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INTERGENERATIONAL SCHOOLING MOBILITY AND MACRO CONDITIONS AND SCHOOLING POLICIES IN LATIN AMERICA

by

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Abstract

The effects of market and policy reforms on poverty and inequality in Latin America have been of considerable concern. The region continues to have relatively great income inequalities. But income inequality measurements based on cross-sectional annual data are snapshots. Two different societies with the same snapshots of income distribution may have different levels of social welfare because they have different degrees of social mobility. To date little attention has been paid to measuring social mobility in the region. Schooling is thought to be a major mechanism through which intergenerational social mobility is affected. This paper explores some dimensions of the strength of the association of family background with child schooling and whether the strength of this association is related to some major macro and aggregate school policy variables. First, arguments about why family background might be associated with schooling and how that association might depend on market reforms and on public schooling policies are summarized. Then the extent of child schooling gaps overall and across parental schooling quintiles and child age groups are described and the empirical associations of family background with schooling are estimated for children aged 10-21 in Latin America based on micro data from 28 household surveys from 16 countries for the 1980-1996 time period for 559 subsamples. Based on these estimates two indices of intergenerational schooling mobility are constructed and used to explore to what extent intergenerational schooling mobility is associated with basic macro economic and aggregate schooling indicators. The empirical estimates have three important implications, the first of which reinforces the existing literature and the other two of which are greater contributions because they are the first explorations of the issues of interest: (1) They are consistent with family background having significant associations with schooling gaps, though with differences across countries, across time, across parental schooling quintiles, and across child age groups. (2) They suggest that macro conditions—in particular those related to the extent of internal market development—importantly shape intergenerational schooling mobility. (3) They suggest that aggregate school policies that are directed towards increasing resources available for basic schooling in general and for improving school quality in particular have important positive impact on intergenerational schooling mobility, though other educational expenditures such as those on tertiary education may reinforce the impact of family background and reduce intergenerational social mobility. Thus, even though the immediate effects of macro market reforms and schooling policy reforms on current income distribution may not have been that strong, there may be important longer-run effects through increasing intergenerational social mobility.

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Introduction

The effects of market and policy reforms on poverty and inequality in Latin America and the Caribbean have been a topic of considerable recent discussion. Agreement is increasing that these reforms have had positive effects in reversing poverty increases due to economic crises in most countries in the region in the 1980s. At a minimum it is clear that the poor fared worse in the countries that delayed reform the longest. Agreement is less uniform regarding the effects of reform on income distribution. Some recent studies suggest that reforms have halted and perhaps reversed trends towards increasing inequality, while others are less optimistic.² In any case the region continues to have relatively great income inequalities in comparison with other major regions (e.g., Deininger and Squire 1996), and it is unlikely that there will be radical changes in these income inequalities in the near future. Some commentators (e.g., Berry 1997, Schemo 1998) suggest that such inequalities may make the sustainability of reforms in the region very difficult, particularly in light of heightened public expectations of benefits from post-reform growth within the more-democratic political contexts of most countries in the region.

But income inequality measurements in cross-sectional data are *snapshots* each at a point of time. In practice, income distributions change over time under the effect of different transition mechanisms. Transition mechanisms may affect social welfare by changing the shape of the *spot* income distributions captured in the usual *snapshots*.² Two different societies with the same *snapshots* of income distribution at a point of time may have different levels of social welfare because they have different degrees of social mobility. For example, Friedman (1962) argues that a given extent of income inequality in a rigid system in which each family stays in the same position in each period may be more a cause for concern than the same degree of income inequality due to great mobility and dynamic change associated with equality of opportunity. Birdsall and Graham (1998), similarly, argue that to assess the impact of market reforms in the region and the probable sustainability of these reforms -- including the political support for these reforms, it is essential to

² Recent studies include Berry (1997), Londoño and Szekely (1997a, 1977b), Lustig and Szekely (1997), Morley (1994), and Psacharopoulos, Morley, Fiszbein, Lee and Wood (1992).

characterize the degree of social mobility both across generations and within generations and whether such mobility has been affected by the recent reforms. However to date little attention has been paid to measuring social mobility and changes in such mobility in the region and how such changes may be related to macro conditions and policies.

Schooling is thought to be a major mechanism through which intergenerational social mobility is affected.³ If schooling has great impact on income and if schooling is strongly affected by family background, intergenerational correlations in incomes across families will be high and intergenerational social mobility as measured by intergenerational relative income changes will be low. If family background plays a minor role in determining schooling, on the other hand, intergenerational social mobility as indicated by relative intergenerational income movements may be high.

In this paper we explore some dimensions of the strength of the association of family background with child schooling and whether the strength of this association is related to some major macro and aggregate school policy indicators. Of course there are many previous studies of associations between some dimensions of family background and schooling of children.⁴ These studies tend almost always to find significant associations of child schooling with mother's schooling and with father's schooling, with the former about 10 percent larger than the latter at the median of estimates that include both. They tend in the majority of cases, but far from all cases (i.e., in about three-fifths of the cases) to find significant associations with household income or some major component of household income.

But most of these studies are for one sample in a particular country at a particular point of

³ Intergenerational mobility is one important concern regarding social mobility, but as noted in the text, there also is concern in the literature regarding intragenerational mobility. See Behrman (1998) for a review of different concepts and measurements of social mobility.

⁴ Behrman (1997) surveys studies that include estimates of the association of mother's schooling with child schooling, most of which also include father's schooling. Behrman and Knowles (1997) review studies of the association of household income (or major components thereof) and child schooling.

time. And no previous studies to our knowledge explore how the association of family background with child schooling may vary with macro economic conditions and aggregate schooling policies, which is a central question for Latin America as argued above. We contribute to the literature by undertaking such estimates for a number of countries in Latin America and by investigating the extent to which intergenerational schooling mobility may depend on macro economic conditions and aggregate schooling policies in the economies in the region.

The paper is organized as follows. In Section 2 we first summarize some standard arguments about why family background might be associated with schooling and how that association might depend on market reforms and other aspects of the macro environment such as public resources devoted to schooling. In Section 3 we describe the extent of child schooling gaps overall and across parental schooling quintiles and child age groups and characterize the empirical association of family background -- as represented by household income, father's schooling and mother's schooling -- with schooling for children aged 10-21 in Latin America based on micro data from 28 household surveys from 16 countries in the region for the 1980-1996 time period. Estimates are made of the associations between the schooling gap B measured as the number of years of school an individual would have if s/he entered school at age six and advanced one grade every subsequent year minus the number of years of school that individual actually has B and family background for each parental schooling quintile for each of four age groups for each these 28 surveys (i.e., $5 \times 4 \times 28 = 560$ sets of estimates).⁵ The extent of intergenerational schooling mobility then is characterized by two indices: (1) the share of the total variance in the schooling gap for each of these surveys/quintiles/age groups that is explained by the three variables that we use to represent family background (Aproportional intergenerational schooling mobility index@) and (2) of the product of the first index and the average size of the schooling gap relative to expected schooling in each subsample (Agap-adjusted intergenerational schooling mobility index@).⁶ In Section 4 we explore to what extent

⁵ Because of the small sample size for the subsample for children ages 13-15 in the fifth quintile for the Argentinean 1996 survey, we have 559 sets of estimates.

⁶ Both of these indices are normalized so that their ranges are from 0 to 100 and so that increasing values imply greater intergenerational schooling mobility.

these intergenerational schooling mobility indices are associated with basic macro economic and aggregate schooling indicators for the relevant countries in the relevant time periods. Section 5 draws some conclusions.

2. Framework for Analysis of Associations between Schooling and Family Background

Becker's (1967) Woytinsky lecture on the determinants of human capital investments is a useful starting point.⁷ Within this framework schooling (and other human capital) investments are made until the private marginal benefit of the investment equals the private marginal cost of the investment. Figure 1-1 provides an illustration for one individual. The marginal private benefit curve depends on the expected private gains (e.g., in wages/salaries in labor markets) due to the human capital investment. The marginal private benefit curve is downward-sloping because of diminishing returns to human capital investments.⁸ The marginal private cost may increase with human resource investments because of the increasing opportunity costs of more time devoted to such investments and because of the increasing marginal private costs of borrowing on financial markets (if such markets do not easily permit borrowing for such purposes, at some point the marginal private cost curve may become very steep or even vertical). For a human resource investment such as in schooling

⁷ There are numerous other models of how human resource investments in children are made within families (e.g., Becker 1975, 1991, Behrman, Pollak and Taubman 1982, 1995, Mulligan 1997), but a modified version of Becker's Woytinsky Lecture serves to communicate the basic points in a simple manner.

⁸ Diminishing marginal returns might be expected (at least at sufficiently high investment levels) because of fixed genetic endowments (e.g., innate ability) for a given individual and because human capital investments such as schooling take time so that greater investments imply greater lags before beginning to obtain the post-investment returns and a shorter post-investment period in which to reap the returns.

at level H^* , the private returns net of costs are maximized.

If all markets function perfectly and schooling only is an investment (i.e., with neither consumption gains nor consumption losses) everyone invests in schooling until the expected rate of return equals the expected rate of return on alternative investments (at the level H^* in figure 1-1) no matter what their family background. In this case the channels through which there may be an association between family background and schooling are none or very few (there still may be some possibilities, e.g., the third and sixth ones below, depending in part on just how inclusive the definition of complete markets is). In the presence of the range of real-world market imperfections, however, there are many reasons why there may be associations between family background and schooling even if schooling is purely an investment. To illustrate, now consider what happens if first the marginal benefits and then the marginal costs are associated with family background in the presence of market imperfections. Because we use income and parental schooling to represent family background in our empirical estimates in Section 3 below, we use these indicators of family background as concrete examples in our discussion here.

Figure 1-2 illustrates the implications of the marginal private benefits for human capital being associated with family background, with two alternative curves indicated -- each depending on a different family background *ceteris paribus*. The dashed curve is drawn everywhere above the solid curve. If the (otherwise identical) individual is in the household with family background that yields the dashed curve the private incentives are to invest at level H^{**} , which is higher than the privately optimal level of human capital investment at level H^* if the individual is in a household with family background associated with the solid marginal private benefits curve.

Why might marginal private benefits of schooling be associated with family background in the presence of market imperfections? Among the answers to this question are:

1. Public policies may affect households differentially depending on their income level and parental schooling. On one hand policies may favor higher-income households with greater parental schooling by providing higher quality schooling to such households in response to

their greater economic and political power. If school quality is complementary with household schooling investments, the dashed marginal private benefits line is for higher-income households with greater parental schooling. Bourguignon (1998), for example, argues that if the poor invest little in education and the rich invest a lot, any improvement in the schooling system -- presumably particularly in the part of the system used primarily by those who are better off, such as tertiary schooling in most countries -- tends to benefit the rich more than the poor. On the other hand, public policies may favor poorer households as part of programs to reduce inequality or to alleviate poverty by allocating better schooling to such households or to the schooling levels used primarily by the poor. In such a case, if school quality is complementary with household investments in education, the dashed marginal private benefits line is for lower-income households that also tend to have lower levels of parental schooling.

