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# Schooling Investments and Aggregate Conditions: A Household Survey-Based Approach for Latin America and the Caribbean

by

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**Abstract:** Schooling is a major factor in economic development. There is extensive empirical literature on what determines schooling attainment. But most of this literature uses micro data to explore connections between schooling attainment and family background and experiences, local markets, local schools and other community characteristics. These studies generally have not linked schooling attainment closely to changes in aggregate economic conditions. This paper uses a new high quality data set for 18 Latin American and Caribbean countries to assess the effects of macro conditions on schooling attainment. Household survey data are used to construct a quasi panel with information on attainment for birth cohorts born between 1930 and 1970, which is merged with country-specific aggregate data. We use the data to document schooling progress in Latin America and estimate multivariate relations for schooling attainment by birth cohorts as related to sets of variables for macroeconomic stability, factor endowments, demographic developments, institutions and culture and religion. These estimates are used to decompose the change in schooling progress by decade, and to explore the causes of the slowdown in schooling accumulation in the region since the 1980s debt crisis.

**Keywords:** schooling, education, human capital, macro stability, macro shocks, Latin America and the Caribbean.

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## Introduction

Human capital, particularly that attained through schooling, is a major factor in economic development. The connections between schooling and economic growth, income inequality and poverty are well established both in economic theory and empirically.[1] There also is a growing consensus that schooling is an important development indicator in itself because it affects individual capabilities to satisfy needs through more effective resource use and may be a source of utility *per se*.

Given the importance of schooling, what determines schooling is of considerable interest. There is extensive empirical literature on what determines schooling attainment. Most of this literature, however, uses micro data to explore connections between schooling attainment and family background and experiences, local markets, local schools and other community characteristics.[2] While these studies have illustrated some of the key determinants of schooling progress, they generally have not linked schooling attainment closely to aggregate economic conditions. There are a few exceptions that consider an explicit macro or aggregate context.[3] However, these explorations have been fairly limited and have tended to focus mainly on the short-term effects of macro crises by concentrating on current enrollments, rather than on the permanent effects that aggregate conditions might have on schooling attainment.

From the point of view of Latin America and the Caribbean (LAC), the region discussed in this paper, there is a major question about the impact of aggregate conditions on schooling decisions about which relatively little is known. What has been the impact of macro fluctuations, particularly the "lost decade" of the 1980s,[4] on schooling attainment? There has been much concern that the poor and even

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[1] For examples of aggregate cross-country studies that emphasize schooling within a larger overview of the development process, see Barro (1991), Barro and Lee (1993, 1994), Barro and Sali-I-Martin (1995), King and Hill (1993), Lau *et al* (1996), Page *et al.* (1993), Schultz (1990, 1993), UNDP (1998), and World Bank (1990, 1991). Some examples of studies that focus on the connection between schooling and income distribution are Almeida Dos Reis and Paes de Barros (1991), Knight and Sabot (1991), Park, Ross and Sabot (1996), Psacharopoulos *et al.* (1992) and Slottje, et.al. (1997).

[2] See, for instance, Alderman, *et al.*(1996), Behrman, Birdsall and Székely (1999), Behrman, *et al.* (1999), Behrman and Knowles (1999), Behrman, Rosenzweig, and Taubman (1994, 1996), Behrman and Wolfe (1987), Birdsall (1985), Deolalikar (1993), DeTray (1988), Foster and Rosenzweig (1996), Glewwe and Jacoby (1994, 1995), Handa (1996), Hossain (1989), Jacoby (1994), Jacoby and Skoufias (1997), James, King and Suryadi (1996), Jimenez and Paqueo (1996), King and Lillard (1987), Psacharopoulos and Arriagada (1989), Rosenzweig (1990), Rosenzweig and Schultz (1987), Schultz (1988) and Strauss and Thomas (1995).

[3] Flug *et al.* (1997), for example, examine secondary school enrollment rates using cross-country panel data for 1970-1992. They find that employment volatility has a significant negative effect on school enrollment in low-income countries while financial depth has a positive effect. Binder (1999), for another example, examines the responses of Mexican state enrollment rates to mean state incomes and finds fairly small elasticities for annual responses, but ones that accumulate to fairly substantial effects over longer periods.

[4] The 1980s are often referred to as the "lost decade" for Latin America because per capita income levels at the end of the decade were generally below those at the start (IDB, 1995).

middle classes have few mechanisms with which to buffer macro shocks so schooling and other human capital investments have been curtailed due to macro crises. While this question is posed in this paper in terms of LAC, there are similar questions for other parts of the developing world. For Africa, for example, there long has been a concern about the possible negative effects of macro stagnation on schooling and other forms of human capital, and the recent financial crisis in East and Southeast Asia accentuated such concerns in that region.

In this paper we use a new high quality data base for 18 LAC countries to assess the effects of aggregate conditions on schooling attainment. Household survey data are used to construct a quasi panel with information on attainment for birth cohorts born between 1930 (who are currently around 65 years of age) and 1970 (currently about 25 years old, and who are generally beyond school age), which is merged with aggregate data. This data set contains more detailed and higher quality data on schooling than that published in international sources such as UNESCO that have been widely used for aggregate studies of schooling. It permits combining cohort-specific data and with time-varying aggregate data for periods in which cohorts were making marginal schooling decisions.

The paper is organized as follows. Section 1 describes the data and discusses its main advantages and limitations. Section 2 documents schooling progress in the 18 LAC countries for which recent household surveys are available and presents some comparisons with Korea and Taiwan, which have some of the most impressive schooling experiences in recent decades. Section 3 discusses the theoretical framework for analyzing the association between schooling and aggregate economic variables. Section 4 presents our econometric estimates using cohort as well as individual data. Section 5 uses the econometric results to decompose the change in schooling progress by decade, and explores the causes of the slowdown in schooling accumulation in LAC since the 1980s debt crisis. Section 6 is a conclusion.

## 1. Data

The most widely used aggregate data for representing schooling investments are based directly or indirectly on the UNESCO statistical yearbook enrollment data.[5] The investment data that are used are primarily the enrollment data for primary, secondary and tertiary schooling levels that UNESCO compiles from annual reports from the schooling systems/Ministries of Education of each country.[6] The details of

[5] The most widely-used data for representing the impact of schooling in aggregate regressions is the Barro and Lee (1994) data on adult schooling stocks. But this source does not include data that permits good characterization of schooling investments as opposed to the stock of schooling for current adults.

[6] These data are sometimes used to construct proxies for school attainment. For example, they are used to construct expected schooling for a synthetic cohort (defined as primary schooling enrollment rates in year t times number of

this data collection procedure are not very clear in UNESCO sources. UNESCO (1991), for example, merely states: "Data are gathered mainly from official replies to UNESCO questionnaires and special surveys but also from official reports and publications supplemented by information available to the Secretariat from other national and international sources. Where available data differ from the recommendations adopted or other concepts and definitions employed by UNESCO, the statistical practice used in the country is followed, with a footnote where possible.... by using the present *Yearbook* in combination with the earlier editions, a meaningful time series can be developed for most areas." (p. i)

There are at least four problems with the UNESCO data.[7] First, on the bases of anecdotes, enrollment rates from school systems would often seem to reflect opening day enrollments and thus be an overestimate of actual school investments, quite possibly with systematic biases associated with the level of development. These biases, moreover, are likely to differ across countries at a point in time and over time within countries. Second, the extent to which enrollment rates capture actual schooling investments across countries also varies considerably because of differential repetition rates across countries. Where repetition rates are high as in some countries in LAC, high enrollment rates may reflect more the deficiencies in the school system than the extent of schooling investment. These biases, once again, are likely to differ across countries at a point of time and over time within countries. Third, there are different starting ages of school and durations of school across countries; this means that cross-country comparisons of enrollment figures based on the same age groups may be misleading. Within countries, moreover, the duration changes over time so these comparisons in many cases are not meaningful even for the same country over time.[8] Fourth, these data are available only with a considerable lag for most countries.[9]

For the present study, we use household survey data for years close to 1996 to construct a time series on schooling attainment by birth cohorts for a 40-year period for 18 LAC countries. These data allow the values of time-varying aggregate variables to be linked to periods in which cohorts were making marginal schooling decisions. This option has none of the four problems noted in the previous paragraph

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grades in the primary school level plus secondary schooling enrollment rates in year t times number of grades in the secondary school level plus tertiary schooling enrollment rates in year t times number of grades in the tertiary school level) in Behrman (1987, 1996) and Schultz (1987). The problems noted below carry over to such uses of these data.

[7] Behrman and Rosenzweig (1994) more extensively discuss limitations of the UNESCO data and present comparisons of enrollment rates with those obtained from a stratified random household survey and report significant differences.

[8] For instance, UNESCO (1991, Table 3.1b) indicates that since 1975 the duration of the first level of schooling had changed in 23 countries and the duration of the second level of schooling had changed in 31 countries.

[9] For instance, in the most recent UNESCO (1997) *Yearbook* at the time that we initiated this study, the most recent data for most countries are from the early 1980s, and there are only very few cases, such as Korea (which we use below) with any information for the 1990s.

for the UNESCO data, though there are other possible problems that we discuss below. The surveys cover 93% of the total population of the region, and in all but two cases are representative at the national level.[10] The earliest survey is for Nicaragua in 1993, and the most recent is for Honduras 1998. Table A1 in the Appendix provides some descriptive information on each survey.

Even though household surveys are cross sections, they contain information on schooling attainment and the year of birth of a random sample of all individuals in a country. This information permits the construction of relatively long "time-series" of information on schooling by birth cohort. Fortunately, questions on schooling in household surveys are about the most standardized across countries. Furthermore, the year in which each cohort was making marginal schooling decisions can be identified with a fair amount of accuracy, and attainment can be related to exogenous variables including aggregate conditions for the same critical time period.

By using household surveys the quality and comparability of long time-series on schooling attainment is significantly improved, but even so, this approach is not free of problems. We discuss here five possible problems. We note that some of these problems are shared by other data sets but that household surveys have the advantage in some cases of permitting the exploration of the importance of these problems.

(1) Limited availability of household surveys: Household surveys are not widely available and easily accessible, which reduces the number of countries that can be studied. While this makes costly the use of this approach for most regions of the world, as we note above we have assembled household surveys that cover 93% of the population in LAC.

(2) Random measurement error in respondent-reported schooling attainment: Self-reported schooling attainment in household surveys is likely to have measurement error, as has been emphasized in recent studies of the impact of schooling on wages (e.g., Ashenfelter and Krueger 1994, Behrman, Rosenzweig and Taubman 1994). Random measurement error tends to bias downwards the estimated impact of schooling when it is right-side variable, particularly for within-twins (siblings) estimates, which is the point about measurement error that is explored in these studies. But, as is well known, random measurement error in the dependent variable does not cause biases in the estimated coefficients. Therefore random measurement error in schooling is not likely to be a major problem for this study.[11]

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[10] The surveys for Argentina and Uruguay cover only central metropolitan areas. Thus measured changes may reflect migration rather than schooling progress for the same population. However, the surveys cover 88% and 90% of the total populations of Argentina and Uruguay, respectively. Therefore, the impact on our estimates of not being representative of random samples is not likely to be very large.

[11] Random measurement error may increase with age because recall problems may increase with age. If so, estimates that assume a constant variance for random measurement error may be inefficient, though not biased.

(3) Selective mortality inversely associated with schooling attainment: If mortality is inversely associated with schooling attainment, schooling attainment as estimated from household surveys or census data is upward biased for older ages, thus resulting in an underestimate of changes in schooling attainment over time. This problem can be addressed and even corrected to some extent if individual death records for sufficiently long periods of time are available. For the United States, Deaton and Paxson (1999) provide evidence of differential mortality rates by education and Attanasio and Hoynes (1998) attempt some corrections to similar data and argue that the effects of mortality are significant. Unfortunately, we cannot correct our data for this problem because detailed information on individual death records is not available. However, in Appendix B1 we assess the magnitude of these biases and whether the effects are likely to differ substantially across the countries under analysis. We conclude that there may be a problem due to selective mortality that is inversely associated with schooling attainment for older generations, but that the impact of the problem for our study is mitigated because it is similar across countries.

(4) Selective migration associated with schooling attainment: Differential immigration or migration associated with schooling can introduce biases depending on the composition of migrants. If a country receives large flows of relatively educated individuals, the composition effect exaggerates domestic educational progress and *vice versa*. In contrast to mortality (which tends to be inversely associated with schooling attainment in most populations), the sign of the association between schooling and net immigration inflows is not clear. In some cases, such as wars, people with more education might be the first to migrate, but in other times, migrants might predominantly be the relatively uneducated. Unfortunately, historical data on migration flows to assess the magnitude of this bias as in the case of mortality are not available. Furthermore, in contrast to mortality, which declines relatively smoothly through time, migration flows can be abrupt and change drastically depending on the conditions of countries at particular points in time. In Appendix B2 we summarize our exploration of some fragmented evidence on the size of migratory flows and their association with schooling. We find that in some cases they can be considerable and associated fairly strongly – either positively or negatively – with schooling. We note some countries within LAC for which migration is likely to be more of a problem.

(5) Post-survey schooling: Another potential limitation of information on changes in schooling attainment from cross-sectional data is post-survey schooling. If a large proportion of sample individuals continue to attend school after the survey, when they are observed in a snapshot their schooling will tend to be underestimated. Appendix B3 summarizes some explorations of the possible importance of this problem. We conclude that, for the age ranges that we consider, post-sample schooling is not likely to bias our comparisons across countries in a significant way.

Given the potential importance of biases introduced by migration, mortality and (to a lesser extent) post-sample schooling, in Section 4 we include in our econometric estimates a variable that controls for the first-order additive effects of these possible biases.

