented estimates of the value of each of these three types of projects in terms of the economic returns they generate by raising individuals' incomes when they are adults. Three policy proposals were examined: 1. Nutrition programs for infants and preschool age children; 2. Conditional cash transfer programs, which provide cash payments to parents if their children are regularly attending school; and 3. Vouchers that can be used to pay for most of the cost of attending private schools. For each proposal, the estimated value of these benefits was compared to the costs. For three different countries, early childhood nutrition programs generated benefits that far exceeded the costs. In contrast, the benefits produced by conditional cash transfer programs in three different countries (Honduras, Mexico and Nicaragua) consistently exceeded the costs only if a 3% discount rate is used;

using a 6% discount rate often produced benefits that were less than the costs. Finally, a study of a voucher program in Colombia appears to have produced benefits that greatly exceed the costs, although one should be cautious about results from a single country since a voucher program in Chile had no discernable impacts on students' education outcomes. A final point that applies to all three types of programs is that some benefits, such as health benefits, could not be easily evaluated, so the benefits from all of these studies may well underestimate the true benefits.

While this information should be very useful to policymakers, there is still much that is unknown. As noted above, there are many more interventions that one could like assessments of, such as decentralized management, bilingual education and teacher training and incentive programs, but there are almost no rigorous studies of these programs. Governments, non-profit aid agencies and large international organizations need to develop effective systems for evaluating education projects and publicizing their results. This will not be a simple task, but the alternative of doing little or nothing to analyze new policies or programs will do nothing to help Latin American and Caribbean countries catch up to the education systems of developed countries.

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Table 1: Trends in Educational Outcomes from 1960 to 2004

	1960	1980	2000	2004
Pre-Primary Gross Enrollment Rate (percent)	--	28	59	64
Primary Gross Enrollment Rate (percent)	77	97	127	110
Primary Net Enrollment Rate (percent)	--	70	96	94
Primary Repetition Rate (percent)	--	15	12	5
Primary School Completion Rate (percent)	--	--	98	99
Primary Pupil-Teacher Ratio	34	31	26	26
Secondary Gross Enrollment Rate (percent)	31	49	86	77
Secondary Net Enrollment Rate (percent)	--	16	64	61
Secondary Repetition Rate (percent)	--	--	11	11
Secondary Pupil-Teacher Ratio	--	--	19	18
Tertiary Gross Enrollment Rate (percent)	3	14	21	30

Source: World Bank World Development Indicators.

Table 2: Basic Education Statistics in 2004, by Country

	Pre-Primary Gross Enrollment Rate (%) 2004	Primary Gross Enrollment Rate (%) 2004	Primary Net Enrollment Rate (%) 2004	Primary Repetition Rate, primary (% of total enrollment) 2004	Primary Completion Rate (% of relevant age group) 2004	Secondary Gross Enrollment Rate (%) 2004	Secondary Net Enrollment Rate (%) 2004	Tertiary Gross Enrollment Rate (%) 2004
Argentina	***62***	***118***	..	***6***	100	***97***	***79***	***53***
Barbados	89	107	97		108	110	95	***38***
Belize	28	124	95	11	103	85	71	3
Bolivia	50	113	95	2	101	***80***	73	41
Brazil	***68***	***151***	***92***	***25***	108	***104***	***69***	***16***
Chile	52	104	..	2	95	89	..	43
Colombia	38	111	83	4	94	75	55	27
Costa Rica	64	112	..	7	92	77	..	25
Cuba	116	100	96	1	93	93	87	54
Dominica	65	95	88	4	107	107	90	33
Dominican Republic	32	112	86	7	91	68	49	
Ecuador	77	117	98	2	101	61	52	..
El Salvador	51	114	92	7	86	63	***44***	19
Grenada	81	92	84	3	***106***	101	78	
Guatemala	28	113	93	13	70	49	34	..
Guyana	106	132	..	***2***	***89***	102	..	9
Haiti	..	..	..	..	***40***	..		
Honduras	33	113	91	8	79	65	..	16
Jamaica	92	95	91	3	84	88	79	***15***
Mexico	84	109	98	5	99	80	64	23
Nicaragua	35	112	88	11	73	64	41	..
Panama	55	112	98	5	97	70	64	45
Paraguay	31	..	..	***8***	***78***	***60***	..	***16***
Peru	60	114	97	8	100	92	69	33
St. Kitts and Nevis	101	101	94	..	114	94	87	
St. Lucia	71	106	98	2	102	81	71	14
St. Vincent and the Grenadines	86	106	94	6	93	78	62	
Suriname	***91***	..	..	..	..	..	..	..
Trinidad and Tobago	86	102	92	5	94	84	72	12
Uruguay	***61***	***109***	..	***9***	***98***	***98***		***37***
Venezuela, RB	55	105	92	7	89	72	61	41
Latin America & Caribbean	65	118	95	6	88	86	67	28

bold and ithalics = 2000 estimate

Source: World Development Indicators, 2007

Table 3. Mean Mathematics and Reading Achievement, TIMSS and PIRLS Studies

	Mathematics (TIMSS)		***Reading (PIRLS)***
	1999	***2003***	***2001***
	Grade 8	*Grade 8*	*Grade 4*
Country			
France	-	-	525
Japan	579	570	-
U.K. (England)	-	-	553
U.S.	502	504	542
Argentina	-	-	420
Belize	-	-	327
Chile	392	387	-
Colombia	-	-	422
Indonesia	403	411	-
Korea (South)	587	589	-
Malaysia	519	508	-
Thailand	467	-	-
Turkey	429	-	449