2. Households may make complementary investments directly in children's education at home and through tutoring or indirectly in their education by improving their health and nutrition. If markets for these investments (or for financing these investments) are imperfect and the costs are less for higher-income households with more-schooled parents, the marginal private benefits of schooling are higher for such households (e.g., the dashed rather than the solid line). For instance, the costs of such investments as helping with homework may be less for more-schooled parents than for less-schooled parents.

3. Children's genetic endowments, for which there are unlikely to be perfect markets, may interact with schooling investments in producing education and be correlated with parental endowments that, in turn, are correlated with household income and with parental schooling because of direct effects of such endowments on income and through parents' human capital stocks, including their education.⁹

4. Households may make complementary investments in job search and have contacts that affect children's search for jobs subsequent to completing schooling. If markets for financing such investments are imperfect and the costs are less for higher-income households with more-schooled parents in part because of more attractive possibilities for working in family enterprises and better connections for other employment opportunities, the marginal private benefits again are higher for such households.

5. Higher-income households with more-schooled parents may have better information (in part because of better family enterprise options and better connections), in the presence of imperfect markets for information, so that they face less uncertainty regarding schooling investment decisions and -- holding constant risk aversion -- therefore have higher marginal

⁹Behrman, Rosenzweig and Taubman (1994, 1996) present evidence, using special twins data, that schooling investments respond positively to child genetic endowments. Behrman and Taubman (1989) present estimates that variations in such endowments are consistent with most of the variance in child schooling. The enormous literature on the associations between schooling of adults and their household earnings/income is surveyed in Psacharopoulos (1994) and Rosenzweig (1995).

private benefits than poorer households with less-schooled parents.

6. Higher-income households with more-schooled parents may have less risk aversion so that, in the presence of imperfect insurance markets or simply insurance that has positive private costs, their private incentives are to invest more in schooling than otherwise identical lower-income households with less-schooled parents.

7. Higher-income households with more-schooled parents may have better means of dealing with stochastic events -- e.g., through their connections they may be more able to offset a bad performance on admissions examinations by their children than can poorer households -- and therefore have private incentives to invest more in schooling than otherwise identical lower-income households with less-schooled parents.

8. Higher-income households with more-schooled parents may have lower discount rates, and thus invest more generally, including in schooling, than lower-income households with less-schooled parents.

The first case relates to endogenous policy choices, which -- depending on the mechanism -- may favor either higher or lower income households (e.g., Rosenzweig and Wolpin 1986). In the second through eighth of these cases there are private incentives to invest more in the schooling of otherwise equal children from higher-income households with more-schooled parents because such households cope better with other market imperfections or have unobserved characteristics that increase investments and are associated with household income and parental schooling.

Figure 1-3 represents two different marginal private cost schedules for schooling. investments that depend on family background, with the dashed line drawn to be less than the solid line. With the solid line the private incentives are to invest at level H^* , which is less than the privately-optimal level of human capital investment at level H^{***} if the dashed line is relevant.

Why might marginal private costs for human capital investments be associated with family background in the presence of market imperfections? Among the answers to this question are:

1. There are capital market imperfections, particularly for human capital investments (in part because human capital is not recognized as collateral) so that the marginal private costs for such investments are particularly high for individuals from poorer families who can not relatively easily self-finance these investments. Additionally, given their greater access to

capital markets, higher income parents may be more able to smooth out income shocks by borrowing, and their children will have greater chances of going through the education system without interruptions. Children from poorer parents may have to drop out from school when faced with a shock, which increases the cost of acquiring the same years of education without interruption. In this case the dashed line is for a household with higher income (and probably more-schooled parents).

2. There are exemptions from paying school fees for children from poorer households, in which case *ceteris paribus* the dashed line is for a poorer household (and probably less-schooled parents).

3. The opportunity costs of attending schooling instead of participating in the labor market differ among individuals from different family backgrounds. If children from better-off families have better alternatives because their families have more land for farming or their own enterprises or are better connected with other employers, the dashed line is for poorer households with less-schooled parents.

Thus, within this simple framework, there are reasons originating in both market failures and policy choices why family background in general, and household income and parental schooling in particular, may be related to the marginal private benefits and the marginal private costs of schooling investments, and thus to schooling investments themselves. If schooling has consumption effects, moreover, they also may result in family background-schooling associations (with the sign depending on the nature of the consumption effects) in addition to any that exist because of the investment dimension of schooling.

Four additional points merit emphasis.

First, such considerations point to the possibility of there being associations between schooling and family background. But they do not uniformly point to the sign of the associations being positive or negative. In any particular context there may be both positive and negative effects that in part may cancel out.

Second, these considerations point to why observed variables such as household income and parental schooling may be associated with schooling, but such associations do not necessarily imply causality. For some of the possibilities mentioned above **B**such as genetic endowments, preferences

and Aconnections@Bthe associations with household income and parental schooling do not reflect causal effects, but that these observed family background indicators are proxies for other correlated unobserved factors. For the purpose of characterizing many aspects of intergenerational mobility, however, the basic question is one of association, so the limited degree to which inferences of causality might be made is not particularly troublesome for this purpose.

Third, these considerations also point to a link between the extent of association between family background and schooling on one hand and the general macro environment on the other if the latter is tied to the extent of market imperfections facing households. This tie, in turn, *a priori* seems plausible because market imperfections arguably are related to the extent of overall macro economic development, because policies may alter the extent of market imperfections (e.g., barriers to international trade) and because macro instabilities may tend to increase problems with market imperfections through, for example, increasing problems of evaluation of investments (including those in human capital) due to increased uncertainty regarding future price movements including those for foreign exchange. The macro environment may affect the association between family background and schooling by changing the returns to schooling or the price of schooling differentially across families through changing the extent of market imperfections facing different households. Studies using aggregate data (IDB 1996) indicate, for example, that countries in the region that have been subject to greater volatility in macro variables have had lower secondary school enrollment rates. More open economies may improve access to the labor market for previously excluded groups and may raise returns to labor differentially depending on skills. Inflation could change the relative price of schooling, especially private schooling, if school fees rise faster or slower than wages. A deeper financial market is likely to loosen the effect of family income on schooling, by improving families' ability to borrow.

Fourth, these considerations also point to a link between governmental educational expenditures and the association between schooling and family background. Public schooling expenditures may affect incentives for schooling investments directly, though as noted above, with the sign of such effects depending on how such expenditures are distributed among children with

different family backgrounds and among school levels.

3. How Associated Is Family Background with Schooling Gaps in Latin America?

We consider schooling gaps separately for four age groups: 10-12, 13-15, 16-18, and 19-21 years old. We consider these age groups separately because family background may have differential effects depending on how close a child is to marginal schooling decisions.¹⁰ The age at which such marginal school decisions are made, moreover, is likely to depend on the nature of the economy and labor markets and on the position of a child's family background within the economy. Therefore at this stage of our analysis we consider separately each of the household surveys that we use for our analysis, and for each survey we consider separately five parental schooling quintiles. We define these quintiles by parental schooling because parental schooling represents not only important components of permanent household income, but also possibly important non income characteristics such as genetic endowments and preferences regarding schooling as well as parental price-of-time considerations. (Remember that we are interested in characterizing associations of child schooling with family background, not in identifying causal effects.) We note that both child ages and parental schooling are characteristics that are not likely to be affected by the recent macro variables that we consider in the next section. We characterize the schooling gap for a child as the years of schooling s/he would have completed had s/he entered at age six and advanced one grade each year minus the number of years of schooling s/he actually had completed at the time of the survey. We utilize 28 household surveys from 16 Latin American countries in the time period between 1980 and 1996 for our analysis. These include all the surveys that we have in usable form and that have the necessary

¹⁰ Another advantage of considering the age groups separately is that this lessens the risk of biases due to school continuation selectivity on unobserved ability. Cameron and Heckman (1998), for example, claim that most of the literature on the effects of parental background on children's attainment concludes that the effect of family background declines after secondary schooling, but that these estimates suffer from omitted ability bias because more able children normally progress more in the education system that affects the estimates of family background effects. We avoid this problem by subdividing the surveys by age groups in this section and by controlling for age groups in the estimates in the next section.

variables for our analysis¹¹.

Magnitudes of Schooling Gaps Overall and by Parental Schooling Quintiles and Child Age Groups:¹² Table 1 gives the country and years for the household surveys that we use and, for each survey, the mean overall schooling gap, the average schooling gap as a percent of the schooling expected with initiation of schooling at age six and promotion of one grade each year, and the mean schooling gap for each parental schooling quintile.

The average schooling gap across all the surveys is 3.0 grades or 31.5% of the expected schooling (in the sense just defined), meaning that on the average a 16 year-old who would have completed 10 grades of schooling if s/he had started at age six and advanced one grade each subsequent year in fact had completed less than seven grades. Therefore these data suggest that the average schooling gap in the region is substantial. Across the 28 surveys the average gaps range considerably, from 1.4 to 5.5 grades and from 14.7% to 57.5% of the expected schooling. The surveys indicate that the smallest gaps in increasing order are for Bolivia 1995, Chile 1994, Bolivia 1986, Chile 1987 and Argentina 1980 and Uruguay 1995 **Ball** with average gaps of 2.0 grades or less. The surveys that indicate the largest gaps in decreasing order are for Brazil 1981, Honduras 1989, Honduras 1996, Brazil 1995 and Nicaragua 1993, El Salvador 1995, Venezuela 1981, Paraguay 1995, Mexico 1984, Colombia 1995, Costa Rica 1995 and Costa Rica 1995 and Mexico 1994 **Ball** with average gaps greater than 3.0 grades. For most countries for which there is more than one survey, gaps fell between surveys by from 0.1 grades (Costa Rica, Peru) to 0.9 grades (Brazil, Venezuela) during the intervening periods of up to 14 years. There are two exceptions: Mexico between 1992 and 1994, where the gap remained the same, and Argentina between 1980 and 1996, where it increased from 2.0 to 2.5. Because the age distributions of children vary somewhat across countries, the patterns in the schooling gaps as percentages of expected schooling, while similar to

¹¹See Duryea and Székely (1998) for a more detailed description of the data.

¹² We also investigated whether there are gender differences in schooling gaps, in the estimated relations discussed below in this section for the association between family background and schooling gaps, or in the estimated associations of intergenerational schooling mobility with macro variables and aggregate schooling policies variables in Section 4. We found no significant gender differences.

those for the schooling gaps in terms of grades, can differ.