## 2. The Schooling Transition in LAC

This section documents schooling progress in 18 LAC countries over the last 60 years, and uses data from the United States, Taiwan and Korea for comparison.[12] The United States (US) is a useful point of comparison that represents developed countries with a longer history of high attainment. We expect recent schooling progress to be relatively slow in the US because there tends to be an upward limit to schooling, and once attainment is high, it is relatively difficult to increase the schooling level of a population. Korea and Taiwan are interesting cases because they are regarded as having achieved outstanding schooling progress during the 20th century. In this section we consider changes in average grades of schooling and school coverage versus completion. Appendix C presents more detailed analysis of the different stages of the schooling transition from low to high levels.

### 2.1 Changes in Mean Grades of Schooling

The first five columns of Table 1 give the average grades of schooling attainment of cohorts born in 1930, 1940, 1950, 1960 and 1970; the last three columns summarize changes in mean schooling attainment for cohorts born in 1930 versus 1950, 1950 versus 1970 and 1930 versus 1970. One advantage of changes in mean schooling attainment as a metric of "schooling progress" is that it includes improvements anywhere in the distribution.[13] The 18 countries in LAC are listed in increasing order of mean schooling attainment for those born in 1930.[14] Similar data for Korea, Taiwan and the United States are given at the bottom of the table.

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[12] Household survey data for the United States and Taiwan were accessed through the Luxembourg Income Study. Korea is the only country for which data were taken from published sources (UNESCO 1997). The data in this case refers to 1995 (as noted, Korea is one of the few countries with data for the 1990s in this publication).

[13] For further characterization of changes in the distribution of schooling see Duryea and Székely (1998) who report that the coefficient of variation of schooling has decreased for recent cohorts in all LAC countries.

[14] The data for Bolivia suggest surprisingly high attainment. Countries with such high attainment generally rank relatively high also in other development indicators such as GDP per capita and health conditions, but Bolivia does not. Comparisons between the information in the 1996 household survey for Bolivia, which we use in this paper, and the most recent census suggest that the household survey may be overestimating attainment: average attainment is around three years lower in the census. Therefore the Bolivian statistics in Table 1 should be viewed with caution and we test below the robustness of our results to the exclusion of Bolivia.

On average, there was an increase of 4.6 grades of schooling in the 18 LAC countries between the cohort born in 1930 and their counterparts born in 1970. The largest increases were in Mexico, the Dominican Republic, Chile, Ecuador, Bolivia and Venezuela, for all of which there was a gain of more than five grades during the period. The smallest changes were in Jamaica, Paraguay, Brazil and Nicaragua, all with less than four grades. In contrast, the average grades of education increased by 6.8 and 6.5 grades in Korea and Taiwan, respectively, during the same period. Table 1 shows that Taiwan and Korea have made impressive strides in schooling attainment, with the recent generations approaching levels in the United States. In the US, which in 1950 had roughly 8 more grades of schooling than the average LAC country, the increase was only 1.1. Schooling progress in LAC was considerably greater for the generations born between 1930 and 1950 -- a gain of 2.7 grades – than for those born between 1950 and 1970 -- a gain of 1.9. A relatively low proportion of individuals in the 1965-1969 cohort was still enrolled in school at the time of the survey (Appendix B3), so the slowdown is likely to reflect real changes in attainment. The slowdown appears to be steeper in Honduras, the Dominican Republic, Venezuela, and Panama, where progress for cohorts born between 1930 and 1950 was more than 1.5 grades greater than for those born in the following two decades. Korea also had a much greater apparent increase between the 1930 and 1950 birth cohorts (4.3 grades) than between the 1950 and 1970 birth cohorts (2.5 grades). Cohorts in Korea that were born before 1955 were subject to high mortality rates, however, which may introduce strong biases (see Appendix B1).

The case of Taiwan is quite different. Measured schooling progress in this country for cohorts born between 1930 and 1950 was 3.2 grades, which is only 0.5 grades greater than the average LAC country. Four LAC countries (Mexico, the Dominican Republic, Venezuela and Chile) had gains about 0.5 grades greater than Taiwan during this period. Schooling in Taiwan for this time period, moreover, received a considerable boost from immigration (Appendix B2). However, unlike most of LAC, Taiwan did not experience a slowdown in the next two decades. The gain for cohorts born between 1950 and 1970 was 3.3 grades, which far exceeds the average 1.9 grade gain in LAC. During this period, moreover, immigration was not a major factor. There is only one country in this region (Ecuador) that had similar progress as Taiwan for cohorts born during these two decades.

Figure 1 plots similar information to that presented in Table 1 for all cohorts born between 1930 and 1970 for a selected group of countries: Chile (one of the countries in LAC with the highest current schooling levels and second only to Argentina for the 1970 birth cohort), Mexico (the country in LAC with the greatest growth in mean grades of schooling between the 1930 and 1970 birth cohorts),[15] Brazil

[15] It should be borne in mind, however, that the composition effect from migration in Mexico is quite large precisely for the cohorts that register the greatest increases (Appendices B1 and B2).

and Nicaragua (two of the countries in LAC with the poorest schooling performances), Korea and Taiwan. All of these countries display significant improvements in mean schooling for persons born between 1940 and 1960, though more for Taiwan than for the others. But Taiwan and Korea increased schooling at a faster rate for persons born after 1960 than did most of LAC with the exceptions of Mexico and the Dominican Republic (the latter can be seen from Table 1). As one result, for example, Chile and Taiwan had similar mean schooling for persons born between 1950 and 1955, but persons born in 1970 in Taiwan have on average one more grade of schooling than their Chilean counterparts.[16] On the other hand the large differences between Mexico and the Dominican Republic versus Korea and Taiwan that we observe today are not due to greater progress in these two East Asian countries for the most recent cohorts but to much higher levels in these two East Asian countries at the start of the period covered.

Table 2 shows similar data to those presented in Table 1, subdivided by gender. The most striking feature of these data is that in two thirds of the 18 LAC countries, the average grades of schooling for females is higher than for males for the cohorts born in 1970. Bolivia, Chile, Honduras, Nicaragua, Paraguay and Peru are the exceptions.[17] On the average in LAC females had 1.1 grades less of schooling than males for the cohort born in 1930, but registered a gain of 1.1 grades more for cohorts born 40 years later. For both males and females, there was a general pattern of greater progress during 1930-50 than during the following two decades, but in the case of females, the slowdown was less. There are five countries (Colombia, Ecuador, El Salvador, Jamaica and Peru) where the gains for females between the 1950 and 1970 birth cohorts were even greater than the gains between the 1930 and1950 birth cohorts.

Taiwan experienced a similar pattern. Females in Taiwan started out 2.4 grades behind males for the 1930-birth cohort, but had practically the same grades of schooling as their male counterparts for the 1970 birth cohort. The increase in schooling attainment for females in Taiwan between the 1930 and 1970 birth cohorts was 8.3 grades, 3.3 grades more than the increase for females in LAC. For males, in contrast, the increase of 5.2 for males in Taiwan was only 1.1 grades greater than for males in LAC.

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[16] Comparing cohorts born earlier than in 1950 in Taiwan and Korea probably includes an important migration component in addition to that due to schooling progress of native-born citizens (see Appendix B2).

[17] Duryea and Székely (1998) obtain this same result for a more limited set of countries and different years. Because female life expectancies tend to be greater than male life expectancies, Table 2 may underestimate schooling progress among males relative to females. However, with the possible exception of the 1930 cohort, the population we are considering is not subject to high enough mortality rates for differential mortality by gender to be much of a factor. Moreover, the main reason why schooling progress among females is greater is because there was substantially more progress for females than for males in the cohorts born between 1950 and1970, for whom mortality effects are quite limited. Only for Chile was the gain in terms of average grades of schooling for 1950-70 greater for males than for females (and in this case the difference was only 0.1 grades).

Therefore, despite the relatively greater school progress in LAC for females relative to males, it is females more than males that fell relatively further behind Taiwan.

Figure 2 plots schooling attainment for Taiwan and the average LAC country, respectively, for all cohorts born between 1930 and 1970.[18] The figure shows that on average, LAC and Taiwan had very similar levels of schooling among cohorts born before 1940, but from this year on, progress in Taiwan was much faster. Thirty years later, cohorts in Taiwan were registering attainment levels almost 50% greater than the average LAC country. The figures also show the slowdown in LAC for the 1960-1970 birth cohorts. Cohorts born in these years were making marginal schooling decisions approximately between 1975 and 1986, which coincides with the early years of the debt crisis in the region. The figure also plots a line with the trend in LAC from 1940 to 1960. Had the same trend continued for cohorts born after 1960, the average grades of schooling for the last cohort would have been close to 10 grades, rather than around 8.5.

To explore whether the slowdown in the accumulation of schooling in the region continued through recent years we present in Table 3 the average grades of schooling of more recent cohorts for the 11 LAC countries for which household surveys from the 1980s and the early 1990s are available to us.[19] If a child enters school at age six and goes through the system without interruption or repetition, s/he would be expected to have 9 and 12 grades of schooling at ages 15 and 18 respectively. However, for all countries in the table, the average grades of education in the first six columns are well below these levels. The last three columns present the increase in mean grades of schooling per decade for 15-year olds, 18-year olds, and for cohorts born between 1960 and 1970 (the last calculated from Table 1), respectively. The most striking feature is that there are only three countries out of 11 for which the increases in mean grades of schooling per decade for these young generations are greater than the gains observed for the 1960-70 cohorts: Argentina for 15-year olds, Honduras for both age groups, and Venezuela for 18-year olds. Unless there is a substantial surge in schooling accumulation after ages 15 and 18, which is unlikely, the results suggest that the slowdown in schooling accumulation observed in Figure 2 continues until recently and even may have intensified.

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[18] The LAC pattern was obtained by pooling all the information on the average grades of schooling by year of birth, for all 18 countries and estimating a country fixed-effects regression using the average schooling of each cohort as the dependent variable and dummy variables for each year as the right-side variables. Figure 2 plots the coefficients for the year dummies. For Taiwan, we estimate the same regression with OLS and plot the year dummies.

[19] We focus on the averages for 15- and 18-year olds, which are at the higher end of the school-age spectrum. But some individuals may continue to accumulate schooling after the surveys so we may be underestimating schooling progress. However, given the relatively low enrollment rates at these ages (which we present below), the snapshots at ages 15 and 18 are good indicators of the pace at which the average schooling is increasing among younger generations.

## 2.2 Coverage vs. Completion

An interesting feature of the dynamics of schooling progress is that most LAC countries had wider educational coverage -- defined here as successful completion of at least the first grade -- than Taiwan and Korea among cohorts born before 1950. However, there is stark contrast between Korea and Taiwan and the LAC countries with respect to the proportion of the population that completed primary schooling. Figures 3 and 4 summarize these differences.

Figure 3 plots the proportion of individuals in each age cohort that completed at least one year of schooling in Taiwan and the average LAC country. For cohorts born between 1930 and 1950 there is practically no difference. For the 1970 cohort Taiwan reached practically full coverage, while the average LAC country lagged, although not far behind, with around 94% coverage. Figure 4 illustrates where the difference between schooling attainment in Taiwan and the LAC region primarily originates. It plots the pattern of primary completion rates for the population that enrolled in primary school, both for Taiwan and for the average LAC country.[20] The main feature of the figures is that while there was practically no difference in coverage around 1930, completion rates were already much higher in Taiwan. It is also interesting to note that there seems to have been a slowdown in the increase of completion rates in the LAC countries for cohorts born after 1960. The widespread incapacity in LAC to take most or all individuals that enroll in the schooling system at least through primary school necessarily affects the prospects of most countries in the region for completing later stages of the educational transition. Clearly Korea and Taiwan have reached a stage in which it is relatively easy to increase the share completing some post-primary education because there are enough individuals in the pipeline who have completed primary school and who are eligible to enter secondary schooling. Significantly smaller proportions of the same birth cohorts in LAC have completed primary schooling and thus may be able to go to the next stage.

[20] The LAC pattern is obtained by pooling all the information on completion rates by year of birth for all 18 countries (similarly to the results in Figure 2), and estimating a country fixed-effects regression with year dummies as right-side variables. The figure plots the coefficients for the year dummies. In the case of Taiwan, we estimate the same regression with OLS, and plot the year dummies.

## 3. Framework for Analysis of the Association between Schooling and Aggregate Variables

This section presents the framework for our econometric explorations in the rest of the paper. Becker's (1967) Woytinsky lecture on the determinants of human capital investments is a useful starting point for our discussion.[21] 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 5 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.[22] The marginal private cost increases 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 capital investment such as schooling, the private net returns are maximized at level $H^*$.

But micro schooling investments are made in aggregate contexts.[23] Aggregate conditions may shift either the marginal private benefits or the marginal private costs.

Figure 6 illustrates the implications of the marginal private benefits for human capital being associated with aggregate conditions, with two alternative curves indicated -- each depending on different aggregate conditions. The dashed curve is drawn everywhere above the solid curve. For the two (otherwise identical) individuals the private incentives are to invest at level $H^*$ or level $H^{**}$, depending on aggregate conditions. Figure 7 illustrates the implications of two different marginal cost curves, depending on different aggregate conditions, with the dashed line drawn to be lower than the solid line.

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[21] 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.

[22] 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.

[23] Because the proximate determinants of schooling investments are at the micro level, as noted in the introduction, most of the empirical literature has focused on micro estimates. Some of the variables that are conjectured to have effects on the macro level, such as resources available for schooling investments, are in part the aggregation of household resources from the micro level. Some other household characteristics, such as heterogeneities in preferences or information, may cancel out in the aggregation.