Source: IAEEA (2000, 2003)

Table 4. Mathematics and Reading Achievement of 15 Year Olds, PISA Study

	Mathematics	***Reading***	
	Mean score	Mean score	Percent with very low skills
Country			
France	517	505	4.2
Japan	557	522	2.7
United Kingdom	529	523	3.6
United States	493	504	6.4
Argentina[a]	388	418	22.6
Brazil	334	396	23.3
Chile[a]	384	410	19.9
Indonesia[a]	367	371	31.1
Mexico	387	422	16.1
Peru[a]	292	327	54.1
South Korea	547	525	0.9
Thailand[a]	432	431	10.4

Notes: Data are for the year 2000.
a. Data are for the year 2002.
Source: OECD and UNESCO (2003)

Table 5: Trends in Education Finance from 1960 to 2004

	1980	2000	2004
Expenditure per student, as a percent of GDP per capita:			
Primary	6	13	16
Secondary	10	13	17
Tertiary	44	48	26
Public spending on education, total (percent of GDP)	5	4	4

Table 6: Statistics on Spending and Teacher-Pupil Ratios in 2004, by Country

	Expenditure per student, primary (% of GDP per capita) 2004	**Expenditure per student, secondary (% of GDP per capita)** 2004	**Expenditure per student, tertiary (% of GDP per capita)** 2004	**Public spending on education, total (% of GDP)** 2004	**Pupil-teacher ratio, primary** 2004	**Pupil-teacher ratio, secondary** 2004
Argentina	***11***	***14***	10	***4***	..	***17***
Barbados	24	29	..	7	15	17
Belize	13	18	218	5	23	19
Bolivia	***16***	***13***	36	***6***	***24***	24
Brazil	..	..	..		..	***17***
Chile	13	14	15	4	***27***	25
Colombia	20	20	***27***	5	29	25
Costa Rica	17	17	***36***	5	21	***19***
Cuba	38	41	87	10	10	11
Dominica	9	6		..	18	17
Dominican Republic				1	24	30
Ecuador					23	13
El Salvador	***10***	***10***	12	***3***	30	-
Grenada	***12***	***13***		***5***	18	20
Guatemala	..	..			31	15
Guyana	11	15	***37***	6	***28***	***16***
Haiti	..	20			***..***	-
Honduras	***14***				***33***	33
Jamaica	12		41	4	***28***	19
Mexico	***15***	***17***	44	***6***	***28***	18
Nicaragua	9	10		***3***	34	32
Panama	10	12	***26***	4	24	16
Paraguay	***13***	***14***	30	***4***	..	***12***
Peru	7	9	12	3	***22***	17
St. Kitts and Nevis	8	..	0	4	18	9
St. Lucia	16	18	***0***	5	24	17
St. Vincent and the Grenadines	29	20		11	18	20
Suriname	..				19	***15***
Trinidad and Tobago	..	..	..		18	19
Uruguay	***6***	***7***	19	***2***	..	***16***
Venezuela, RB					19	***-***
Latin America & Caribbean				5	***23***	***19***

bold and ithalics = 2000 estimate

Source: World Development Indicators, 2007

Table 7: Estimates of Benefit-Cost Ratios, by Type of Education Intervention

		3% Discount Rate			*6 % Discount Rate*		
Program	**Country**	**Cost**	**Benefit**	**B/C Ratio**	**Cost**	**Benefit**	**B/C Ratio**
Early Childhood Nutrition Programs							
INCAP (10% return)	Guatemala	68	622	9.2	66	261	4.0
INCAP (5% return)	Guatemala	68	312	4.6	66	131	2.0
PIDI	Bolivia	1394	4647	3.3	1256	2781	2.2
Narangwal: 1st scena	India/Philip.	100	929	9.3	100	390	3.9
Narangwal: 2ndscena	India/Philip.	100	417	4.2	100	271	2.7
Conditional Cash Transfer Programs							
Progresa/Oportunidades	Mexico						
3 yr, prog. (10% ret.)		391	1081	2.8	380	453	1.2
3 yr, prog. (5% ret.)		391	541	1.4	380	227	0.6
perm prog (10% ret.)		839	1081	1.3	754	453	0.6
perm prog. (5% ret.)		839	541	0.6	754	227	0.3
Red de Proteccion Social	Nicaragua						
10% ret. excl. attend.		268	2377	8.9	264	997	3.8
5% ret., excl. attend.		268	1189	4.4	264	498	1.9
10% ret. incl. attend.		268	6084	22.7	264	2551	9.7
5% ret., incl. attend.		268	3042	11.3	264	1275	4.8
PRAF	Honduras						
10% ret. excl. attend.		131	875	6.7	128	367	2.9
5% ret., excl. attend.		131	438	3.3	128	183	1.4
10% ret. incl. attend.		131	1113	8.5	128	467	3.7
5% ret., incl. attend.		131	557	4.2	128	233	1.8
Vouchers for Private Secondary Schools							
PACES (0.12 increase)	Colombia	193	1215	6.3	188	872	4.6
PACES (1 yr. increase)	Colombia	193	4914	25.5	188	2060	10.9

Note: All costs and benefits are in terms of U.S. dollars.