Within countries there is a tendency for the gaps to be larger for the lower-income quintiles. The average gaps across all 28 surveys tend to decline with increasing parental schooling quintile, which suggests that family background is playing a role in determining the schooling gaps (Table 1).¹³ The average gap across surveys for the first quintile is 4.5 grades, which is over twice as large as the average across surveys for the fifth quintile of 1.8 grades, so the association of family background with schooling gaps may be considerable on the average. But there also are considerable differences among the surveys in how much the mean schooling gaps differ between the first and fifth parental schooling quintiles. The absolute differences are relatively small **B2.0** grades or less **Bin** increasing order for Bolivia 1986 and 1995, Argentina 1996 and Chile 1994, and Chile 1987 and Venezuela 1995. They are relatively large **B3.0** grades or more **Bin** decreasing order for Brazil 1981, Brazil 1995 and El Salvador 1995, Mexico 1989, Honduras 1996, Honduras 1989, Ecuador 1995, and Mexico 1992. There therefore is some tendency for countries with large average schooling gaps to have relatively large gaps between the means for the first and the fifth parental schooling quintiles.¹⁴ For most countries for which there is more than one survey, the differences between the mean schooling gaps between the first and fifth parental schooling quintiles fell between surveys with the largest declines for Argentina (1.1 grades), Peru (0.8), Venezuela (0.7) and Mexico (0.6 between 1989 and 1992). So there was a dominant tendency towards equalization of children's schooling relative to parents' schooling over time. But this tendency was not universal; there were small increases between the schooling gap means for the first versus the fifth parental schooling quintile in Costa Rica, Mexico (1984-1989), and Honduras and no change in Bolivia.

Table 2 gives the mean schooling gaps for the four age groups considered. Within each

¹³ The only exceptions to strictly monotonic declines with increasing parental schooling quintiles are Bolivia 1986 (in which case the mean for the second quintile is less than those for the third and fourth quintiles, which are the same), Bolivia 1995 (in which case the means are the same for the third and fourth quintiles) and Venezuela 1995 (in which case the means are the same for the second and third quintiles)

¹⁴ But this association is not perfect. Nicaragua 1993, for example, is tied for third in the average size of the schooling gap, but is 18th in terms of the difference between the means for the first versus the fifth parental school quintiles.

survey the mean schooling gaps are larger for older age groups, with the cross-survey averages 1.5 years for the 10-12 age group, 2.2 years for the 13-15 age group, 3.4 years for the 16-18 age group, and 5.3 years for the 19-21 age group. This is consistent with human capital models that emphasize the advantage of obtaining a given level of education when as young as possible in order to have as long as possible a post-schooling period in which to reap the returns. The differences in mean schooling gaps across the age groups nevertheless varies a fair amount across surveys, perhaps because different countries have placed different relative emphasis on enrollments at different school levels. That is, if two countries have the same average schooling gaps and the same age distributions but one has relatively higher primary school enrollments and the other relatively higher tertiary school enrollments, the former is likely to have a greater difference between the mean schooling gaps of the youngest and the oldest group than the latter. Another explanation may be different rates of increase of enrollments in the two countries. In any case the difference between the mean schooling gaps for the 10-12 year-old group and the 19-21 year-old group range from 2.0 grades (Bolivia 1995, Peru 1996) to 5.4 to 5.6 grades (Honduras 1989, Honduras 1996, Nicaragua 1993). For nine of the countries for which there is more than one survey, the difference in mean schooling gaps between the oldest and the youngest groups fell over time, with the largest drop equal to 1.4 years for Peru, as would be expected with increasing enrollments starting with close to universal primary enrollments. But for Honduras and Mexico between 1992 and 1994, there were small increases.

Extent of Associations of Schooling Gaps with Measured Family Background: How strongly associated are these schooling gaps with family background? To explore this question we first regress the schooling gap (SGAP) on three indicators of family background -- father's schooling (S_f), mother's schooling (S_m), household income (Y_h)¹⁵, two controls (CON, whether a household is rural or urban and limited demographic characteristics of the household, e.g. whether it is a female-headed household), and a stochastic disturbance term (e):

$$(1) \text{ SGAP} = a_0 + a_1 S_f + a_2 S_m + a_3 Y_h + a_4 \text{CON} + e.$$

¹⁵When the child for which the gap is measured earns an income, we subtract such income from the total household per capita income.

We use the first three family background measures to represent variations in family background across households in each subsample.¹⁶ From the estimated coefficients we construct a proportional family background immobility index for age groups 10-12, 13-15, 16-18 and 19-21. The index is defined as the proportion of the variance in the schooling gap of each age group that is associated with the weighted average of parental schooling and household income, where the weights are the regression coefficient estimates for these three variables. Our *prior* is that using these three indicators of family background is likely to lead to an underestimate, if anything, of the total effects of family background because these three measures are correlated less than perfectly with some aspects of family background that may be relevant, such as long-run income or wealth, influence and

¹⁶ An alternative interpretation is that this relation represents an intergenerational adjustment towards equilibrium. If the schooling gap is expected schooling (S_e) minus schooling actually attained (S) and in equilibrium schooling is the same for the father, mother and child, relation (1) can be solved to obtain $S = (a_0 - S_e + a_3 Y_h + a_4 CON + e)/(-1 - a_1 - a_2)$. The equilibrium value changes over time, of course, because the numerator is not constant. From this perspective the impact of family background on the equilibrium schooling can be viewed as $a_3 Y_h/(-1 - a_1 - a_2)$, which is an alternative way of characterizing the impact of family background on schooling. We do not explore this alternative in this paper because in our judgement it would place undue emphasis on the role of current household income (the only common Y_h variable across the surveys that we use).

connections.¹⁷

Table 3 summarizes how consistent these three family background measures are with variances in schooling gaps for each of the four age groups and for the average across the age groups in each of the 28 surveys. The overall average across all age groups and all surveys is 0.1698, suggesting that the central tendency is for these three family background indices to be consistent with about a sixth of the sample variations across children in schooling gaps. But there are considerable variations across surveys and across age groups.

Across surveys the averages for all four age groups range from 0.0874 for Bolivia 1986 to 0.2773 for Brazil 1995. The surveys for which these three indices of family background on the average are consistent with less than 10 percent of the variance in schooling gaps are (in increasing

¹⁷ Behrman and Knowles (1997) report, for example, that for a Vietnamese household survey the estimated impact of indicators of household income increase in magnitude an average of 50-60% if a permanent income measure is used instead of current income. Likewise studies of intergenerational earnings/income correlations for the U.S. find correlations that are about twice as high if more permanent income measures are used rather than annual measures (e.g., Behrman and Taubman 1990, Solon 1992, Zimmerman 1992). We are not able to explore what would happen with a permanent income measure in the present study, however, because the information to construct such a measure is not available in most of the household surveys that we use. With regard to parental schooling, we are limited to years of completed schooling. But school quality also may have an impact on income and school quality, while correlated with years of schooling, is far from perfectly correlated with years of schooling (e.g., Behrman and Birdsall 1983 for a study for Brazil). This again suggests that our representation of family background is partial. There are a number of studies, finally, that control for unobserved family endowments by using family and/or longitudinal data and find that there are effects of unobserved family background factors beyond the effects of observed family background such as parental schooling, income and occupation (e.g., Behrman, Hrubec, Taubman and Wales 1980, Behrman and Wolfe 1984, Pitt, Rosenzweig and Hassan 1990, Rosenzweig and Schultz 1987, Rosenzweig and Wolpin 1995).

order of their consistency) Bolivia 1986, Chile 1994, and Bolivia 1995. The surveys for which these three indices of family background on the average are consistent with more than 20 percent of the variance in schooling gaps are (in decreasing order of their consistency) Brazil 1995, Brazil 1981, Peru 1985, Honduras 1989, El Salvador 1995, Paraguay 1995, Honduras 1996 and Peru 1996. For seven of the 11 cases in which there are at least two surveys for the same countries, the consistency of these three family background variables with variance in the schooling gap fell between the surveys, with the largest drop in absolute terms the one of 0.0560 for Argentina. The four exceptions are Bolivia, Brazil, Costa Rica and Mexico between 1984 and 1989, with the last of these -- 0.0463 --the only one that is greater than 0.02

Across age groups on the average there is a strong tendency for the consistency of the three family background variables with the schooling gaps to increase with child age: overall averages of 0.1129 for the 10-12 year-old age group, 0.1452 for the 13-15 year-old age group, 0.1905 for the 16-18 year-old age group, and 0.2307 for the 19-21 year-old age group. Thus on the average the estimated family background effects are consistent with over a fifth of the variance in the schooling gap for the oldest of these four age groups, as compared with a little over a tenth for the youngest of these four age groups. For most of the individual surveys (and for over 90% of the transitions between adjoining age groups) the consistency also increases monotonically with age.¹⁸ Nevertheless there are considerable variations across surveys in the extent to which the consistency of these three family background with schooling gaps changes across age groups. At the extremes are Bolivia 1995 with less than 0.01 difference between the youngest and oldest age groups and Argentina 1996 and Colombia 1995 with a difference greater than 0.25 between these two age groups.

¹⁸ Among the 84 (= 3*28) transitions from younger to older age groups, there are seven (8.3%) for which there is not an increase: five between the 10-12 year-old and 13-15 year-old age groups (Argentina 1980, Bolivia 1986, Bolivia 1995, El Salvador 1995, Venezuela 1981) and one each for the transitions between the 13-15 year-old and 16-18 year-old age groups and between the 16-18 year-old and 19-21 year-old age groups (Nicaragua 1993 and Panama 1995, respectively).

Thus, though there is considerable variation across surveys and across age groups, these three family background variables are consistent with from 1 to 32% of the variation in age-group specific schooling gaps,¹⁹ with an average consistency of about one sixth. There also is a strong tendency for this consistency to increase with the children's ages, which is consistent with our conjecture that family background is likely to be more important in the Latin American region in the mid and late teenage years during which marginal decisions about continuing or not in school are concentrated.

Estimation of Indices of Intergenerational Schooling Mobility Based on Child Schooling Gaps and Observed Family Background: We undertake our estimates of intergenerational schooling mobility by first estimating relation (1) for each of the 559 ($=28*5*4-1$)²⁰ survey-quintile-age group subsamples. We subdivide the surveys by quintiles and by age groups because: (a) we are particularly interested in the poorest households in the bottom quintile, (b) we anticipate that there may be nonlinearities in the associations between our indicators of family background and schooling gaps for each age group, (c) we anticipate that there are differences across age groups, and (d) this increases our sample size for the estimates of the relation between family background and macro characteristics to which we turn in Section 4 using sample subdivision by characteristics that are not likely to be affected by the macro variables considered there.