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 aggregate conditions shift the marginal private benefit and marginal private cost curves for micro household decisions relating to schooling investments? The literature has suggested that several features of the aggregate economic environment affect schooling attainment and decisions whether to continue investing in schooling. Here we summarize some of these factors. We begin with those of central interest to this study and then continue with some considerations that might merit control variables. We note below in the discussion of our estimates in Section 4 how the right-side variables that we include might relate to these features of the aggregate economic environment (though, as noted, at this level of aggregation some of the right-side variables may be representing multiple factors).

- *Macroeconomic shocks*: In a world with perfect and costless credit and insurance markets, unexpected shocks are not likely to affect long-term investments such as schooling. However, in the presence of liquidity constraints, uncertainty and lack of insurance or costly insurance, individuals facing shocks have to reallocate their resources to absorb shocks. A negative shock in such a case effectively increases the private marginal costs of schooling by shifting the curve in Figure 7 from the dashed line to the solid line, thus reducing the equilibrium level of schooling investments. If households are risk adverse and can not insure costlessly, moreover, greater uncertainty due to greater macro fluctuations reduces their private marginal benefits in utility terms, which is equivalent to a shift from the dashed to the solid line in Figure 6, again reducing the equilibrium level of schooling investments. When physical capital assets can be used as a buffer stock, individuals may be able to protect long-term investments in schooling. But in their absence, the reallocation of household resources may lead to a reduction in schooling investment. If reductions or interruptions in schooling have effects on subsequent attainment, shocks can have long lasting effects even if they are only temporary phenomena. This may be the case because of the vital role of age in the schooling process. Generally, as a child ages the opportunity cost of not working increases. In addition, children who are behind their peers in grade achievement may become discouraged and drop out. Also, the high transaction costs of entering and exiting from schooling may preclude or delay re-entry of dropouts. Such factors frequently are alleged to be of considerable importance in LAC. There is some limited evidence from a few mostly micro studies for developing countries that shocks to household income affect schooling investment significantly precisely due to liquidity constraints and the absence of insurance mechanisms (Chiu 1998, Duryea 1998, Flug, et. al. 1996, and Jacoby and Skoufias 1997).

- *Availability of resources to finance investment*: In investment models of schooling if markets are perfect, parental income has no effect on schooling (Becker 1964, Ben-Porath 1967, and Heckman 1976). However if access to credit is conditional on parents' income then that income may affect investment in children's schooling. Recent empirical estimates that incorporate a range of aspects of schooling (e.g., age of starting schooling, rate of progress through grades, and cognitive achievement in addition to schooling attainment) and use representations of long-run income find stronger associations between child schooling and parental income than in the previous literature (e.g., Behrman and Knowles 1999). Consumption models of schooling also predict a positive correlation between permanent parental income and children's schooling if child schooling is a "normal" good. If access to credit markets is conditional on parental income, higher household income due to better macro conditions lessens the capital market restrictions on schooling investments effectively by

shifting the private marginal cost curve in Figure 7 from the solid to the dashed line, thus increasing the equilibrium level of schooling investment. If schooling is partly consumption and is a normal good, higher household income due to better macro conditions shifts the marginal private benefit curve up, as from the solid to the dashed line in Figure 6, increasing the equilibrium level of schooling investment. Public expenditures in education and public infrastructure also reduce the private marginal cost of acquiring education and increase the equilibrium level of attainment because they complement household resources.

- *Factor endowments, trade openness and returns to schooling:* Factor endowments determine production structures and therefore the demand for different kinds of skills, the returns to education, and the incentives to invest in education. Substantial natural resources, for example, are alleged to lead to production structures in which the returns to broad education are limited, though the returns to some forms of specialized technical education (e.g., mining engineering) may be high. If so, then substantial natural resources lead to private marginal benefit curves more like the solid one in Figure 6 than like the dashed one, thus in itself leading to a lower level of equilibrium schooling investment than were the production structure are less based on natural resource riches. As noted by Spilimbergo, Londoño and Székely (1999), however, the demand and price paid for the income-earning assets owned by individuals (including education) are affected not only by the scarcity or abundance of factors of production in each country, but also by the extent to which the country is exposed to international trade. If a country opens up to trade, its production factors compete more directly with those of other countries, and the rewards paid to them change. In the case of schooling, we would expect that if a country opens up to trade there will be more incentives to acquire education because trade openness generally involves more rapid changes in technology and in capital, which have positive effects on the returns to education (e.g., Rosenzweig 1995). Therefore trade openness and other forms of deregulation in themselves are likely to lead to private marginal benefits such as the dashed rather than the solid line in Figure 6, implying a higher level of equilibrium schooling investment than in a more closed and regulated economy *ceteris paribus*. However, if the returns to education increase and there are better labor market opportunities, the opportunity cost of spending time in school increases, with possible negative implications on attainment; in terms of Figure 7 the private marginal costs are higher (e.g., the solid line rather than the dashed line) due to greater opportunity costs of time in a more open economy. Overall, the net effects of changes in factor endowments and trade openness, thus, are ambiguous.

- *Age structure:* As the demographic transition progresses, first the young dependency ratio increases and then it falls. This changes the relative resources per child that are available for schooling that might be manifested in first decreasing and then increasing school quality as reflected, for example, in student-teacher ratios.[24] The lower the young dependency rates and the smaller the cohort, therefore, the larger the expected attainment. A lower young dependency ratio, thus, may be reflected in higher schooling quality for given private costs (and thus the dashed rather than the solid private marginal benefits curve in Figure 6) or lower private marginal costs for a given level of schooling quality (and

[24] Behrman, Duryea and Szekely (1999b) present evidence of significant increases in public educational expenditures per school-age child as youth dependency ratios fall due to population aging based on aggregate data from 164 countries for 1950-1995. There is some controversy about how important are class sizes (e.g., Hanuchek 1995, Kremer 1995). But two recent papers with evidence on the negative effect of class size on attainment are Angrist and Lavy (1999) and Krueger (1999). Lazear (1999) also presents an interesting argument about why in equilibrium students may be selected so that true inverse effects of class size on student achievement are difficult to discern.

thus the dashed rather than the solid private marginal cost curve in Figure 7), both of which lead to higher equilibrium levels of private schooling investment.

- *Urbanization, changing prices and child time use*: With urbanization there typically are at least three important price changes relevant to children's time use. First, the value of child labor usually is relatively high in predominantly agricultural activities on family farms but tends to decrease with shifts in production structure associated with urbanization, so the opportunity cost in terms of foregone labor activity to attend school declines. Second, the costs of providing schooling typically are lower in urban areas than in rural areas due to lower transportation costs and greater economies of scale. Third, the expected returns to education are normally larger in urban areas, creating more incentives to acquire schooling in urban settings. For these reasons urbanization is expected to be positively associated with higher enrollment and attainment. The first two effects are manifested in private marginal costs being lower in urban than in rural areas (i.e., the dashed rather than the solid line in Figure 7). The third is manifested in the private marginal benefits being higher in urban than in rural areas (i.e., the dashed rather than the solid line in Figure 6).

- *Health*: Health can affect attainment through at least three channels. First, as health conditions improve and life expectancies increase, people will perceive increased probabilities of their children surviving to adulthood so they can achieve their desired family size with fewer births and allocate more resources to each child.[25] Second, better health permits children to learn more in school and thus increases the returns to time spent in school. Third, increases in life expectancies increase the potential years of labor market participation, which in turn increases the returns to investments in schooling. Thus, improvements in health are expected to be associated with improvements in schooling attainment by effectively increasing the private marginal benefits through complementary household investments and through higher expected post-schooling returns, as in the dashed rather than the solid curve in Figure 6.

- *Cultural patterns, religious beliefs, and traditional values:* Religious beliefs and cultural patterns influence time allocations between home and markets and within the household. Thereby they have a large influence on schooling decisions, in some cases with large differences by gender. Within LAC, Catholicism has dominated since the European conquest and settlement, but Protestantism and non-Christian religions have grown relatively rapidly in recent decades. Cultural patterns, religious beliefs and values that allow, for example, for greater participation of females in labor markets are likely to be associated with higher private marginal benefits of schooling investments in females (the dashed rather than the solid curve in Figure 6) and lower private marginal costs at least in utility terms (the dashed rather than the solid curve in Figure 7) and thus increase the equilibrium level of schooling investment.

- *Institutions*: Differences in quality, emphasis among types of schooling, and in the organization of schooling systems, all of which are related to the type of institutions that run the education system, can have strong effects on schooling enrollments and attainment.[26] Institutions that are more responsive to household demands for schooling, for example, can provide higher quality schooling (and thus private marginal benefit curves like the dashed rather than the solid lines in Figure 6) and/or lower private marginal cost curves (i.e., the dashed rather than the solid private marginal cost curve in

[25] Behrman, Duryea and Szekely (1999a) find that in aggregate data fertility declines over time are more associated with improved health and longer life expectancies than with any other variables, including women's schooling that often has been claimed to have the strongest association with fertility declines based on cross-sectional comparisons.
[26] See for instance IDB (1996) and Behrman and King (2000).

Figure 7), thereby increasing the equilibrium level of schooling investments. Engerman, Haber and Sokoloff (1998) have argued that the geographic characteristics of countries determine the comparative advantage, the types of goods and services produced in an economy, and different forms of organization and institutions that create incentives for schooling. Traditionally in LAC governments have dominated the provision of schooling, though in recent years some countries such as Chile and Colombia have been in the forefront of introducing new forms of delivering educational services.

## 4. Aggregate Determinants of Schooling Attainment: A Household-Survey-Based Cohort Approach

Our strategy for testing the relevance of the arguments that are summarized in Section 3 is to exploit the time series dimension of the cross sectional data used in Section 2 to construct a quasi panel of schooling attainment for birth cohorts for 1930-1970 for the 18 LAC countries under analysis. The panel is constructed by obtaining the average grades of schooling attainment of each annual birth cohort, such as the series we plot in Figure 1, and then pooling the information for all countries. This enables us to focus on completed schooling and yet have variance in aggregate conditions.

To implement this procedure, we need to link the aggregate variables with the critical time period of marginal schooling decisions for each cohort because the data do not indicate exactly when individuals completed their schooling. We define the relevant time period by first identifying in what year the average individual in each cohort would have completed school if s/he had entered school at age six and did not interrupt her/his schooling or repeat grades until s/he completed school. We then link these data to averages for our aggregate data for a five-year period ending in this year. We average over several years under the assumption that the relevant time period during which marginal school decisions were made covered several years near the end of this period.

### 4.1 Basic Estimates

Table 4 presents four variants of the basic regressions.[27] We include all the variables mentioned in Section 3 above, with a few exceptions for which sufficiently long time series data that are comparable across countries are not available (e.g., returns to education, expenditures on education and infrastructure).[28]

[27] There is large variation in sample size across surveys (Table A1), so the degree of precision of the averages by year of birth differs across countries. We use sampling weights to correct for these differences.

[28] We use the World Bank Development Indicators (1998) for most of the aggregate variables (with exceptions indicated at the end of this note). This is the most comprehensive data base on public expenditures in education, for example, but these data only start in 1970 so including this variable would cut by more than half the time-series for each country. In addition to this data source, we use (a) the Penn World Tables for the PPP-adjusted GDP per capita

The first three regressions refer to country fixed-effects estimates for the whole sample and for males and females separately. The dependent variable is the average grades of schooling of each cohort for all cohorts born between 1930 and 1970 for which the critical year for marginal schooling decisions is 1950 or later (we do not have data on the aggregate variables before 1950). We estimate the first three regressions by controlling for all country fixed effects because our argument is in essence a time-series argument, and we do not want the coefficient estimates to be affected by cross-country variations in unobserved variables. These estimates are consistent with a substantial part of the variance in the dependent variable, at least 95%.[29] Specification tests at the bottom of the table indicate that the country fixed effects are significant. Nevertheless, for comparison and to elucidate the associations with some particular slowly changing or fixed country characteristics such as religion, we present random effects estimates in the fourth column.[30] We now consider in turn the various right-side variables that we include and note how they relate to conjectures in the literature about aggregate determinants of schooling.

*Macroeconomic conditions:* To explore the effects of macroeconomic conditions on investments in schooling, we include: (1) the international terms of trade to represent external shocks that are normally stronger for the primary sectors; (2) the coefficient of variation of the real GDP per capita growth as a proxy for volatility; (3) the average GDP per capita growth rate to represent changes in the availability of resources; and (4) the PPP adjusted GDP per capita as a measure of the average attainment and volatility is associated with significantly lower attainment. The terms of trade effects are very similar for males and females, but volatility has a slightly larger effect on males. GDP growth has the expected positive sign, but the coefficient estimate is significantly nonzero only for females. As discussed in Section 3, positive marginal income changes have a theoretically ambiguous effect on schooling investments because they imply more resources for investment and perhaps higher expected returns for school investments on one hand but they may reflect higher opportunity cost for attending

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used to capture growth and volatility and for trade openness (exports plus imports as share of GDP); (b) the United Nations (1998) for population statistics including the number of people of working age, life expectancies at age one, young dependency ratios, population by birth cohorts at time of birth relative to population in 1995; (c) La Porta, *et al*. (1998) for population shares by religion, and English rule of law; and (d) Sachs and Warner (1995) for latitude.

[29] Comparison with the random effects estimates, which is consistent with 79.9% of the variance in the dependent variable, suggests that part of the consistency of the first three regressions with the variance in the dependent variable is due to the fixed effects, but that most of it is due to the included aggregate variables.