The first three columns in Table 4 summarize the average values of the coefficient estimates for the three indicators of family background for each survey (averaged across quintiles and age groups), for each quintile (averaged across surveys and age groups), and for each age group

¹⁹ The range is from 0.0077 for the 10-12 year-old age group in Argentina 1996 to 0.3162 for the 19-21 year-old age group in Brazil 1995.

²⁰ See note 4.

(averaged across surveys and quintiles). To make the income units comparable across surveys, we transformed the survey incomes into purchasing power parity adjusted 1985 US dollars.²¹

Consider first current household income. For all 28 surveys the average coefficient estimates across quintiles and age groups are negative, suggesting that generally within the quintile subsamples there is a negative association between schooling gaps for children 10-21 years old and household incomes. This is consistent with a better family background mattering in the sense of the household having higher income being associated with a smaller schooling gap. Examination of the coefficient estimates by quintiles for each of the individual surveys suggests a tendency for the income coefficient estimates to be more negative (i.e., larger in magnitude) for lower quintiles. In about a third of the cases the quintile income coefficient estimates that is most negative is for the lowest quintile and in over half it is for the lowest two quintiles. Likewise examination of the coefficient estimates by age groups for each of the individual surveys suggests a tendency for the income coefficient estimates to be more negative (i.e, larger in magnitude) for older age groups.

²¹ Adjustment factors were obtained from World Penn Tables 1995 and from World Bank World Development Indicators, 1998.

Consider next parental schooling. Both father's and mother's schooling generally (though not always) have significantly negative coefficient estimates in the 559 underlying equations so more parental schooling reduces the schooling gap on the average for all 28 surveys, as we anticipated *a priori*.²² For both father's and mother's schooling the coefficient estimates also tend to decline in magnitude (i.e., be less negative) with higher education quintiles (though not for every survey). This inverse association tends to be fairly strong for both father's and mother's schooling, with the average coefficient estimate for the first relative to the fifth quintile equal to 472% for father's schooling and 345% for mother's schooling (though for both father's and mother's schooling the average for the third quintile is higher than that for the second quintile). For both father's and mother's schooling the coefficient estimates also tend to increase in absolute magnitudes for the older age groups -- e.g., those for the 19-21 year-old group are over three times as large as those for the 10-12 year-old age group for both father's and mother's schooling. This is consistent with parental schooling being more associated with child schooling gaps for older children for whom most marginal schooling decisions are made. For the countries for which there are two surveys, the coefficient estimates of both father's and mother's schooling decreased in seven of the 11 cases.

For 26 of the 28 survey averages, for every quintile average and for every age group average, the absolute magnitude of the coefficient estimate is larger for mother's schooling than for father's schooling (though in some cases not by much). For the overall average the coefficient of mother's schooling is 50 percent larger than that for father's schooling. This pattern is consistent with the conventional wisdom about mothers being more important than fathers in how children are raised and educated. But two points merit mention. First, a larger part of the effect of father's schooling than of mother's schooling may be working through household income because in the majority of households males are the larger earners. Second, even though this pattern is accepted as conventional wisdom, the relative discrepancies that we find are much larger than what is reported on the average in previous studies. Behrman (1997), for example, reviews 237 estimates of associations between child schooling and mother's schooling and finds that in the studies that also have father's schooling,

²² For Argentina 1996 the mean estimates across quintile-age groups are positive.

only in 52 percent of the cases is the coefficient estimate larger for mother's than for father's schooling. In contrast, among the 559 underlying estimates that we obtain, the coefficient estimate for mother's schooling is larger than that for father's schooling in 75 percent of the cases.

One last, but important, point about the coefficient estimates for parental schooling is that, although they tend to be significant and of the *a priori* expected negative sign, their magnitudes are not all that great. For the overall averages, a three-year higher level of father's schooling would be associated with a reduction in the schooling gap of about 0.3 grades and a three-year higher level of mother's schooling would be associated with a reduction of about 0.4 grades. **B**respectively about a tenth and a sixth of the average gap. For the bottom quintile, the effects are somewhat larger **B**about 0.5 and 0.6 grades, respectively, for three-year higher levels of father's and mother's schooling. Likewise the effects for the 19-21 year-old group are even larger **B**about 0.6 and 0.9 grades, respectively, for three-year higher levels of father's and mother's schooling.

From the estimated coefficients of the three family background variables we construct two basic intergenerational schooling mobility indices: (1) the **A**proportional intergenerational schooling mobility index@that we define as the proportion of the variance in the schooling gap that is associated with the weighted average of parental schooling and household income, where the weights are the regression coefficient estimates for these three variables, and (2) the **A**gap-adjusted intergenerational schooling mobility index@that we define as the proportion of the variance in the schooling gap that is associated with the weighted average of parental schooling and household income multiplied by the average gap relative to the expected schooling for that subsample). We normalize each of these indices so that they fall between 0 and 100 inclusively and so that increases within this range indicate greater intergenerational schooling mobility (and lesser influence of family background). These two indices are positively correlated (with a correlation coefficient of 0.79) but represent somewhat different aspects of intergenerational mobility related to schooling.

Our proportional intergenerational schooling mobility index is constructed to be invariant to the absolute magnitude of the schooling gap. Bolivia 1986 and Honduras 1989 both have the same

proportional intergenerational schooling mobility index (42.0). But the average schooling gaps from these two surveys differ substantially **B**1.6 grades and 5.2 grades, respectively. There is a sense, therefore, in which it can be argued that family background had a more important absolute effect on the schooling gap in Honduras 1989 than in Bolivia 1986 because the gap is so much larger in the former. Our gap-adjusted intergenerational schooling mobility index captures the fact that the absolute magnitude in terms of grades of schooling of the family background association with the gap is much larger for Honduras 1989 than for Bolivia 1986 -- at the averages for these two surveys, 53.7 versus 85.0 -- even though the proportional intergenerational schooling mobility index is identical for these two surveys.

The last two columns in Table 4 give the average values of our two intergenerational schooling mobility indices for the 28 surveys, for the quintiles and for the four age groups. The range of values across surveys is, as noted, from 100 (Chile 1994) to 0 (Brazil 1981) by construction (the end points happen to be the same for the two indices). The range in averages across quintiles is smaller than across surveys, with the lowest mean for the proportional index at 38.3 for the fifth quintile and the highest mean for that index at 63 for the third quintile but the second lowest at 53.1 for the first quintile -- so obviously this index does not have a strong association with the parental schooling quintiles. For the gap-adjusted index, in contrast, the means increase monotonically from 55.4 for the first quintile to 80.2 for the fifth quintile. For both of these mobility indices, the ranges that are intermediate in magnitude (i.e., larger than for quintiles and smaller than for surveys) for the means for age groups, which also have monotonically decreasing values: from 66.7 to 2.5 for the proportional index and from 78.0 to 36.8 for the gap-adjusted index.

4. How is Intergenerational Schooling Mobility Associated with Macro Conditions and Aggregate Schooling Policy Variables?

The discussion at the end of Section 2 suggests that macro measures of market development, of the level of development, of instability and aggregate measures of schooling policies may affect how great is intergenerational schooling mobility through affecting the extent of market imperfections and the extent to which policies related to schooling offset or increases such imperfections. In this section we explore whether there is empirical evidence consistent with such possibilities from recent Latin American experience. We undertake this exploration by regressing our two intergenerational schooling mobility indices for our 559 subsamples on a parsimonious set of four macro and three aggregate schooling policy variables:

Macro variables:

GDP per capita (purchasing-power-parity adjusted); from the World Penn Tables 1995 and World Bank World Development Indicators, 1998.

Trade openness (exports plus imports over GDP); from World Penn Tables 1995 International Monetary Fund, International Financial Statistics, various issues.

Financial depth (M2 over GDP); constructed from data in International Monetary Fund, International Financial Statistics, various issues.

Inflation rate; constructed IDB (1997).

Schooling policy variables:

Government expenditures on all levels of education over GDP; from UNESCO Statistical Yearbook, 1982-1997

Government expenditures on primary schooling per person of primary school age adjusted for purchasing power parity (PPP); constructed with data from UNESCO Statistical Yearbooks, 1982-1997. To adjust for PPP, we use the World Penn Tables 1995 and the World Bank Development Indicator 1998, and to obtain number of persons in primary age school we use the United Nations Population Statistics, 1996 revision.

Average school quality, as represented by average schooling of teachers; calculated from the 28 household surveys used for the econometric estimation of the family background index.

These variables were selected on the basis of their availability and their probable centrality in our judgement for the question being investigated.²³ In order to capture the macro-effects over the time that children in the samples were making schooling decisions at the margin, we chose different reference periods for each age group. For children in the 10-12 age group we use averages over two years (the year of the surveys and the previous year); for 13-15, 16-18 and 19-21 year olds use three, four and five year averages, respectively.

The period of reference all of these macro variables are averages over five years (the year of the survey and the previous four years) in order to capture medium-run macro effects over the time that children in the samples were making schooling decisions at the margin.

Table 5 presents the correlations among the two intergenerational schooling mobility indices and these four macro and three aggregate schooling variables. The two intergenerational schooling mobility indices are fairly correlated as noted above. Each is positively correlated with the trade openness, financial depth and school quality and negatively correlated with overall educational

²³ We also have explored the inclusion of some other aggregate variables (e.g., Gini coefficients to represent distribution) but they do not have statistically significant coefficient estimates nor affect the other estimates significantly, so in the interests of simplicity and clarity we do not include these variables in the estimates that are discussed below.

expenditures and inflation rates.²⁴ Though the absolute magnitudes of these correlations are not all that large (all are smaller than 0.25), their signs generally are consistent with improved macro performance and schooling policies increasing intergenerational schooling mobility, with the notable possible exception of overall school expenditures.

Table 6 presents two sets of random effects multi variate estimates for our two intergenerational schooling mobility indices, the proportional one and the gap-adjusted one. We use random effects because of the possibility of correlated disturbances due to the use of 20 age-quintile subsamples from each survey. For each estimate a Hausman specification test accepts the null hypotheses that the differences between fixed effects and random effects coefficients are not systematic (Chi² tests and probability levels are given in the table). For the first estimate for each dependent variable, the right-side variables are the seven macro and aggregate schooling variables and additive dummy variables for the parental schooling quintiles and child age groups. For the second estimate for each dependent variable, in addition are included multiplicative quintile dummy variables to allow the coefficients for the first and fifth quintiles to differ from those for the other three quintiles. We focus on the possibilities that the coefficients may differ for the bottom and top quintiles because we are particularly interested in these quintiles (particularly the bottom one) from a distributional perspective and because our *priors* **B**reinforced by the patterns in the dependent variables noted in Section 3 **B** are that any nonlinearities are likely to be manifested most clearly in the tails of the distribution.

We note five important characteristics of these estimates:

First, the specifications are significant and consistent with a fair amount of the variance in the intergenerational schooling mobility indices. Chi² tests indicate that each of these four estimates is significant at the 0.0000 level. The R²s indicate that these associations are consistent with from 18.6 to 28.9% of the variance in the intergenerational schooling mobility indices, with greater consistency

²⁴ But the first is positively and the second negatively correlated with GDP per capita and expenditures on primary schooling.

with the gap-adjusted index. Particularly given the limited representation of the macro environment and school policies by just seven fairly crude aggregative variables, this consistency is supportive of our basic conjecture that macro and aggregate schooling factors importantly shape the associations between family background and schooling investment gaps and therefore intergenerational schooling mobility.

Second, on a general level the four specifications suggest the same sign patterns for most of the coefficient estimates of the four macro and three aggregate schooling variables and quintile and age-group controls (details are discussed below in next three points). Therefore our basic results seem generally robust to several specification alternatives.

Third, there is some evidence that the effects differ by parental schooling quintiles, but the relevant estimates differ somewhat depending on which intergenerational school mobility index is used and whether or not there are quintile interactions in addition to additive quintile effects included in the specification. As noted, we focus in these estimates on whether the first and/or the fifth quintile differ from the others. (We have found no evidence of significant differences among the middle three quintiles in other estimates not presented here.) Joint tests indicate that additive quintile effects are significantly nonzero for three of the four estimates (the exception is the second estimate for the first intergenerational schooling mobility index). For the proportional intergenerational school mobility index, the point estimates for the additive quintile effects weakly suggest that the fifth quintile has lesser social mobility than the first, but the second-fourth quintiles possibly more. For the gap-adjusted intergenerational mobility index, the point estimates for the additive quintile effects suggest a definite monotonic increase in social mobility with higher parental-schooling quintiles if there are only additive quintile effects, though the estimates are much less precise with one deviation from a monotonically increasing pattern if there also are interactive quintile effects.

Joint tests for the multiplicative quintile effects indicate significance at a high level (i.e., 0.0010 and 0.0008, respectively) for both intergenerational schooling mobility indices. But joint tests also suggest that which quintile differs significantly from the other four differs for the two dependent

variables: for the proportional intergenerational schooling mobility index only the interactions involving the fifth quintile differ significantly from the others, while for the gap-adjusted intergenerational schooling mobility index only the interactions involving the first quintile differ significantly from the others. The individual coefficient estimates indicate that for the proportional intergenerational schooling mobility index, social mobility increased significantly more for the fifth than the other quintiles with higher quality schooling but less than for the other quintiles (at the 10% level) with greater overall governmental schooling expenditures. The individual coefficient estimates also indicate that for the gap-adjusted intergenerational schooling mobility index, social mobility increased significantly more for the first than the other quintiles with greater overall educational expenditures but less than for the other quintiles with higher inflation.

Fourth, there is strong evidence that the estimates differ by age groups, but that all of these effects are additive. Joint tests indicate that the additive age group dummy variables are significant at the 0.0000 level in each of the four estimates. The individual parameter estimates indicate decreasing social mobility with increased age each for each of the four estimates. But adding interactions with age-group dummy variables does not result in any significant differences. For example, if age-group interactions are added to the second specification for each of the two dependent variables to allow for the possibility that the coefficient estimates of the macro and aggregate schooling variables differ for the youngest and for the oldest age-groups (compared with the middle two age groups), χ^2 tests for joint parameter significant reject the significance of these interaction terms ($\chi^2 = 10.75$ (probability = 0.7059), $\chi^2 = 12.20$ (0.5902), respectively). Thus, the substantial age differentials noted with regard to Tables 2 and 3 result only in additive shifts, not differential coefficients for the macro and aggregate schooling policy variables.

Fifth, a number of the macro and aggregate schooling variables have significant coefficient estimates, with plausible *a priori* interpretations.

Two of the macro variables have significant coefficient estimates. The first is for financial depth, which is probably our best single indicator of the extent of general internal market development. Financial depth has significant positive effects that are robust across the four specifications. Within the framework discussed in Section 2, these provide strong support for the role of internal market development in increasing social mobility.²⁵

The second macro variable with significant coefficient estimates is inflation, for which there is relatively great *a priori* ambiguity regarding the expected sign. If inflation effectively increases imperfections in markets by reducing the quality of information due to rapidly changing absolute and relative prices, negative coefficient estimates would be expected. But inflation may work in the opposite direction by increasing the sensitivity to market changes given the high cost of lags in market behavior or may weaken the capacity for families to cope with rapid changes, both of which may lead to positive associations of the intergenerational indices with inflation. The latter type effects seem to dominate for both intergenerational school mobility indices, with significant coefficient estimates for the gap-adjusted index.

Two of the three aggregate schooling policy variables have significant coefficient estimates. School quality has significant positive effects for all four specifications (based on joint tests with quintile interactions for the second specification). PPP adjusted governmental expenditures on primary schools relative to the pool of primary-age students has positive coefficient estimates in all four specifications that are significantly nonzero in the specifications for the gap-adjusted intergenerational school mobility index (based on joint tests with quintile interactions for the second of these specifications). Total governmental expenditure on education, in contrast, has negative (though not significant even at the 10 percent level) coefficient estimates in all four specifications. These negative estimates weakly suggest that, once there is control for resources devoted to primary

²⁵ Financial depth may be representing in part the effects of trade openness on improving the functioning of internal markets because the correlation between these two variables is fairly high at 0.53 (Table 5).

schooling and to improving school quality at the basic levels, the total educational expenditures are reflecting largely expenditures that, if anything, reinforce family background and reduce intergenerational social mobility, such as public subsidies for tertiary schooling for children of upper-middle and upper class families.

Thus there seems to be strong support for our basic conjecture in this paper that market reforms, through affecting the extent of market imperfections, and the nature of aggregate public educational expenditures both can have important effects on the role of family background in determining schooling and, through this channel, on intergenerational social mobility. Therefore, although the recent macro changes and schooling policy changes in the region have not had as strong effect on the current income distribution as some may have hoped, they well may have had important and largely positive effects on increasing intergenerational social mobility. Such effects may make recent policies more politically acceptable and therefore sustainable and may have longer-run equalizing and growth-inducing effects on the economies in the region.

5. Conclusions

This paper contributes to our understanding of the nature and extent of schooling gaps and to what extent they are associated with family background in the Latin American region and to whether intergenerational schooling mobility is associated with macro and aggregate schooling policy characteristics of economies.

The empirical estimates in the paper have three important implications. First, they are consistent with family background having significant associations with schooling gaps in the region, though with differences across countries, across time, across parental schooling quintiles, and across child age groups. Second, and more important for our purposes and in terms of contributions to the literature, the empirical estimates suggest that macro conditions **B** in particular those related to the extent of internal market development **B** importantly shape intergenerational schooling mobility.

Third, and also more important for our purposes and in terms of contributions to the literature, the empirical estimates suggest that aggregate school policies that are directed towards increasing resources available for basic schooling in general and for improving school quality in particular have important positive impact on intergenerational schooling mobility, though other educational expenditures such as those on tertiary education may reinforce the impact of family background and reduce intergenerational social mobility. Thus, even though the immediate effects of macro market reforms and schooling policy reforms on current income distribution may not have been that strong, there may be important longer-run effects through increasing intergenerational social mobility.

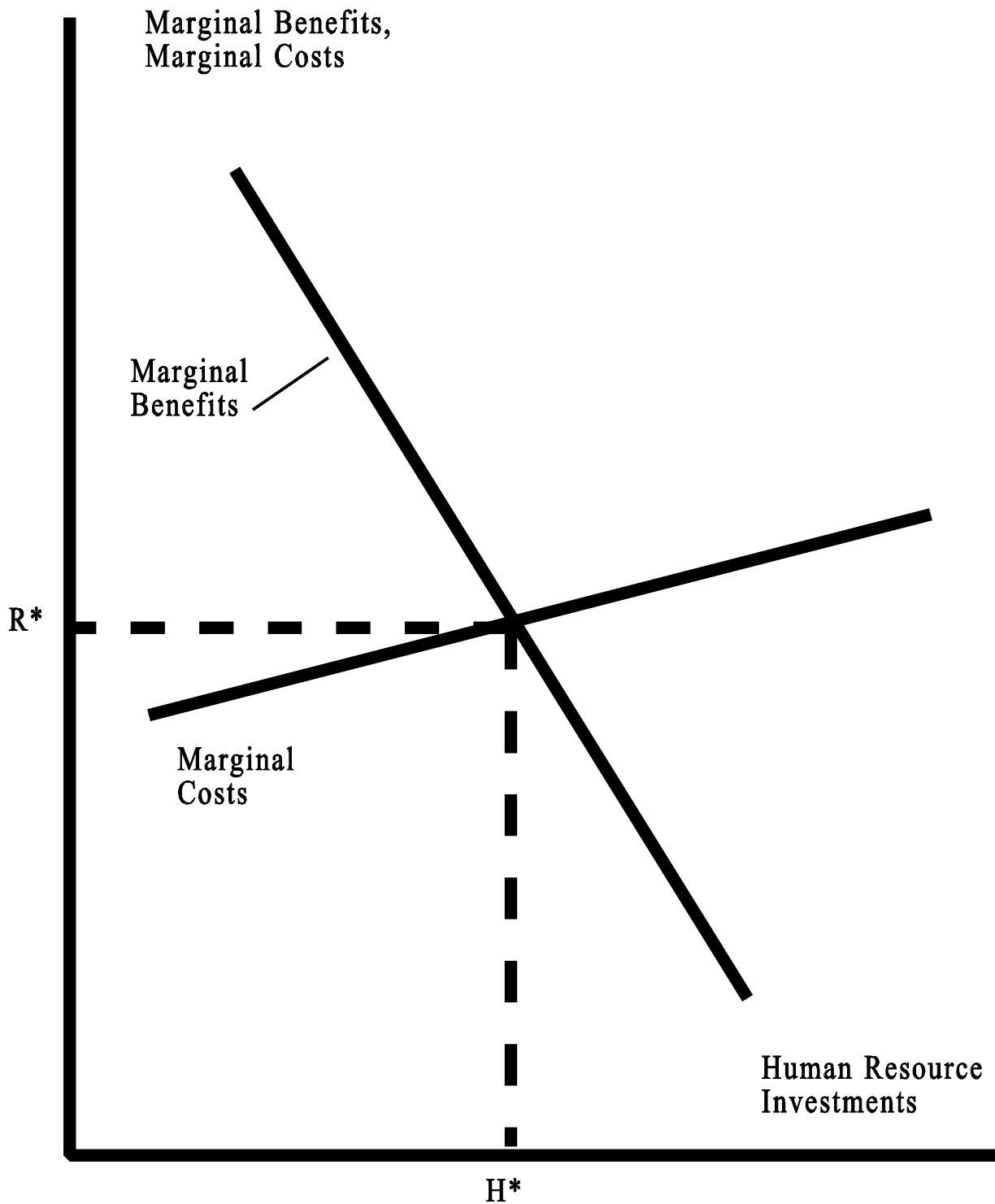


Figure 1-1. Private Marginal Benefits and Private Marginal Costs of Human Resource Investments