[30] For the time-varying variables, we therefore concentrate exclusively on the fixed-effects estimates. In some cases the random-effects coefficient estimates are very similar, and in some cases they differ considerably. For the time-varying variables the random-effects estimates have the same sign but different (in absolute value) coefficient estimates. The cases in which there are substantial differences may reflect that the observed aggregate indicator is correlated with unobserved country characteristics that are controlled in the country fixed-effects but not the random-effects estimates.

school rather than working. Our results suggest that the marginal resource/incentive effect captured by the GDP growth rate is stronger for females, while opportunity costs in labor market might counterbalance these resources/incentives for males. The direct effect of the level of resources available, which is captured by GDP per capita, has similar effects. Greater GDP per capita is associated with higher attainment for the whole population. However, the effect is about twice as strong for females, and is not statistically significant for males.

*Agricultural land and capital per worker:* These variables convey information on factor endowments. Our estimates suggest that having more agricultural land per capita (which is a proxy for abundance of primary goods) is associated with having lower attainment, while more capital relative to the working age population is associated with higher attainment (although the coefficient estimate is not statistically significant). An interpretation as in Engerman, et al. (1998) for agricultural land is that natural resources tend to create large rents, which in turn lead to concentration of political power and lower public investment in education. Another possible explanation is that, as shown by Spilimbergo, Londoño and Székely (1999), countries that are natural-resource abundant tend to have higher inequality, and high inequality tends to limit investment in the schooling of the poor because of limited capital market access and limited political power (e.g., Birdsall, Ross and Sabot 1997). An interpretation for the coefficient estimate of capital relative to the working age population is that physical capital is complementary with human capital, so more capital increases the productivity of more-schooled labor and thereby increases incentives to invest in schooling. The estimated effect of agricultural land per capita is very similar for males and females, while the capital per worker has a stronger impact on females.

*Trade openness*: As argued in Section 3, factor endowments may have very different returns depending on to what degree they are exposed to external trade. Trade is a channel for technological transfer and has effects on the productivity of factors, and in particular, on schooling. As predicted, the sign of the coefficient of trade openness is positive and significant for the combined estimate and for males.

*Young dependency rate and relative cohort size:* We define the young dependency rate for this purpose as the population in ages 10 to 19 relative to the population in ages 30 to 55. We choose this measure because most individuals in LAC during the sample period made their marginal schooling decisions while they were in the 10-19-age range and the population in the 30 to 55 range provides most of the resources for financing for schooling. The negative coefficient estimate, particularly for males, supports the argument that the age structure affects resources available for schooling. Most LAC countries are already at a stage at which young dependency rates are starting to decline and will remain at relatively low levels for decades (Behrman, Duryea and Székely 1999b). The estimates indicate this is

likely to provide a boost for schooling of males. We do not have an explanation why the estimated effect is much smaller and not significantly nonzero for females. Our prior would have been, in fact, that it would have been at least as important for females as for males given results in other studies that suggest that human capital investments in females are more vulnerable at the margin than are those in males. In addition to the young dependency rates, we include relative cohort size, as defined as the ratio of the size of the 10 to 19 age group at the time of critical marginal schooling decisions relative to the size of the same age group 15 years earlier. This variable is expected to capture the changing crowding-out effect of the demographic transition. The coefficient for relative cohort size is negative, but insignificant, suggesting that these crowding-out effects have not been not important determinants of attainment in LAC.

*Health and urbanization:* To account for the effect of health, we use life expectancy at age one, which is net of infant mortality that is associated with fertility, as in Behrman, Duryea and Székely (1999a). As expected, the signs of the coefficient estimates are positive, though significant only for females. We also include the proportion of the population in urban areas. As predicted, the proportion of population in urban areas has a positive effect on attainment. The effect is larger for males, and is not statistically significant for females.

*Culture, religion, and institutions in random-effects estimates:* To control for some effects of religious and cultural patterns we include the proportions of Catholics and Protestants. Both have positive and significant impact on attainment, but the effect of Protestantism is much larger. We include two variables to proxy for the type of institutions in the country. The first is a dummy variable indicating if the country has the English rule of law, which is a good proxy for colonial heritage. The coefficient estimate for English rule of law is negative and significant. The second is an index of latitude that proxies for the geographic conditions of the country (the higher the value of the index, the further away is the main city of the country from the Equator). We include this variable to account for the hypothesis that geography affects attainment presumably through its effects on institutions. The latitude index mainly distinguishes between tropical and temperate areas, and accounts for the possibility that different forms of production and social organization emerge in different conditions. The latitude index has a positive and highly significant coefficient estimate. So the results for the variables that are summarized in this paragraph are consistent with the argument that cultural and religious patterns, and institutions are important parts of the country fixed effects that affect schooling attainment.

*Mortality and migration:* We argue in Section 1 and Appendices B2 and B3 that composition effects due to selective mortality and/or migration may introduce biases in our comparisons through time. Data availability prevents us from identifying the magnitude and direction of the bias. But we can (and

do) control for the fact that the sizes of some cohorts observed around 1995 may differ substantially from their original sizes at birth. None of the coefficient estimates are significantly different from zero even at the 10% level.

*Secular trends:* We control for general secular changes due to secular shifts in unobserved variables such as school supply-side characteristics and demand for schooled workers. The year trend has positive and significant coefficients that are larger for females than for males.

Some robustness tests: We estimate the same regression with a number of variations that only affect the estimates maringally, so we do not present the estimates for brevity: (i) instead of using the information for every year on attainment we only use one observation every three years to make the time-series less smooth; (ii) we use a four-year moving average for the dependent variable to reduce noise introduced by small cell sizes; (iii) we regress the dependent variable on the aggregate variables for the critical marginal schooling decision year instead of using five-year averages; (iv) we use the information in Appendix Table C5 to look at the countries where a relatively large share of children is not enrolled in school by age six, and assume that instead of entering at age six children enter the system at age eight in these cases, which modifies the critical year for marginal schooling decisions; (v) we increase the assumed entry age for the school system to seven rather than six for all countries; and (vi) we estimate the equations without using sampling weights.

We also estimate some variations for which there are more significant changes, so we present these estimates in Appendix Table D2. (i) We exclude GDP per capita from the independent variables to explore the impact of multicollinearity between this variable and our measures of volatility and GDP growth (which are calculated using the same GDP per capita). The coefficient estimate for the share of urban population is reduced and the coefficient estimates for volatility, GDP growth and trade openness increase in size and significance. But the main conclusions discussed so far hold. (ii) We exclude Bolivia because of our concerns about the quality of these data. Our conclusions also hold when excluding this country. (iii) We exclude all cohorts below 28 years of age, rather than 25, to lessen the possibility of underestimating attainment due to post-sample schooling. (iv) For the same reason we alternatively assume that if an individual above 25 years of age is enrolled in school at the time of the survey, s/he will attain an extra grade beyond that reported in the sample. (v) All individuals over 25 that are still in school are assumed to attain *two* extra grades beyond that reported in the sample. The only changes worth noting are that the coefficient estimates for capital per worker and GDP growth are somewhat sensitive to the last two changes, but their signs and significance still remain practically the same.

## 4.2 Estimates Using Individual Data

Because we have individual micro-data we can undertake the same estimates by linking the critical year for marginal schooling decisions to each individual, rather than to the average individual in each cohort. This implies pooling all the individual data from the 18 surveys. This has the advantage of increasing the precision of the determination of the relevant critical year, which reduces measurement error.

But using individual data also raises problems. When we use the average grades of schooling by cohort as in Table 4, we average out the effect of personal characteristics and family background. But in the individual data their effects may be relevant but information to control for them is unavailable. This would not cause biases if family background were uncorrelated with the macro variables. The correlations between family background and variables representing the stability of the macroeconomic environment are likely to be small. However, for variables that move smoothly through time, there may be larger correlations. Consider, for instance, two individuals born in the same year, but one has three more grades of schooling than the other exclusively due to better family background. If the right-side variables move smoothly through time, the regression would confound the effect of macro variables with the impact of a better family background because the individual with higher education would exit the schooling system with secularly changed macro conditions. We include a time trend in the regression using individual data, as we did in Table 4, to attempt to control for this possibility. But the interpretation of some variables such as the demographic indicators and factor endowments is not as clear as in the case of Table 4 because they might be capturing part of the family background effect. The coefficient estimates for the variables of primary interest in this paper -- the measure of volatility, GDP growth and the terms of trade -- are not likely to be subject to this problem.

Table 5 presents our results with the individual data, which refers to about 383,000 observations (some observations are dropped due to lack of macro variables for the early critical marginal schooling decision years). We estimate the equations with Huber-White corrected standard errors and clustering for country, year of birth and grades of schooling. As in Table 4 the first three regressions control for all country fixed effects, and refer to the total population, males and females, respectively and the fourth regression is for random effects. The main differences with Table 4 for the fixed-effects estimates include: (i) the coefficient for capital per worker becomes highly significant, for the whole population as well as for males and females separately; (ii) health conditions increase in significance and appear to have a larger effect on males; (iii) the coefficient for the proportion of urban population increases considerably in size (by a factor of about 10), and becomes highly significant; (iv) GDP per capita growth becomes statistically significant for the whole population and for males; (iv) the young

dependency rate increases in significance and becomes stronger for females than for males; and (v) trade openness becomes statistically insignificant. The main difference with Table 4 for the variables emphasized in the random-effects estimates is that the size of the coefficient for the effect of latitude is now relatively small.

Due to the potential correlation with family background, it is safer to interpret the effects of terms of trade, macro volatility and GDP growth as genuine macro effects, while the other variables, which move much more smoothly through time, are more likely to be contaminated by unobserved family background variables. The results in Table 5 clearly support the previous conclusion that macroeconomic shocks affect attainment significantly. These results are not changed by robustness tests parallel to those described in Section 4.1.

## 4.3 Estimates for Primary Completion Rates

Section 2 shows that LAC has relatively low attainment not because of lack coverage of the educational system, but because relatively low proportions of the individuals who enroll in primary school ever complete this level. Moreover, there has been a slowdown in the increase in the proportion of completion rates among cohorts born between 1950 and 1970. Therefore, it is of interest to examine the determinants of these low completion rates. An additional element of interest is that primary completion rates are good measures of attainment at the lower end of the schooling distribution. Table 6 presents three fixed-effects regressions for the proportion of individuals in each birth cohort that completed primary relative to the proportion of that birth cohort who ever enrolled in primary school. The right-side variables are the same as in Table 4.

The estimates in Table 6 differ in relatively few respects from those in Table 4. One difference is that the impact of the volatility of GDP growth appears to be substantially greater, and the effect is greater for males than for females. A second is that the share of urban population and young dependency rates are much more significant for completion rates than they are for attainment. This suggests that demographic effects are particularly important for basic schooling. Robustness tests parallel to those discussed as the end of Section 4.1 do not indicate that these results are very sensitive to those alternatives, but for brevity these results are not presented here.

## 5. Decomposing the Changes in Attainment

We here use the estimates from Section 4 to decompose the changes in schooling progress in the 18 LAC countries in our sample in order to assess the economic impact of the right-side variables on the patterns that we describe in Section 2. To decompose the changes, we use the regression coefficients in the first column in Table 4 and the average values of the right-side variables (in Appendix Table D1) to predict the average grades of schooling of each birth cohort and how much of the changes in the grades of schooling is accounted for by each right-side variable.

Table 7 summarizes the main results for the whole population, and for males and females separately. The first three columns in the first row in the table give the change in average grades of schooling for individuals whose critical years for marginal schooling decisions were between 1950 and 1970. These individuals where born during the late 1930s and late 1950s, and were going through the educational system in 1950-1970. The last three columns give the change in average grades of schooling for all individuals going through the school system after 1970. Most of these individuals were born between the early 1960s and 1970, and belong to the generations that experienced the slowdown in schooling accumulation that is documented in Section 2. For all columns the changes are normalized to represent the change per 10-year period. The second row gives the difference in the rate of schooling accumulation between the two periods. It shows that for the average individual going through the school system during the 1980s the increase in grades of schooling were 0.72 grades less than individuals going through the system during the 1970s, with the declines somewhat larger for males (-0.85) than for females (-0.58).

The following three rows give the differences in schooling that are predicted by our model, the differences between the predicted and the real changes, and (for the 1970-1980s period) the slowdowns in schooling that are predicted by the model. The first column indicates that the predicted change for the whole population during the 1950-1970s decades is 1.91 grades, while the observed change was 1.89. The difference is -0.02 grades, which is quite small (with similarly small differences for males and females considered separately). The last three columns of the table show that the predictions are less accurate for the 1970+ period, particularly for females. The third row presents the slowdown between the 1970s and 1980s that is predicted from our regressions. We predict a larger slowdown than actually observed for females, but for males, the estimated slowdown is practically the same as that observed.

The next five rows decompose the effect of groups of right-side variables, which are net of country fixed effects and the secular trend. The first column shows that most of the “explained” gain in average grades of schooling for people going through the educational system during 1950-1970 is

accounted for by increasing shares of urban population and improving macroeconomic conditions. These two sets of variables alone account for almost half of the increase in average grades of schooling per decade during the period. The effects associated with urbanization were greater for males, while the favorable macro conditions benefited females more. Health conditions provided an additional boost for female schooling but only a small positive effect on males. The story for the 1970-1980s period, which is presented in the last three columns, is quite different. Our right-side variables actually predict a reduction in average grades of schooling during this period for the whole population and for males, and only a marginal improvement for females. The deterioration in the macroeconomic environment during the 1980s had a strong negative effect, while the acceleration of urbanization (which may have been triggered in part by the same adverse macroeconomic conditions) increased schooling. Factor endowment changes also had negative implications for schooling. For males and females together, the effects of the aggregate variables cancel out an increase of almost one third of a year of schooling from urbanization. For males, the positive effect of urbanization was somewhat larger than the negative effect of the adverse macroeconomic conditions, but factor endowments combined with the macro environment result in a negative predicted gain. For females, the macro conditions of the 1980s were also the main cause of the slowdown in schooling accumulation.