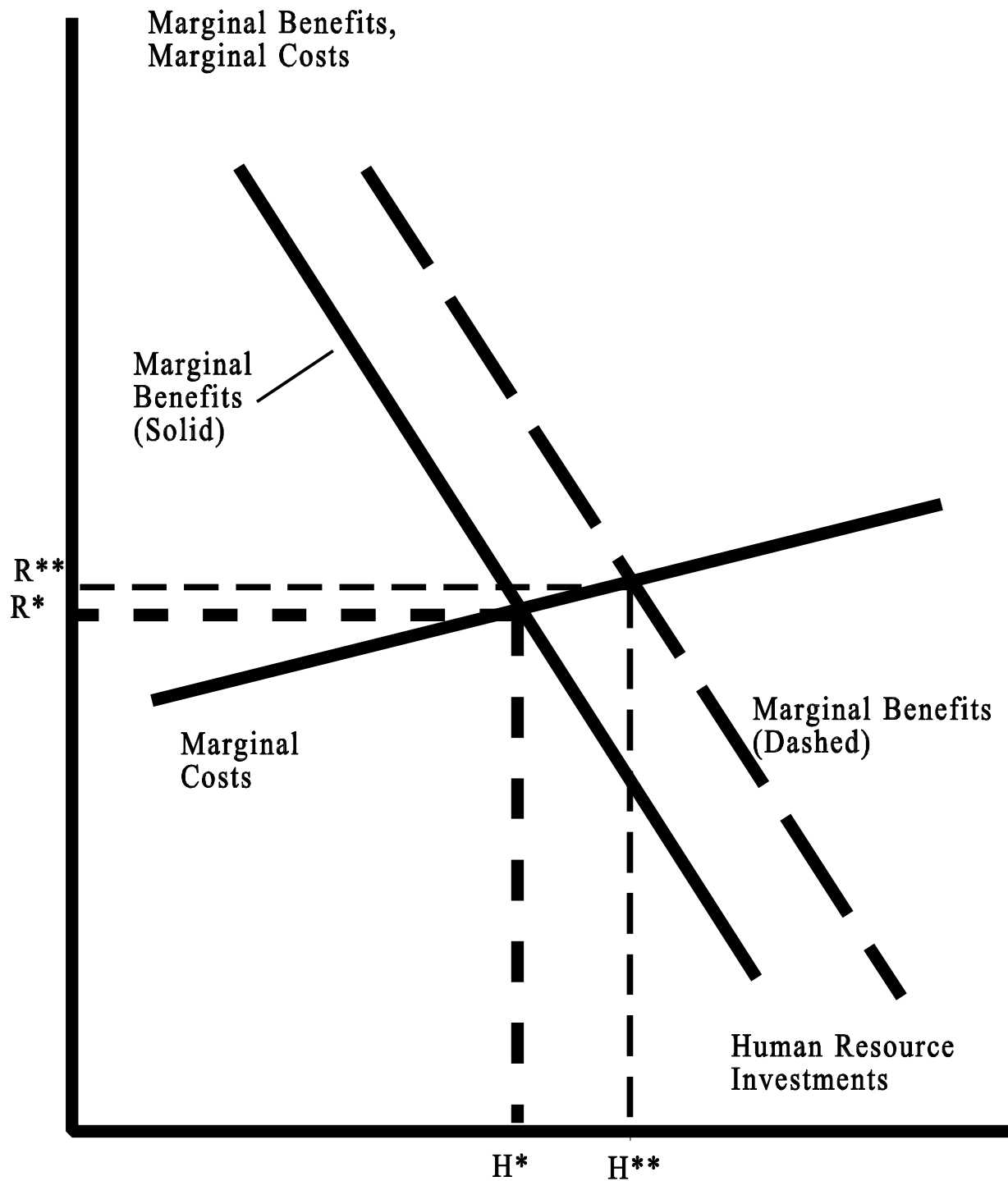


Figure 1-2. Private Marginal Benefits and Private Marginal Costs of Human Resource Investments, with Marginal Benefits Dependent on Income

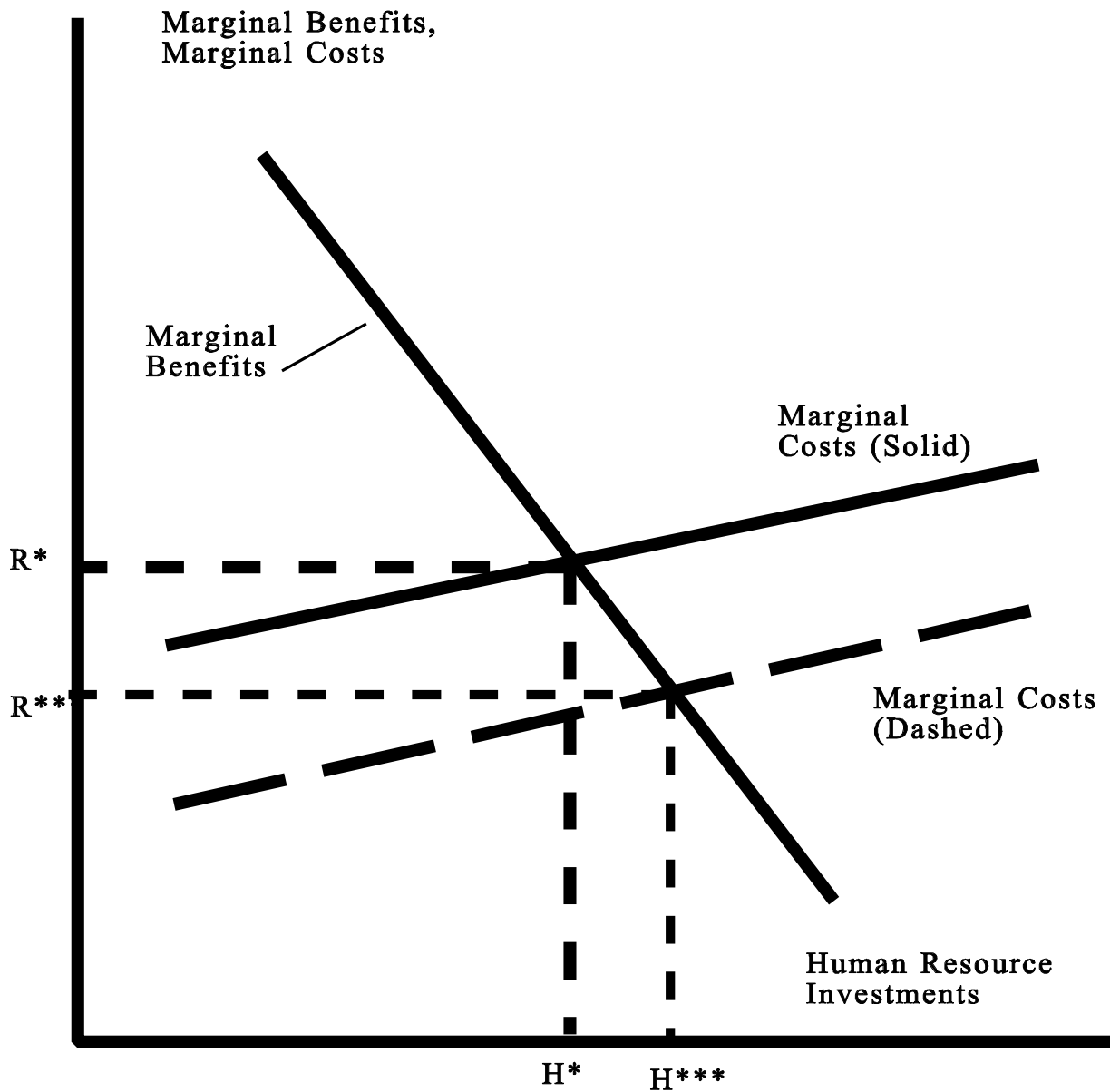


Figure 1-3. Private Marginal Benefits and Private Marginal Costs of Human Resource Investments, with Marginal Costs Dependent on Income

Table 1. Schooling Gaps as Percentage of Expected Schooling Conditional on Age for Ages 10-21 Overall and Schooling Gaps in Years Overall and by Parental Schooling Quintiles^a

| Country | Year | Average Schooling Gap | | Schooling Gaps in Years by Parental Schooling Quintiles | | | | |
|----------------------|------|-----------------------|---------------------------------|---|-----|-----|-----|-----|
| | | Years | % of Expected Schooling for Age | 1 | 2 | 3 | 4 | 5 |
| Argentina | 1980 | 2.0 | 19.2% | 3.4 | 2.2 | 2.1 | 1.5 | 0.6 |
| | 1996 | 2.5 | 27.2 | 3.1 | 2.2 | 1.9 | 1.2 | 1.4 |
| Bolivia | 1986 | 1.6 | 16.3 | 2.4 | 1.4 | 1.5 | 1.5 | 1.2 |
| | 1995 | 1.4 | 15.8 | 2.2 | 1.7 | 1.3 | 1.0 | 1.0 |
| Brazil | 1981 | 5.5 | 57.5 | 7.7 | 6.3 | 5.6 | 4.6 | 3.2 |
| | 1995 | 4.6 | 48.0 | 6.9 | 5.6 | 4.4 | 3.7 | 2.6 |
| Chile | 1987 | 1.7 | 17.4 | 2.9 | 2.0 | 1.4 | 1.3 | 0.9 |
| | 1994 | 1.5 | 14.7 | 2.3 | 1.9 | 1.3 | 1.1 | 0.8 |
| Colombia | 1995 | 3.3 | 36.8 | 4.7 | 3.5 | 2.9 | 2.6 | 2.7 |
| Costa Rica | 1981 | 3.2 | 30.2 | 4.6 | 3.7 | 3.0 | 2.6 | 1.9 |
| | 1995 | 3.1 | 30.6 | 4.6 | 3.6 | 3.2 | 2.6 | 1.7 |
| Ecuador | 1995 | 2.7 | 26.5 | 4.3 | 3.5 | 2.4 | 2.0 | 1.2 |
| El Salvador | 1995 | 4.1 | 43.1 | 6.0 | 5.4 | 4.1 | 3.1 | 1.7 |
| Honduras | 1989 | 5.2 | 50.9 | 6.8 | 5.8 | 4.9 | 4.6 | 3.6 |
| | 1996 | 4.7 | 45.2 | 6.3 | 5.4 | 4.7 | 3.9 | 3.0 |
| Mexico | 1984 | 3.4 | 37.5 | 4.7 | 3.7 | 3.3 | 3.1 | 2.3 |
| | 1989 | 3.1 | 33.7 | 4.8 | 3.3 | 2.7 | 2.4 | 2.2 |
| | 1992 | 2.9 | 32.7 | 4.6 | 3.5 | 2.5 | 2.3 | 1.6 |
| | 1994 | 2.9 | 32.9 | 4.6 | 3.5 | 2.7 | 2.0 | 1.9 |
| Nicaragua | 1993 | 4.6 | 44.9 | 5.7 | 5.2 | 4.6 | 4.2 | 3.5 |
| Panama | 1995 | 2.1 | 20.5 | 3.7 | 2.4 | 1.7 | 1.4 | 1.0 |
| Paraguay | 1995 | 3.5 | 36.3 | 5.0 | 4.2 | 3.3 | 2.7 | 2.2 |
| Peru | 1985 | 2.7 | 28.1 | 4.7 | 3.1 | 2.1 | 1.9 | 1.5 |
| | 1996 | 2.6 | 31.8 | 4.0 | 3.0 | 2.6 | 1.8 | 1.3 |
| Uruguay | 1981 | 2.3 | 23.4 | 3.6 | 2.9 | 2.3 | 1.7 | 1.2 |
| | 1995 | 2.0 | 18.9 | 3.2 | 2.5 | 2.0 | 1.5 | 1.0 |
| Venezuela | 1981 | 3.6 | 35.5 | 5.1 | 4.1 | 3.4 | 3.0 | 2.4 |
| | 1995 | 2.7 | 26.9 | 4.0 | 2.6 | 2.6 | 2.5 | 2.0 |
| Average ^b | | 3.0 | 31.5 | 4.5 | 3.5 | 2.9 | 2.4 | 1.8 |

Source: Authors' calculations from household survey data.

^a Schooling gap defined to be schooling that would have attained at age when surveyed if had began schooling at age six and progressed one grade every subsequent year minus actual number of completed grades (i.e., Expected schooling[®]). Household surveys for Bolivia and Uruguay are urban only and for Argentina are for Gran Buenos Aires only.

^b Equally weighted country averages (not population weighted).

| Table 2. Schooling Gaps for Ages Groups 10-12, 13-15, 16-18 and 19-21 ^a | | | | | |
|---|------|--|-------|-------|-------|
| Country | Year | Schooling Gaps in Years for Age Groups | | | |
| | | 10-12 | 13-15 | 16-18 | 19-21 |
| Argentina | 1980 | 0.7 | 1.2 | 2.3 | 3.9 |
| | 1996 | 1.4 | 2.8 | 2.0 | 3.9 |
| Bolivia | 1986 | 0.7 | 1.1 | 1.7 | 3.1 |
| | 1995 | 0.8 | 1.1 | 1.6 | 2.8 |
| Brazil | 1981 | 3.1 | 4.5 | 6.0 | 8.0 |
| | 1995 | 2.5 | 3.6 | 5.1 | 7.1 |
| Chile | 1987 | 0.5 | 1.1 | 2.1 | 3.8 |
| | 1994 | 0.5 | 0.9 | 1.7 | 3.2 |
| Colombia | 1995 | 2.2 | 2.7 | 3.5 | 5.3 |
| Costa Rica | 1981 | 1.1 | 1.8 | 3.7 | 6.0 |
| | 1995 | 1.3 | 1.9 | 3.4 | 5.7 |
| Ecuador | 1995 | 1.1 | 1.8 | 3.1 | 4.8 |
| El Salvador | 1995 | 2.3 | 3.2 | 4.6 | 6.3 |
| Honduras | 1989 | 2.5 | 3.6 | 5.7 | 8.0 |
| | 1996 | 2.0 | 3.2 | 5.2 | 7.6 |
| Mexico | 1984 | 1.8 | 2.6 | 3.9 | 6.5 |
| | 1989 | 1.7 | 2.3 | 3.5 | 5.5 |
| | 1992 | 1.6 | 2.3 | 3.4 | 5.4 |
| | 1994 | 1.6 | 2.2 | 3.5 | 5.6 |
| Nicaragua | 1993 | 2.0 | 3.2 | 5.1 | 7.4 |
| Panama | 1995 | 0.8 | 1.3 | 2.3 | 4.0 |
| Paraguay | 1995 | 1.7 | 2.5 | 3.9 | 6.1 |
| Peru | 1985 | 1.3 | 2.0 | 3.0 | 4.7 |
| | 1996 | 2.2 | 2.3 | 2.8 | 4.2 |
| Uruguay | 1981 | 0.9 | 1.6 | 2.6 | 4.4 |
| | 1995 | 0.7 | 1.2 | 2.2 | 3.8 |
| Venezuela | 1981 | 1.6 | 2.4 | 3.9 | 6.3 |
| | 1995 | 1.1 | 1.8 | 3.0 | 5.1 |
| Average ^b | | 1.5 | 2.2 | 3.4 | 5.3 |
| Source: Authors' calculations from household survey data. | | | | | |
| ^a Schooling gap defined to be schooling that would have attained at age when surveyed if had began schooling at age six and progressed one grade every subsequent year minus actual number of completed grades. Household surveys for Bolivia and Uruguay are urban only and for Argentina are for Gran Buenos Aires only. | | | | | |
| ^b Equally weighted country averages (not population weighted). | | | | | |

| Table 3. Proportional Family Background Immobility Indices for Age Groups 10-12, 13-15, 16-18 and 19-21 and Overall Average ^a | | | | | | |
|--|------|--------------------------------------|--------|--------|--------|---------|
| Country | Year | Family Background Immobility Indices | | | | |
| | | 10-12 | 13-15 | 16-18 | 19-21 | Average |
| Argentina | 1980 | 0.1125 | 0.0971 | 0.2123 | 0.2392 | 0.1653 |
| | 1996 | 0.0077 | 0.0264 | 0.1410 | 0.2619 | 0.1093 |
| Bolivia | 1986 | 0.0478 | 0.0356 | 0.1052 | 0.1611 | 0.0874 |
| | 1995 | 0.1053 | 0.0757 | 0.0906 | 0.1150 | 0.0967 |
| Brazil | 1981 | 0.2459 | 0.2611 | 0.2717 | 0.2883 | 0.2668 |
| | 1995 | 0.2498 | 0.2538 | 0.2894 | 0.3162 | 0.2773 |
| Chile | 1987 | 0.0649 | 0.0683 | 0.1112 | 0.1906 | 0.1087 |
| | 1994 | 0.0392 | 0.0478 | 0.1167 | 0.1732 | 0.0942 |
| Colombia | 1995 | 0.0117 | 0.1273 | 0.2296 | 0.2633 | 0.1580 |
| Costa Rica | 1981 | 0.0614 | 0.1604 | 0.2236 | 0.2462 | 0.1729 |
| | 1995 | 0.1075 | 0.1652 | 0.2341 | 0.2433 | 0.1875 |
| Ecuador | 1995 | 0.1354 | 0.1603 | 0.2334 | 0.2241 | 0.1883 |
| El Salvador | 1995 | 0.1983 | 0.1859 | 0.2210 | 0.2512 | 0.2141 |
| Honduras | 1989 | 0.1714 | 0.1912 | 0.2408 | 0.3110 | 0.2286 |
| | 1996 | 0.1499 | 0.1780 | 0.2157 | 0.2835 | 0.2068 |
| Mexico | 1984 | 0.0559 | 0.1368 | 0.1556 | 0.1721 | 0.1301 |
| | 1989 | 0.0766 | 0.1755 | 0.1936 | 0.2598 | 0.1764 |
| | 1992 | 0.0722 | 0.1498 | 0.1905 | 0.2275 | 0.1600 |
| | 1994 | 0.0491 | 0.1429 | 0.1822 | 0.2457 | 0.1550 |
| Nicaragua | 1993 | 0.1498 | 0.1840 | 0.1274 | 0.1995 | 0.1652 |
| Panama | 1995 | 0.1020 | 0.1387 | 0.2126 | 0.2060 | 0.1648 |
| Paraguay | 1995 | 0.1373 | 0.1472 | 0.2412 | 0.3042 | 0.2075 |
| Peru | 1985 | 0.2274 | 0.2289 | 0.2306 | 0.2942 | 0.2453 |
| | 1996 | 0.1791 | 0.2008 | 0.2075 | 0.2182 | 0.2014 |
| Uruguay | 1981 | 0.0913 | 0.1406 | 0.1508 | 0.1878 | 0.1426 |
| | 1995 | 0.0600 | 0.1038 | 0.1438 | 0.1632 | 0.1177 |
| Venezuela | 1981 | 0.1456 | 0.1439 | 0.1834 | 0.1945 | 0.1669 |
| | 1995 | 0.1063 | 0.1380 | 0.1774 | 0.2196 | 0.1603 |
| Average ^b | | 0.1129 | 0.1452 | 0.1905 | 0.2307 | 0.1698 |

Source: Authors' estimations from household survey data.

^a Proportion of variance in schooling gaps that is associated with variance in parental schooling and household income based on 559 survey-age group regressions. Household surveys for Bolivia and Uruguay are urban only and for Argentina are for Gran Buenos Aires only.

^b Equally weighted country averages (not population weighted).