Figure 8 summarizes the results by showing the contribution of each group of variables to the slowdown observed in the 1980s. The results suggest that the main cause for the slowdown was the macroeconomic environment. Volatility was much higher in the 1980s than in preceding decades, growth was much lower than during the 1970s and 1950s, and GDP per capita remained practically unchanged (Table D1). These shifts had important implications for schooling progress. Had there not been any other factors influencing attainment, our model predicts that there would have been a negative change in average grades of schooling for individuals going through the system during the 1980s crisis years. The Figure also shows that our model predicts smaller negative effects for males than for females. As shown in Section 2, females have actually caught up with males in terms of average grades of schooling, and most of their gains relative to males were precisely during the 1970s and 1980s. Thus, there are other factors that we are not able to identify that account for an important part of schooling progress among females.

Table 8 presents the same decomposition as in Figure 8 for each of the 18 LAC countries in our sample.[31] With only three exceptions, the conclusions derived from this decomposition are that the main cause of the slowdown in schooling accumulation for cohorts that were going through the schooling

[31] The table presents a decomposition similar to the one shown in Figure 8. It contains the difference between the change in each right-side variable during the 1950-1970 period and the 1970-1980 period.

system during the 1980s was the adverse macroeconomic environment. The negative macro effects are especially large for Costa Rica, Nicaragua, Bolivia, Ecuador, Peru, Chile, Uruguay, Paraguay, Argentina and Mexico. Two countries that deviate from the general pattern are the Dominican Republic and Jamaica, where macro conditions were actually favorable for the acquisition of schooling. Factor endowments played a predominant role in Brazil, where they accounted for a slowdown of about half a year of schooling, and had an even greater effect than the macro factors.

The last two rows in Table 7 show our final simulations. The first predicts the change in attainment by using the regression coefficients in Table 4 and mean values for the 1980s for factor endowments, health, urbanization and demography, as in previous simulations. But we use mean values of the 1970s for the terms of trade, volatility, GDP per capita growth and GDP per capita level, rather than the 1980s values. This simulates the change that would have been observed had individuals going through the system in the 1980s faced the more favorable macroeconomic conditions of the 1970s rather than the adverse conditions of the 1980s. According to these results, rather than a gain of 1.17 grades of schooling for the whole population, the improvement would have been of 1.79 grades (more than half a grade more). In the case of males and females, the simulated gains are 1.49 and 1.98, which are much higher than the actually observed values of 0.84 and 1.50, respectively. The last row in the table predicts what would the slowdown have been if rather than the conditions of the 1980s, individuals going to school during these years faced the macro conditions of the 1970s. The result is that for the whole population, the slowdown would have been  0.10 grades instead of 0.72. For males the slowdown would have been 0.19 rather than the observed 0.85, while for females the slowdown would have been 0.10 rather than 0.58 grades.

Thus, among the variables we are able to represent, the negative macroeconomic conditions of the 1980s are the most important explanation for the slowdown in schooling accumulation in LAC. This is an important conclusion because it suggests that macroeconomic crisis may have long-term negative effects through lessening investments in human capital.

## 6. Conclusions

There is extensive empirical literature on what determines schooling attainment.  But most studies have not been able to link schooling attainment closely to changes in macroeconomic and other aggregate conditions. This paper uses a new high quality household survey-based data set for 18 Latin American and Caribbean countries to assess the effects of aggregate conditions on schooling attainment.  These data first are used to document that the Latin American and Caribbean region experienced a sharp slowdown

in schooling progress in the 1980s. One feature of the LAC schooling transition is that most individuals enroll in school, but much smaller proportions complete primary schooling than in countries with more extensive schooling transitions during the same time period, such as Korea and Taiwan.

We discuss a theoretical framework on the association between schooling attainment and sets of variables for macroeconomic stability, factor endowments, demographic developments, institutions and culture and religion, and then estimate multivariate relations for these variables using schooling attainment by birth cohorts as the dependent variable. The most robust conclusion is that macroeconomic stability, represented by the international terms of trade and GDP volatility, are the most significant determinants of schooling attainment and of the proportion of individuals that complete primary schooling. Estimates using the individual records of the 18 household surveys confirm this conclusion.

Finally the multivariate estimates are used to decompose the change in schooling progress by decade, and to explore the causes of the slowdown in schooling accumulation in LAC since the 1980s debt crisis. Among the variables that we are able to represent, the negative macroeconomic conditions of the 1980s are the most important explanation for the slowdown in schooling accumulation. This is an important conclusion because it suggests that macroeconomic crises may have long-term negative effects through altering investments in human capital. If human capital is a determinant of economic growth as suggested by the literature, macroeconomic instability may lead to a vicious circle in which low growth and high macro volatility hamper schooling attainment, which in turn inhibits future growth. Individuals in LAC going through the educational system in the 1980s are the new generations of young adults entering the labor market in the 1990s and will be of working age for 40 years. These generations were of school age at a time where the economic environment was adverse, and this may have reduced permanently their capacities to achieve a better standard of living throughout their lives.

# Appendix B

## B1. Mortality and Schooling Progress

Composition effects due to differential mortality that is inversely associated with schooling attainment can introduce an upward bias at older ages that would result in an underestimation of the schooling progress of the country in question.

Unfortunately, we cannot correct our data for this problem because detailed information on individual death records is not available. However, here we attempt to assess the magnitudes of the biases, and most importantly, to determine whether the effects differ substantially across the countries under analysis. Table B1 presents data on changes in the size of several birth cohorts born between 1920 and 1974, which gives some idea about the effect of mortality effects and other changes such as migration flows. Each column measures the size of the population from a cohort that is observed at two points in time, once when the cohort is born (or as close as possible to its year of birth), which clarifies the original size of the group, and once in 1995. The change in the size of the cohort indicates how important mortality and migration might be for each specific age group.[32] Take for instance the second row in the table, which refers to Jamaica. The column referring to the cohort born between 1970 and 1974 indicates that by 1995, 78% of the total population that was born in that cohort is still observed. The United Nation's (UN) data on which the results are computed is mostly taken directly from censuses and is normally regarded as reliable, so it would be safe to say that either migration or mortality are likely to play a relatively important role in the changes in the stock and flow of schooling in Jamaica.

Because the UN population statistics cover the 1950-1995 period, it is not possible to compare the original size of *all* cohorts with the size they have in 1995. Cohorts born in 1920-24 are observed for the first time in this data in 1950, so the comparison in the table in this case and for the other cohorts born before 1950 refers to the size observed in 1995, relative to the size that the cohort had in 1950. For older cohorts, the proportion of the original population still observed in 1995 is quite low. Among the LAC countries, the average for the 1920-24 cohort is 41%, but the percentages for individual countries range from 28% in Bolivia to 57% in Costa Rica. At the bottom of the table we compare with the United States and Korea (which are countries that are used in comparisons in Section 2). For Korea the proportions are close to the lowest ratios observed in LAC. If the population from each cohort that survives in 1995 were representative of the whole population in the cohort in terms of schooling attainment these ratios would not affect our analysis. However, if in fact life expectancy is lower for less educated individuals, as the evidence seems to indicate, lower numbers in the first columns of the table would imply that conclusions on schooling progress in that country based on recent cross-sectional data is biased downward. For our analysis, we focus on cohorts born after 1930 because from this year on, at least half of the original cohort is observed in all countries (with the only exception of Jamaica), and in most cases, more than 60% of the individuals belonging to the cohort are observed. There are three cases (Costa Rica, Venezuela and Argentina) that stand out from the rest in that the ratio is quite high. Therefore, it is likely that comparisons with the other countries will overestimate progress in these cases. In Nicaragua, Bolivia, El Salvador and Jamaica, the proportions are lower and so comparisons with the rest of the countries will tend to underestimate progress.

[32] Migration can have a positive or negative effect on the size of the cohort. In the case of immigration to a country, the additional population may counter balance the effect of mortality, and even though the size of some cohorts remains the same, there still might be strong composition effects.

As the year of birth is closer to 1995, the effect of mortality tends to be lower, but migration is expected to play a more important role. It can be seen that in all countries in Table B1 the ratios increase with the year of birth, but in some, including El Salvador, Jamaica, Bolivia and Nicaragua we observe on average less than 68% of the original population of each cohort. In El Salvador and Nicaragua, which experienced several years of war, it is likely that the reduction is due to a combination of mortality and migration, while in Jamaica and Bolivia, migration might play a more important role. Apart from these cases, there is another group of countries, including Uruguay, Mexico, Peru, Honduras and the Dominican Republic, where for the cohorts born after 1950 the ratios are around the average for the region, so the biases are expected to be lower than in the case of the previous four countries, but higher than for the remaining countries.

To provide some idea about how important mortality might be, Table B2 plots the death rate per 1,000 individuals for the whole population in each country for several five-year intervals.[33] Generally the differences among the countries in the table are not particularly large enough to lead to significant biases in the comparisons of schooling progress through time. The most notable exception in the table is the case of Korea in 1950. As can be seen, mortality rates in 1950 were strikingly high (around 28.5%). However, since these years correspond to the Korean War, it is difficult to interpret the effects on attainment. If relatively more uneducated individuals died during the war, schooling progress would be underestimated, while if more educated individuals died, there would be an overestimation of progress. Thus, the implication of these high death rates for our analysis is that the confidence in the attainment level of generations that were alive in 1950 is lower than for subsequent generations. In the case of Korea it seems safer to compare attainment among cohorts born from 1960 on.

## B.2 The Effects of Migration

Similar to mortality, differential immigration or migration among the educated and the uneducated can introduce biases depending on the composition of migrants. If a country receives large flows of relatively educated individuals, the composition effect will be confounded with genuine education progress, while if large proportions of educated migrate to other countries, the composition effect will be confounded with lower progress.

The effects of migration are much more difficult to trace than mortality. In some cases, such as wars, people with higher education might be the first to migrate, but in other times, migrants might predominantly be the relatively uneducated. Unfortunately, historical data on migration flows to assess the magnitude of this bias as in the case of mortality is not available. Furthermore, in contrast to mortality, which declines smoothly through time as shown in Table B2, migration flows can be abrupt and change drastically depending on the conditions of countries at particular points in time. The last column in Table B2 plots the proportion of the total population that migrated during the 1990-1995 period (which is available from the UN). The most drastic case appears to be Jamaica, where 3.8% of the whole population of the country migrated during these five years. Other notable cases are Nicaragua, Mexico, and the Dominican Republic, where more than 1.2% of the whole population migrated. Another interesting case is Costa Rica, which received large flows of immigrants during these years, equivalent to 2.8% of the total population. For the rest of the countries, migration rates are relatively low at least for these particular years.

These results are revealing of the magnitude of the migration effect, but they do not cover a sufficiently long time period to make judgements about the bias it might introduce when comparing schooling

[33] Death rates in the table are net of infant mortality, and are calculated from the UN population statistics.

attainment across countries because the flows observed in 1995 are not necessarily representative of past migration flows. There are two cases that we are able to document, and that can shed light on these differences. The first case is Mexico. Table B3 plots the distribution of the population from eight birth cohorts, by education level, for 1994 and 1996, respectively. This is an interesting case, because as is well known, Mexico went through a deep economic crisis at the end of 1994 (right after the household survey had been held), with reductions in GDP per capita of more than 8% and even larger contractions in consumption. The large migration flows documented in table B1 might well have been triggered by the crisis. If migration were the same across education groups we would expect to observe very similar distributions of the population by schooling level because the birth cohorts in the table (and specially the older ones) are way passed schooling age. Differences could also arise from differential mortality, but the evidence for Mexico in Table B2 would lead to expect rather small shifts from this source.

For cohorts born between 1930 and 1939, who were around 55-65 years of age by the mid-1990s, the distribution of the population by education is very similar for 1994 and 1996. Therefore, either low proportions of individuals from these groups migrated, or if they did, migration patterns were very similar across education groups, with no effect for our analysis. This is the case also for cohorts born between 1955 and 1965, who by the mid-1990s were around 30 to 40 years of age. For these age groups the distribution by education level changes, but not significantly (for the cohort born between 1955 and 1969 changes are somewhat larger, but still relatively small and might be associated with genuine education progress). In contrast, for the cohorts born between 1940 and 1955, who by 1995 were between 40 and 50 years of age, the distribution of the population by education changed significantly between 1994 and 1996. In all these cases, the proportion of uneducated declines between 6 and 3 percentage points, while the proportion of individuals with primary incomplete increases (although only for the 1940-44 and the 1950-54 cohorts). There is also evidence that the proportion of individuals with complete secondary education declined by around 3 to 4 percentage points. These changes are not likely to be the result of post-sample schooling (this is documented later), and suggest that migration was higher among people with no education, and people with secondary complete, but the flows among the first of these groups seem to be larger. This has a positive effect on the stock of schooling in the country and would bias schooling progress upward. As shown in the text later using 1996 data, Mexico apparently made large schooling progress particularly among cohorts born between 1940 and 1955, but the evidence in Table B3 reveals that part of this progress could be confounded with composition effects from migration.

Another interesting case is Taiwan, which is regarded as being one of the countries with greater schooling progress in the developing world, and is used in this paper as a benchmark to compare with LAC. There seems to be consensus in that this achievement is mainly associated with policy choices that created incentives and means for the accumulation of schooling. Although we do not doubt that this is the case, it is interesting that especially in its early years, migration flows could have played an important role in boosting the stock of education, with positive effects for subsequent generations. Table B4 shows the population structures of Taiwan in 1946, 1951 and 1956, and follows the size of birth cohorts through ten years, in the same fashion than in Table B1. For instance, the first row in the table follows the cohort born in 1897-1901, that by 1946 was around 46 years of age. Five and ten years later, practically the same number of people was observed in this cohort. However, for younger age groups, the size of the cohort increases significantly between 1946 and 1951. The largest increase in absolute terms is registered among cohorts born between 1922 and 1926, who by 1946 were around 20 years of age. According to the information in the table,[34] the size of this cohort increased by 18% in five years, which is most likely reflecting the high migration rates. In fact, in the middle portion of the table we decompose the increase in the size of the population, and observe that births and deaths (the natural increase) can only account for

[34] Which is taken from the Statistical Yearbook of the Republic of China, 1975.

around 40% of the population increase during 1946-1951, while for 1951-1956 practically all the change is attributed to the natural increase. Thus, very high migration rates might have changed the composition of the population in the early years of the country.

The lower portion of the table provides information on the education structure of Taiwan, and helps trace the effects of migration on schooling attainment. There are three major changes in the education structure of the population between 1946 and 1951 that occurred simultaneously with the large migration flows. First, the proportion of illiterate individuals declined by more than ten percentage points, from 54.98% to 43.4%. Second, the proportion of individuals with primary education increased by more than six points, while the proportions with junior high and senior high increased by around 3 and 2 points, respectively. Given the short time span between these changes, and given that the comparisons in the table refer to age groups that had exited school age, it is unlikely that they reflect genuine schooling progress. They are probably the result of migration flows of individuals with relatively higher schooling than the average Taiwanese.

In sum, Tables B3 and B4 provide evidence on the effects of migration on schooling progress. In some cases, such as Mexico, a relatively high proportion of uneducated individuals seem to have migrated after the 1994 economic crisis, creating an upward bias in schooling for prime age adults. On the other hand, Taiwan seems to have received a significant boost in schooling levels in its early years due to the composition of immigrants with relatively high education. For the rest of the countries under analysis, migration effects might also be important, but the direction and magnitudes of the biases are more difficult to trace down due to data availability.

## B3. Post-Sample Schooling

Another potential limitation of information on schooling progress is post-sample schooling. If a large proportion of individuals in the age ranges considered continue to acquire schooling after the surveys, when they are observed in a snapshot their schooling will tend to be underestimated. Table B5 in the Appendix provides some information on the magnitude of this potential bias. It plots the proportion of individuals that are passed standard school age, and that are still enrolled in school at the time of the survey. For cohorts born before 1965, the proportions are low in all countries, suggesting that the attainment of age groups above 25 year of age will not change significantly if observed in subsequent years. For the cohort born between 1965 and 1969, which is around 30 years of age in 1995, the proportions are higher, but still well below 10% of the total population of the cohort in most cases. The only two countries where post-sample schooling can lead to a more important downward bias in attainment seem to be Uruguay and Bolivia, where around 9% of the population born between 1965 and 1969 are still enrolled in school at the time of the survey. Because, as we show later, these countries appear to have some of the highest attainment levels anyway, post-sample schooling is not likely to bias our comparisons across countries in a significant way.

# Appendix C

## C1. The First Stages of the Schooling Transition

Shavit and Blossfeld (1997) claim that it is usually the case that countries progress through an "education transition" that starts with most of the population with no schooling. The first stage of the education transition is reached when within new cohorts, the proportion of individuals with no schooling is negligible (say under 5%) and most of the individuals in the cohort complete primary education (with an initial sub-stage in which there is almost universal enrollment and completion of at least one year of school.) In the second stage most individuals complete some secondary school, in the third stage most complete secondary school, and in the fourth stage most complete some tertiary education. In this Appendix, we document the speed at which each of the LAC countries in our sample went through this transition, and we compare them with Korea and Taiwan.

Table C1 presents information on the initial sub-stage of the first stage of the transition: the shift from no schooling to almost universal completion of at least one grade. This table gives the proportion of populations in selected birth cohorts with at least some primary schooling. On the average in LAC, for example, 72% of the cohort born in 1930 had some schooling, 80% of the cohort born in 1940, 87% of the cohort born in 1950, 73% of the cohort born in 1960, and 95% of the cohort born in 1970. For LAC as a whole, thus, the initial sub-stage of at least 95% of cohorts having some schooling was reached only around 1970. For generations born earlier than 1940 LAC had about the same proportion of birth cohorts that completed at least one year of schooling as in Korea and Taiwan. In fact, Korea and Taiwan had larger shares of population with no schooling for cohorts born in the 1930s than did Ecuador, Colombia, Peru, Costa Rica, Panama, Paraguay, Chile, and Jamaica.[35] All the LAC countries for which household survey data are available -- with the exceptions of the Dominican Republic, Nicaragua, El Salvador, Honduras and Brazil--[36] by 1970 the birth cohort had already surpassed the initial sub-stage of the transition in which more than 95% of the population in a cohort had at least some education. The countries to reach this sub-stage by 1940 were Uruguay and Jamaica. By 1950 Chile – and also Korea and Taiwan – reached this sub-stage. These two East Asian countries reached this sub-stage long before Ecuador, Colombia, Dominican Republic, Peru, Paraguay and Venezuela even though these LAC countries seemed to have better educational prospects by this criteria a decade earlier.

Table C2 gives the proportions of cohorts that have completed at least primary schooling – which, when this proportion reaches 95%, indicates the completion of the first stage of the education transition. Korea and Taiwan had high proportions of their cohorts born in 1930 and 1940 with at least complete primary schooling -- a little over 65%. The only two countries in LAC with higher proportions were Jamaica and Argentina. In the course of the next two decades Korea (by 1950) and Taiwan (by 1960) attained the first stage of the educational transition with at least 95% of new cohorts completing primary schooling. The only countries in LAC to attain the first stage of the educational transition during the period are Jamaica (1960), and Argentina and Uruguay (1970).

Within LAC, the three countries with expansions in the proportions of population with primary complete in the period under analysis over 50 percentage points are Mexico (61%), Costa Rica (54%), Ecuador (53%), Honduras (53%), Chile (52%) and Bolivia (52%). These countries had rather low proportions of the population with complete primary among individuals born in 1930, but in the following 40 years they

[35] As noted in Appendices B1 and B2, in these two East Asian countries there were large political discontinuities that caused important migration and mortality effects that are confounded with schooling progress for those born in these countries.

[36] Mexico is in the margin of the 5% cut off point.

expanded coverage substantially. In contrast, the expansion seems to be much slower in Colombia and Peru, where more than 40% of the population of the 1940 cohort had completed primary school, but the proportion increased by only 30 percentage points in the following thirty years. Less than two-thirds of cohorts born in 1970 in Brazil (55%), Honduras (64%), El Salvador (59%) and Nicaragua (58%) completed primary school.

## C2. Coverage vs. Completion

An interesting feature of Tables C1 and C2 is that among cohorts born before 1950, in 12 out of the 18 LAC countries, a larger proportion of the population was covered by the education system before 1950 than in Taiwan.[37] Table C1 also shows that there are only very small differences across most of the countries, including Taiwan and Korea, in the proportions of individuals in the 1970 cohort with no schooling. In fact, the difference between these two East Asia countries and Uruguay, Chile, Panama, Costa Rica and Paraguay is negligible. In all cases less than 3% of the population in that cohort has no schooling. However, when we turn to Table C2 there is stark contrast between Korea and Taiwan and the other LAC countries with respect to the proportion of the population in the 1970 cohort that have finished primary schooling. While in Korea and Taiwan virtually 100% of this cohort has completed primary school, less than 65% of the same group finished primary schooling in Honduras, El Salvador, Brazil and Nicaragua, and around 85% has done so in another six countries. An extreme case is Brazil. Brazil is *not* the country with the highest proportion of uneducated (see Table C1), but it is the country with the lowest proportion of individuals with completed primary schooling. This suggests that even though initial enrollment in the educational system might not be a problem in most LAC countries any longer (and in fact this is not the main source of differences between the two East Asian and most LAC countries), in recent decades there still have been enormous differences in the capacity to retain individuals in the education system until they complete at least primary education.[38]

Table C3 illustrates these differential progress rates through primary school by giving the proportion of the population in a given cohort that completes primary education relative to the individuals that enroll in primary. In the educational literature these are sometimes characterized as “efficiency rates” though they do not necessarily bear a close relation to economic efficiency.[39] As expected, the table shows that in Korea and Taiwan, for individuals in cohorts born in 1930 practically all of those who entered into primary school also completed primary school (the rates are similar to those in the US). So, historically it seems that retention rates in these countries have been very high. In contrast, among all the individuals belonging to the 1930 cohort in Chile, Mexico, Nicaragua, El Salvador, Paraguay, Honduras, the Dominican Republic and Brazil that enrolled in primary school, less than 40% of them completed this level. Most LAC countries were able to catch up in terms of educational efficiency rates in the following 40 years. For cohorts born in 1970 the probability of obtaining a primary education degree conditional on ever enrolling has increased to around 85%on the average in the LAC countries included in the table, which is a substantial improvement, but still much less than in the East Asian countries.

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[37] Primary completion in Tables C2 and C3 was considered to occur after completing at least 5 years of schooling in Bolivia and Colombia; 6 years in Brazil, El Salvador, Costa Rica, Ecuador, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay and Venezuela; 7 in Argentina; and 8 in Chile and the Dominican Republic.

[38] Filmer, et.al. (1998) arrive at a similar conclusion by comparing enrollment and attainment among younger generations and including information for other regions in the world.

[39] The number of completed grades of schooling is efficient if the social marginal benefit of the last grade completed equals the social marginal cost of that grade. There is no reason why the economically efficient number of grades of schooling for some individuals in some contexts cannot be less than completion of primary school.

Table C4 presents the same rates broken down by gender. For the cohort born in 1970 few differences are apparent on average, with completion rates higher for females in 10 countries and higher for males in eight countries.[40] The main difference is that in most cases, improvements among males were much lower for the 1950-70 cohorts than for the 1930-1950 ones, while this does not seem to be the case for females. For females in 10 countries, the expansion was even greater for the 1950-70 cohorts than for the 1930-50 cohorts.

Household survey data show that there are two features shared by most LAC countries that are associated with these relatively low (at least by East Asia standards) primary completion rates. First, with the exception of Argentina, Uruguay (both of which are urban surveys) and Jamaica, enrollment rates at ages six and seven are not 100% even though in 15 of the 18 countries for which we have this data, initial enrollment is expected to occur at age six (Table C5). According to UNESCO, the entrance age in El Salvador, Honduras, Brazil and Nicaragua is 7 years of age.[41] In most LAC countries children are entering relatively late in the school system. At age 9 14 countries register enrollment rates over 95 percent, and in El Salvador, Honduras and Brazil enrollment never reaches more than 95% at any of the ages considered. Second, retention rates at young ages are strikingly low. In countries like Brazil and Honduras, which have low primary completion, enrollment rates are very low at ages 6 and 7, but then stabilize at around 90% for ages 8 to 12 approximately. Surprisingly, enrollment rates at age 12 are not substantially different in Brazil and Uruguay, even though we know that primary completion rates are much higher in Uruguay. This confirms the well-known problem that in Brazil the limited grades completed are not so much because of low enrollment rates as the relatively low probability to complete a sufficient number of grades to obtain a primary degree, even by remaining enrolled in school for many years.[42] While Honduras is also characterized by high repetition rates, unlike in Brazil, enrollment rates start declining sharply by age 11. Similarly in Colombia, Ecuador, El Salvador, Mexico and Paraguay, early departure from school contributes to low primary completion rates.

Perhaps the most striking feature of Table C5 is that even though there are declines in enrollment at around age 12 for several countries, enrollments are higher than might have been expected after looking at the results in Table 5 where we showed that primary completion rates are below or around 80% in most countries in the region. This reflects that although individuals might find it relatively easy to enroll in school, they find it hard to actually complete grades. To look into this in more detail, we display in Table C6 the proportions of 8-year old children that have not completed at least one grade of schooling in eight countries. The countries correspond to cases where we have two household surveys that were held in almost adjacent years. For example, in Brazil we observe 8-year olds in a 1993 survey, and we follow this age group two years later when it appears in the 1995 survey. Thus, we observe Brazilian children at age eight in 1993 and include the proportion of them who have *not* completed at least one grade of schooling and then we plot the proportion of children age 10 in 1995 who have not completed at least one grade of schooling. In countries such as Honduras, Peru and Uruguay the surveys are more than two years apart so we still follow the group of children that was of age eight in the first survey and track them in the following survey, when are three or four years older.

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[40] In Tables C4 and C7 some secondary schooling was considered to occur after completing at least 6 years of schooling in Bolivia and Colombia, 7 years in Brazil, El Salvador, Costa Rica, Ecuador, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay and Venezuela, 8 in Argentina, and 9 in Chile and the Dominican Republic.

[41] UNESCO Statistics in the database available at http://unescostat.unesco.org.

[42] Barros and Lam (1996) note that the difference in mean educational attainment of 14 years olds in the Northeast of Brazil and São Paulo is not explained by regional differences in school attendance rates, but by regional differences in repetition rates.

The results in Table C6 are quite revealing. For example, in Brazil, although Table C5 shows that at age eight enrollment rates exceed 90%, Table C6 shows that 54.8%of 8-year olds have not completed one grade of schooling. Two years later, 19%of the children in the same group (which is now 10 years of age) have not completed one grade. So, a sizable proportion of children seem to be taking a very long time to complete at least one grade of schooling even though they have been enrolled in the system for some years. This does not seem to be a problem in Chile or Panama, but in the other six countries it also seems to be the case that a large proportion of children have to be enrolled in school for several years before they are able to complete the first grade. For instance, in Honduras 38.1%of the children enrolled have not completed even one grade by age eight. So, for at least half of the countries for which we have information for two adjacent points in time, it seems that the low primary completion rates as compared to Taiwan and Korea are exacerbated by low promotion rates in the initial stages of primary school.