Table 4. Average Coefficient Estimates for Father-s Schooling, Mother-s Schooling, and Household Head-s Income and in Estimates for Schooling Gaps for Ages 10-21 and Intergenerational Schooling Mobility Indices, by Surveys, by Parental Schooling Quintiles and by Age Groups^a

| Country | Year | Average Coefficient Estimates for | | | Intergenerational Mobility Indices ^c | |
|-----------------|------|-----------------------------------|--------------------|---------------------------------------|---|-----------------------------|
| | | Father-s Schooling | Mother-s Schooling | Household Current Income ^b | Proportional Mobility Index | Gap-Adjusted Mobility Index |
| Argentina | 1980 | -0.084 | -0.145 | -6.51E-05 | 8.6 | 73.1 |
| | 1996 | 0.0459 | 0.386 | -1.28E-04 | 12.4 | 59.0 |
| Bolivia | 1986 | -0.100 | -0.144 | -1.27E-06 | 42 | 85.0 |
| | 1995 | -0.090 | -0.094 | -1.13E-04 | 80.2 | 95.0 |
| Brazil | 1981 | -0.171 | -0.222 | -2.35E-04 | 0.00 | 0.00 |
| | 1995 | -0.214 | -0.220 | -2.01E-04 | 27.2 | 34.5 |
| Chile | 1987 | -0.055 | -0.082 | -6.42E-05 | 85.2 | 96.0 |
| | 1994 | -0.040 | -0.071 | -2.64E-05 | 100 | 100 |
| Colombia | 1995 | -0.116 | -0.203 | -3.35E-05 | 95.1 | 92.7 |
| Costa Rica | 1981 | -0.086 | -0.152 | -1.71E-04 | 9.9 | 51.3 |
| | 1995 | -0.265 | -0.261 | -1.26E-04 | 69.1 | 79.6 |
| Ecuador | 1995 | -0.110 | -0.182 | -5.02E-05 | 75.3 | 89.3 |
| El Salvador | 1995 | -0.161 | -0.192 | -2.94E-04 | 54.3 | 61.0 |
| Honduras | 1989 | -0.077 | -0.179 | -2.98E-04 | 42 | 53.7 |
| | 1996 | -0.139 | -0.299 | -3.70E-04 | 50.6 | 57.6 |
| Mexico | 1984 | -0.202 | -0.212 | -5.47E-05 | 61.7 | 73.7 |
| | 1989 | -0.169 | -0.195 | -8.13E-05 | 46.9 | 66.9 |
| | 1992 | -0.122 | -0.210 | -9.53E-05 | 44.4 | 63.8 |
| | 1994 | -0.120 | -0.144 | -8.52E-05 | 48.1 | 71.5 |
| Nicaragua | 1993 | -0.124 | -0.184 | -2.90E-04 | 50.6 | 55.4 |
| Panama | 1995 | -0.070 | -0.134 | -1.18E-04 | 63 | 85.7 |
| Paraguay | 1995 | -0.169 | -0.221 | -1.84E-04 | 53.1 | 63.0 |
| Peru | 1985 | -0.124 | -0.094 | -1.09E-04 | 46.9 | 68.3 |
| | 1996 | -0.063 | -0.106 | -1.29E-04 | 58 | 75.8 |
| Uruguay | 1981 | -0.028 | -0.115 | -1.08E-04 | 70.4 | 86.9 |
| | 1995 | -0.083 | -0.113 | -1.00E-04 | 70.4 | 89.9 |
| Venezuela | 1981 | -0.153 | -0.204 | -7.80E-05 | 66.7 | 75.4 |
| | 1995 | -0.085 | -0.143 | -5.87E-05 | 77.8 | 84.0 |
| Quintile 1 | | -0.170 | -0.214 | -3.03E-04 | 53.1 | 55.4 |
| 2 | | -0.081 | -0.149 | -1.76E-04 | 55.6 | 63.2 |
| 3 | | -0.137 | -0.197 | -1.23E-04 | 63 | 76.4 |
| 4 | | -0.073 | -0.115 | -6.96E-05 | 58 | 79.6 |
| 5 | | -0.036 | -0.062 | -2.63E-05 | 38.3 | 80.2 |
| Age Group 10-12 | | -0.065 | -0.098 | -8.98E-05 | 66.7 | 78.0 |
| 13-15 | | -0.105 | -0.160 | -1.35E-04 | 50.6 | 72.7 |
| 16-18 | | -0.115 | -0.176 | -2.12E-04 | 28.4 | 61.2 |
| 19-21 | | -0.210 | -0.303 | -2.61E-04 | 2.5 | 36.8 |
| Overall Average | | -0.098 | -0.148 | -1.30E-04 | 54.3 | 71.1 |

Source: Author-s estimations from household survey data.

^a Survey averages are averages across quintiles. Quintile and overall averages are averages across countries, with countries equally-weighted.

^b Household incomes were transformed into PPP adjusted 1985 US dollars to make the coefficients comparable across surveys

^c See text for definition of intergenerational school mobility indices.

Table 5. Bivariate Correlations Among Variables Used in Analysis of Associations between Intergenerational Schooling Mobility and Macro Variables and Aggregate Schooling Policy Indicators and Means and Standard Deviations (Based on 559 Observations)

| | Correlations Among Variables | | | | | | | | | Mean | Stan. Dev. |
|---|------------------------------|-------|-------|-------|-------|-------|-------|-------|------|------|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| Intergenerational Schooling Mobility Indices | | | | | | | | | | | |
| 1 Proportional Intergenerational Schooling Mobility Index | 1.00 | | | | | | | | | | |
| 2 Gap-Adjusted Intergenerational Schooling Mobility Index | 0.79 | 1.00 | | | | | | | | | |
| Basic Macro Variables with Quintile Interactions | | | | | | | | | | | |
| 3 GDP per capita | 0.07 | -0.01 | 1.00 | | | | | | | | |
| 4 Trade Openness | 0.10 | 0.11 | -0.20 | 1.00 | | | | | | | |
| 5 Financial Depth | 0.25 | 0.15 | 0.09 | 0.53 | 1.00 | | | | | | |
| 6 Inflation Rate | -0.15 | -0.15 | -0.13 | -0.31 | -0.51 | 1.00 | | | | | |
| Aggregate Schooling Policy Indicators | | | | | | | | | | | |
| 7 Gov. Exp. on Education/GDP | -0.04 | -0.05 | -0.03 | 0.51 | 0.32 | -0.10 | 1.00 | | | | |
| 8 Gov. Exp. on Primary Education/Pop. 6-12 Years Old | 0.06 | -0.06 | 0.67 | -0.14 | 0.18 | -0.05 | 0.23 | 1.00 | | | |
| 9 Educational Quality Indicator | 0.25 | 0.23 | 0.06 | 0.19 | 0.40 | 0.48 | -0.22 | -0.16 | 1.00 | | |

Table 6. Estimates of Associations between Intergenerational Schooling Mobility Indices and Macro Variables and Aggregate Schooling Policy Indicators

| | Proportional Intergenerational Schooling Mobility Index | | Gap-Adjusted Intergenerational Schooling Mobility Index | |
|---|---|-------------------|---|------------------|
| Basic Macro Variables with Quintile Interactions | | | | |
| GDP per capita | -3.78E-06 (1.21) | -4.51E-06 (1.39) | -2.14E-06 (1.58) | -2.14E-06 (1.56) |
| * quintile 1 | | 5.97E-07 (0.19) | | -3.18E-07 (0.29) |
| * quintile 5 | | 2.55E-06 (0.81) | | 9.37E-08 (0.08) |
| Trade Openness | 0.0004 (0.03) | 0.00261 (0.16) | 0.0041 (0.55) | 0.00484 (0.63) |
| * quintile 1 | | -0.0218 (1.19) | | -0.00813 (1.26) |
| * quintile 5 | | 0.00113 (0.62) | | 0.00522 (0.81) |
| Financial Depth | 0.0778 (2.73) | 0.0865 (2.69) | 0.049 (4.45) | 0.0498 (4.12) |
| * quintile 1 | | 0.0262 (0.52) | | 0.0206 (1.16) |
| * quintile 5 | | -0.0669 (1.31) | | -0.0273 (1.52) |
| Inflation Rate | 0.0029 (0.30) | 0.00590 (0.53) | 0.0104 (2.95) | 0.0128 (3.21) |
| * quintile 1 | | -0.0322 (1.76) | | -0.0155 (2.40) |
| * quintile 5 | | 0.0163 (0.88) | | 0.00277 (0.42) |
| Aggregate Schooling Policy Indicators | | | | |
| Gov. Exp. on Education/GDP | -0.0047 (1.19) | - 0.004783 (1.13) | -0.0022 (1.35) | -0.00238 (1.42) |
| * quintile 1 | | -0.00875 (1.68) | | 0.00370 (2.01) |
| * quintile 5 | | -0.00886 (1.70) | | -0.00268 (1.45) |
| Gov. Exp. on Primary Education/Pop. 6-12 Years Old | 0.0000336 (1.21) | 0.0000229 (0.78) | 0.000023 (2.04) | 0.0000192 (1.63) |
| * quintile 1 | | 0.0000128 (0.38) | | 5.02E-06 (0.43) |
| * quintile 5 | | 0.0000476 (1.38) | | 0.000017 (1.40) |
| Educational Quality Indicator | 0.0040 (2.24) | 0.00313 (1.60) | 0.0016 (2.14) | 0.00157 (1.99) |
| * quintile 1 | | -0.00136 (0.53) | | -0.000891 (0.98) |
| * quintile 5 | | 0.00597 (2.31) | | 0.00101 (1.10) |
| Additive Quintile Dummy Variables (with Quintile 1 as Reference Category) | | | | |

| | | | | |
|--|-----------------|-----------------|-----------------|-----------------|
| Quintile 2 | 0.0024 (0.48) | 0.00996 (0.23) | 0.0040 (2.31) | 0.00323 (0.21) |
| Quintile 3 | 0.0080 (1.64) | 0.01556 (0.36) | 0.0106 (6.15) | 0.00985 (0.64) |
| Quintile 4 | 0.0045 (0.91) | 0.0121 (0.28) | 0.0123 (7.12) | 0.0115 (0.75) |
| Quintile 5 | -0.0122 (2.49) | -0.0684 (1.28) | 0.0126 (7.27) | 0.00706 (0.38) |
| Additive Age Group Variables (with Ages 10-12 as Reference Category) | | | | |
| Ages 13-15 | -0.00928 (2.11) | -0.00922 (2.14) | -0.00145 (0.94) | -0.00142 (0.93) |
| Ages 16-18 | -0.0241 (5.48) | -0.0241 (5.59) | -0.00636 (4.10) | -0.00636 (4.18) |
| Ages 19-21 | -0.0407 (9.24) | -0.0407 (9.42) | -0.0162 (10.39) | -0.0162 (10.60) |
| Other Estimates and Summary Statistics | | | | |
| Constant | -0.0916 (2.97) | -0.0848 (1.87) | -0.0510 (3.97) | -0.049 (2.85) |
| Overall R ² | 0.186 | 0.227 | 0.259 | 0.289 |
| Chi ² (Prob > Chi ²) | 140.75 (0.0000) | 182.84 (0.0000) | 260.29 (0.0000) | 307.93 (0.0000) |
| Hausman specification test Chi ² (Prob > Chi ²) | 9.64 (0.7882) | 9.87 (0.9994) | 4.62 (0.9904) | 4.66 (0.0000) |
| Joint Chi² Tests of Significance of Groups of Parameters (Probability) | | | | |
| Quintile effects: additive | 19.68 (0.0006) | 4.87 (0.3010) | 84.53 (0.0000) | 27.25 (0.0000) |
| multiplicative | | 36.12 (0.0010) | | 36.61 (0.0008) |
| quintile 1 only | | 11.68 (0.1117) | | 20.83 (0.0040) |
| quintile 5 only | | 19.63 (0.0064) | | 9.30 (0.2315) |
| Age group effects: additive | 97.90 (0.0000) | 101.97 (0.0000) | 132.53 (0.0000) | 138.21 (0.0000) |
| ^a Random effects estimator. Absolute values of z statistics given in parentheses to right of point estimates (z \$1.96 Y significant at 5% level; z \$1.67 Y significant at 10% level). | | | | |

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