## C3. Later Phases of the Transition

Table C7 gives the percentages of each birth cohort that has at least some secondary schooling. As for primary schooling, similar proportions of the 1930 cohort in Korea, Taiwan, Uruguay, Chile, Peru and Panama had at least some secondary education. However, there was much faster subsequent progress in the two East Asian countries. For cohorts born four decades later, virtually 100% of their populations had completed at least some secondary school, so they had completed the second stage of the educational transitions. Among the four LAC countries that started at a similar level, only Uruguay registered rates over 80% for cohorts born in 1970 and the remaining three had rates between 70% and 80%. There is a group of countries including Venezuela, Mexico, Colombia and Ecuador that started off with lower proportions with secondary enrollment, and where around 60% of the 1970 cohort had at least some secondary education. In the rest of the countries, the proportions were relatively low for the 1930s, and remained at around 50% or less for cohorts born forty years later. Again, the group of countries with lower primary completion rates had the lowest proportions of individuals ever enrolled in secondary mainly because there was not a sufficiently large group of people eligible to enter secondary school.

The cross-country differences in Table C7 mirror the differences in primary completion educational "efficiency rates" across countries presented previously. The most noteworthy exception to this pattern is Costa Rica, which has relatively large primary completion rates and high educational efficiency rates at the primary level, but very low proportions of population ever enrolled in secondary. Up to cohorts born by 1960 Costa Rican secondary enrollment had expanded considerably, but there was no progress between the 1960 and 1970 cohorts and Costa Rica had among the lowest rates of some secondary schooling for the 1970 birth cohort. Table C5 shows that in Costa Rica there is a sharp decline in enrollment rates starting precisely at age 12, when most children have finished their primary education if they started at age six and progressed a grade each subsequent year. Enrollment rates decline after age 12 almost at the same pace as in Honduras, which is among the countries in LAC with the poorest overall schooling performance.

In Table C8 we present the proportion of the population in selected cohorts that have completed secondary education.[43] Again, Korea and Taiwan had similar rates to those for some LAC countries for the 1930 birth cohort (urban Argentina, Peru, Panama, Chile). But Korea and Taiwan performed much better than any of the LAC countries in the subsequent four decades, so that for the 1970 birth cohort Taiwan had a secondary completion rate of 77% and Korea of 95% -- that latter indicating the

[43] Secondary completion was considered to occur after completing 11 years of schooling in Brazil, Colombia, Costa Rica, Honduras, Jamaica, Nicaragua, Peru, and Venezuela, and 12 years in Argentina, Bolivia, Chile, the Dominican Republic Ecuador, El Salvador, Mexico, Panama, Paraguay, and Uruguay.

completion of the third stage of the educational transition and significantly higher than the 88% for the United States. The LAC countries with the highest secondary completion rates for the 1970 cohort are Jamaica, Peru and Chile, with almost 60% -- 10 and 20 years later than Korea and Taiwan. The lowest rates for the 1970 cohort were in Honduras, Nicaragua, Paraguay, Brazil and El Salvador, with proportions similar to those in Korea for cohorts born 30 or 40 years earlier.

Finally, Table C9 shows the proportion of selected birth cohorts that have some higher education.[44] Interestingly, there are 12 LAC countries that had *larger* proportions with some higher education among cohorts born before 1960 than did Taiwan.[45] Moreover, on average, the LAC countries in the sample had a larger proportion enrolled in higher levels of schooling up to the 1960 cohort. This is in stark contrast with all the comparisons for lower schooling levels above. Take for instance the case of the Dominican Republic, which is among the countries with relatively low attainment in the region. Table 1 shows that on average, cohorts born in 1960 had 8.6 grades, while the same cohort in Taiwan had 11 grades. Nevertheless, 13.7% of individuals from the same cohort in the Dominican Republic had some higher education, while only 9.5% did so in Taiwan. This reflects that not only LAC countries have had lower education progress in the past decades, but that the variance of grades of schooling is higher than in countries with better performance such as Taiwan.

In sum, the pattern of schooling progress in LAC, could be characterized as follows: the system provides widespread coverage in most countries but attainment levels are relatively low due to the low proportion of individuals that complete the basic first years of education at young ages. In spite of the low primary and secondary completion rates, a relatively high proportion (at least by Taiwanese standards) of the population attend higher education, which reflects relatively unequal distribution of schooling.

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[44] The completion of some higher schooling was considered to occur after completing at least 12 years of schooling in Brazil, Colombia, Costa Rica, Honduras, Jamaica, Nicaragua, Peru, and Venezuela, and at least 13 years in Argentina, Bolivia, Chile, the Dominican Republic, Ecuador, El Salvador, Mexico, Panama, Paraguay, and Uruguay.
[45] Because it is more likely for 25 year olds to be acquiring higher education than attending lower schooling levels, comparisons for the 1970 cohort are less confident than for previous ones.

**Figure 1**

**Mean Years of Schooling by Cohort**

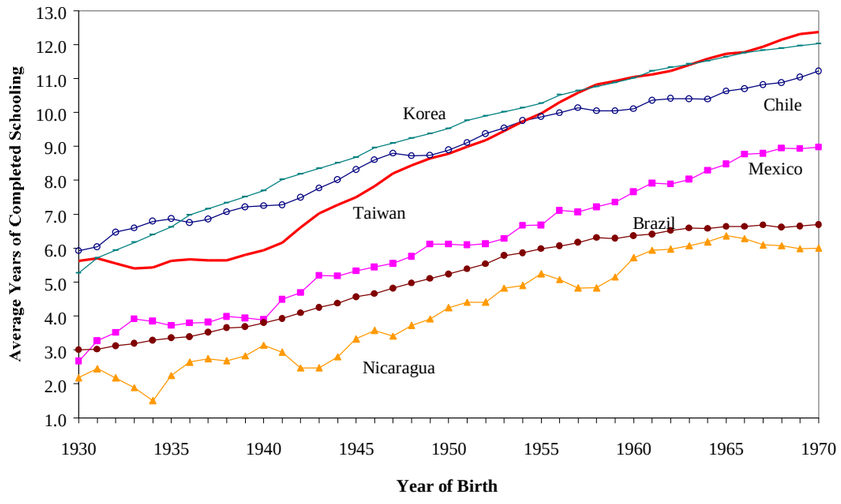



**Figure 2**

**Pattern of Schooling Progress in**
Taiwan and Latin America

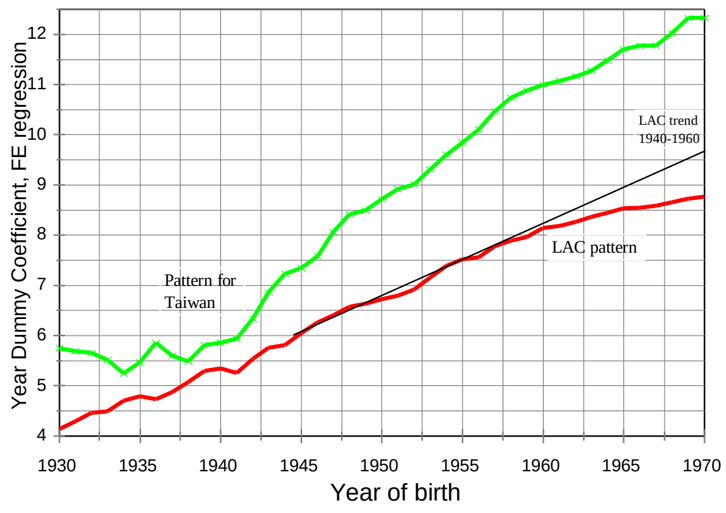


**Figure 3**

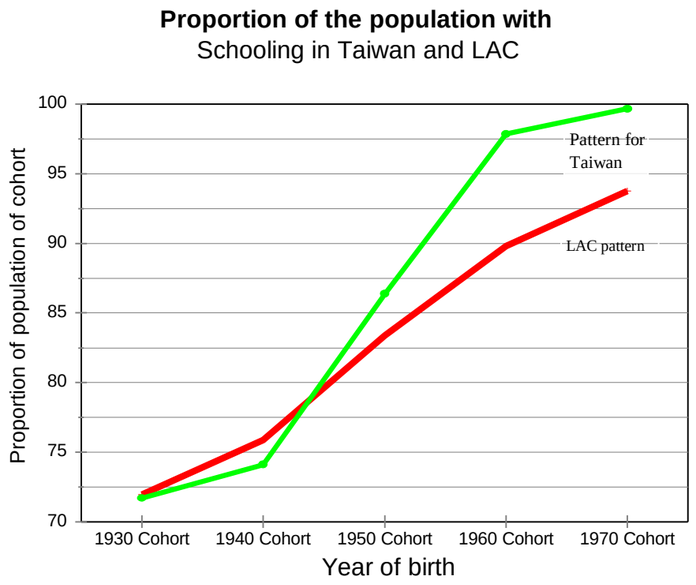
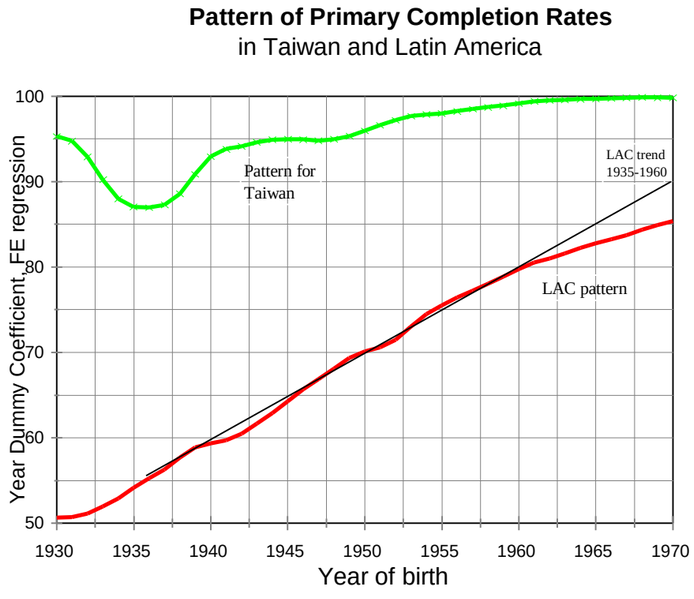



**Figure 4**



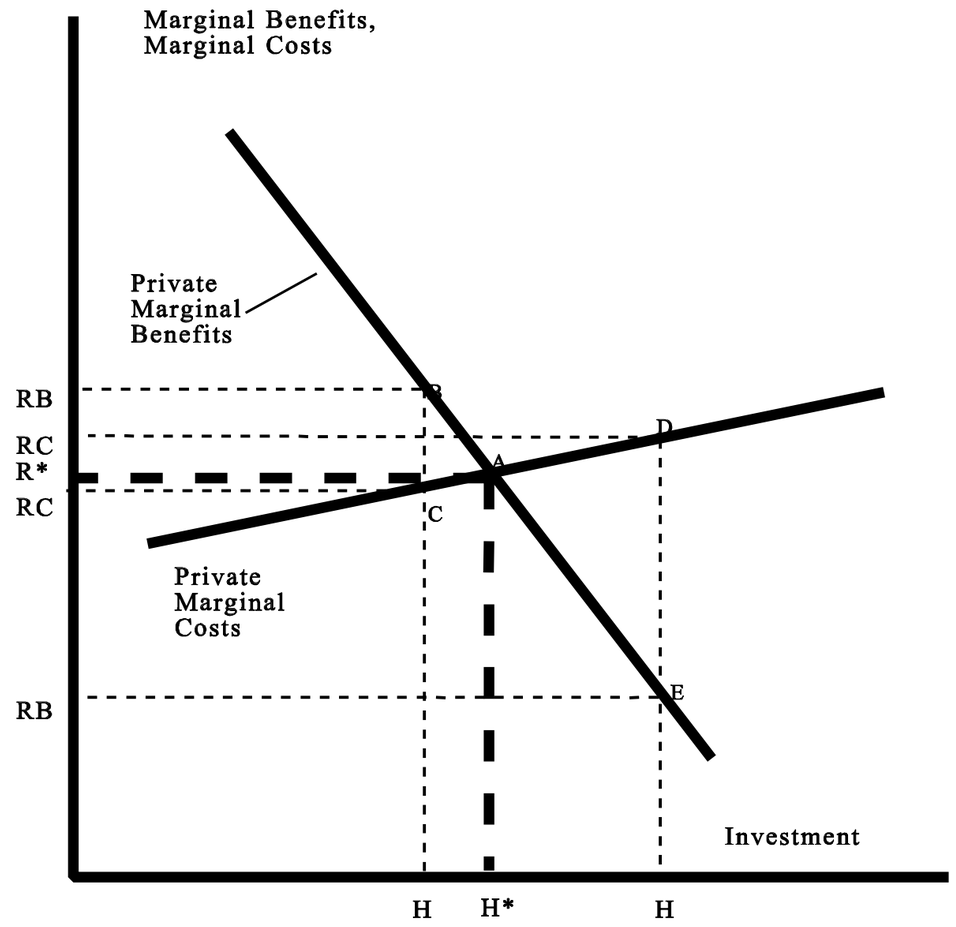



Figure 1. Private Marginal Benefits and Private Marginal Costs of an Investment for an Individual

Figure 6

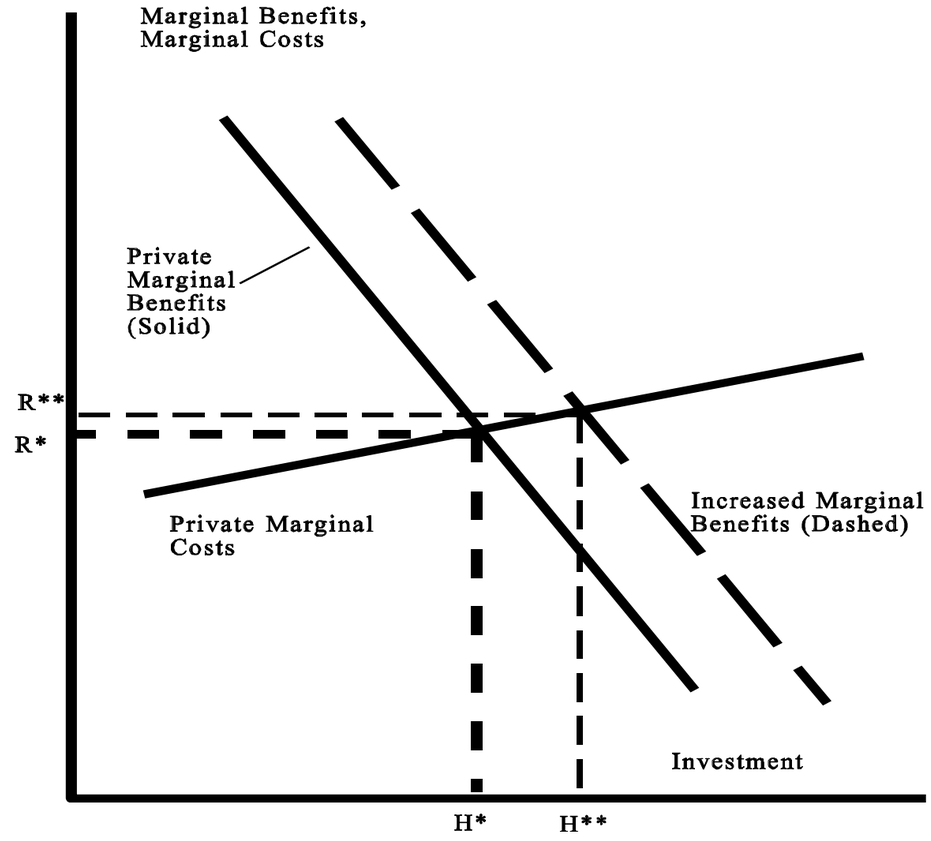



Figure 2. Private Marginal Benefits and Private Marginal Costs of Investment for an Individual, with Increased Marginal Benefits (Dashed Line)

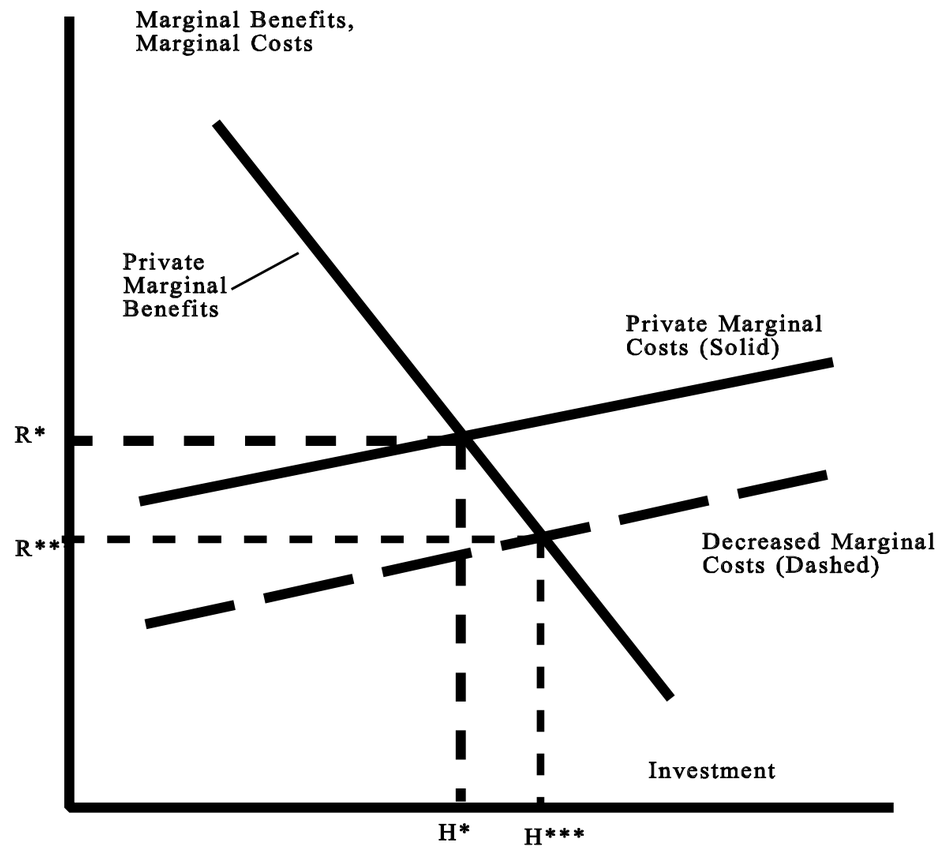



Figure 3. Private Marginal Benefits and Private Marginal Costs of Investment for an Individual, with Decreased Marginal Costs (Dashed Line)

**Figure 8**

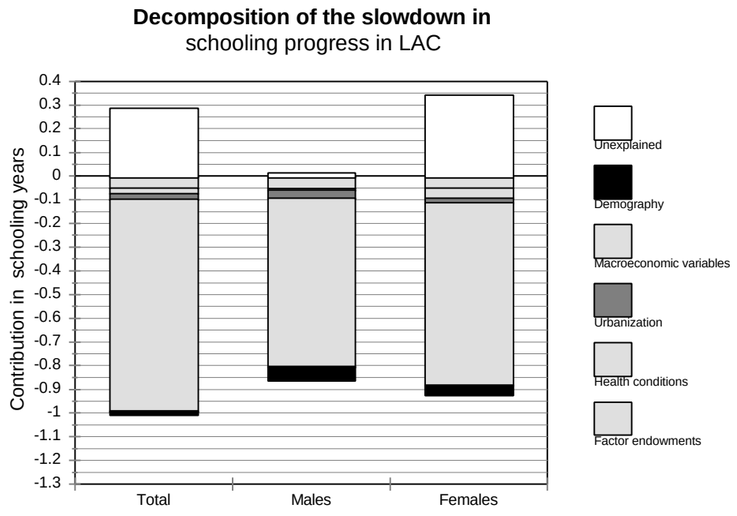

Decomposition of the slowdown in
schooling progress in LAC
Contribution in schooling years
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
-1.1
-1.2
-1.3
Total
Males
Females
Unexplained
Demography
Macroeconomic variables
Urbanization
Health conditions
Factor endowments

**Table 1**

Average years of schooling by birth cohort

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 1.4 | 3.2 | 4.6 | 5.6 | 6.1 | 3.2 | 1.4 | 4.7 |
| Nicaragua | 2.0 | 3.2 | 4.3 | 5.8 | 5.8 | 2.2 | 1.6 | 3.8 |
| El Salvador | 2.1 | 3.2 | 4.1 | 5.7 | 7.0 | 2.0 | 2.9 | 4.9 |
| Brazil | 2.8 | 3.6 | 5.2 | 6.2 | 6.7 | 2.4 | 1.5 | 3.9 |
| Mexico | 2.9 | 4.2 | 6.7 | 8.2 | 9.3 | 3.8 | 2.6 | 6.4 |
| Dominican Republic | 3.2 | 4.2 | 7.0 | 8.6 | 9.1 | 3.9 | 2.1 | 5.9 |
| Venezuela | 3.2 | 5.1 | 6.9 | 7.9 | 8.3 | 3.7 | 1.4 | 5.1 |
| Bolivia | 3.3 | 4.5 | 6.3 | 7.0 | 8.6 | 2.9 | 2.3 | 5.2 |
| Paraguay | 3.8 | 5.1 | 6.1 | 7.4 | 7.3 | 2.3 | 1.2 | 3.5 |
| Ecuador | 3.9 | 4.5 | 6.5 | 8.5 | 9.5 | 2.6 | 3.0 | 5.6 |
| Colombia | 3.9 | 4.4 | 6.2 | 7.7 | 8.4 | 2.3 | 2.2 | 4.4 |
| Costa Rica | 4.3 | 5.7 | 7.1 | 8.8 | 8.4 | 2.8 | 1.3 | 4.1 |
| Chile | 5.2 | 7.1 | 8.9 | 10.1 | 11.1 | 3.7 | 2.1 | 5.8 |
| Panama | 5.8 | 6.9 | 8.8 | 10.3 | 10.1 | 3.1 | 1.3 | 4.4 |
| Peru | 6.0 | 6.3 | 7.4 | 9.4 | 10.0 | 1.4 | 2.6 | 4.0 |
| Uruguay* | 6.3 | 7.4 | 8.8 | 10.0 | 10.7 | 2.5 | 1.9 | 4.4 |
| Jamaica | 6.9 | 7.9 | 8.3 | 9.6 | 10.6 | 1.4 | 2.3 | 3.7 |
| Argentina* | 7.5 | 8.3 | 10.0 | 11.0 | 11.3 | 2.5 | 1.3 | 3.8 |
| Average LAC | 4.1 | 5.3 | 6.9 | 8.2 | 8.8 | 2.7 | 1.9 | 4.6 |
| Korea | 5.3 | 7.7 | 9.5 | 11.0 | 12.0 | 4.3 | 2.5 | 6.8 |
| Taiwan | 5.8 | 5.8 | 8.9 | 11.0 | 12.3 | 3.2 | 3.3 | 6.5 |
| USA | 12.3 | 12.9 | 13.6 | 13.3 | 13.4 | 1.3 | -0.2 | 1.1 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997

*The survey for Argentina includes only Gran Buenos Aires; the survey for Uruguay covers only urban areas.

## Table 2

Average years of schooling by birth cohort for males and females

| Country | | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|---|
| | | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Argentina* | Male | 8.3 | 8.9 | 10.1 | 10.6 | 11.1 | 1.9 | 0.9 | 2.8 |
| | Female | 7.1 | 7.8 | 9.9 | 11.3 | 11.5 | 2.8 | 1.6 | 4.4 |
| Bolivia | M | 4.0 | 6.2 | 7.2 | 7.9 | 9.5 | 3.2 | 2.2 | 5.5 |
| | F | 2.5 | 3.2 | 5.3 | 6.3 | 7.9 | 2.8 | 2.6 | 5.4 |
| Brazil | M | 3.2 | 3.8 | 5.3 | 6.0 | 6.5 | 2.1 | 1.1 | 3.3 |
| | F | 2.6 | 3.4 | 5.1 | 6.4 | 7.0 | 2.5 | 1.9 | 4.4 |
| Chile | M | 5.3 | 7.4 | 9.1 | 10.3 | 11.3 | 3.7 | 2.2 | 6.0 |
| | F | 5.2 | 6.9 | 8.8 | 10.0 | 10.8 | 3.6 | 2.1 | 5.6 |
| Colombia | M | 4.2 | 4.6 | 6.4 | 8.0 | 8.2 | 2.2 | 1.8 | 4.0 |
| | F | 3.7 | 4.3 | 6.0 | 7.4 | 8.5 | 2.3 | 2.5 | 4.8 |
| Costa Rica | M | 4.8 | 5.8 | 7.2 | 9.3 | 8.2 | 2.4 | 1.1 | 3.5 |
| | F | 4.0 | 5.6 | 7.0 | 8.3 | 8.7 | 3.0 | 1.6 | 4.7 |
| Dominican Republic | M | 3.4 | 4.1 | 7.4 | 9.1 | 8.8 | 4.0 | 1.4 | 5.4 |
| | F | 3.0 | 4.3 | 6.7 | 8.1 | 9.4 | 3.7 | 2.6 | 6.4 |
| Ecuador | M | 5.0 | 4.4 | 7.2 | 8.5 | 9.2 | 2.2 | 2.0 | 4.2 |
| | F | 3.1 | 4.6 | 6.0 | 8.4 | 9.8 | 2.9 | 3.8 | 6.7 |
| El Salvador | M | 2.1 | 3.3 | 4.8 | 6.2 | 6.7 | 2.8 | 1.9 | 4.7 |
| | F | 2.1 | 3.2 | 3.5 | 5.4 | 7.2 | 1.4 | 3.7 | 5.1 |
| Honduras | M | 1.6 | 3.2 | 5.5 | 5.8 | 6.2 | 3.8 | 0.7 | 4.6 |
| | F | 0.9 | 2.9 | 4.6 | 5.6 | 6.1 | 3.7 | 1.6 | 5.3 |
| Jamaica | M | 7.0 | 7.6 | 8.6 | 9.7 | 10.4 | 1.7 | 1.7 | 3.4 |
| | F | 6.7 | 8.1 | 7.8 | 9.5 | 10.7 | 1.0 | 2.9 | 4.0 |
| Mexico | M | 4.0 | 5.1 | 6.7 | 8.3 | 8.9 | 2.7 | 2.2 | 4.9 |
| | F | 2.2 | 3.3 | 6.6 | 7.7 | 9.0 | 4.5 | 2.4 | 6.8 |
| Nicaragua | M | 2.7 | 3.8 | 4.6 | 6.4 | 6.4 | 1.9 | 1.9 | 3.7 |
| | F | 1.5 | 2.7 | 4.2 | 4.4 | 6.3 | 2.8 | 2.0 | 4.8 |
| Panama | M | 5.9 | 7.1 | 9.1 | 10.0 | 9.5 | 3.2 | 0.4 | 3.6 |
| | F | 5.6 | 6.6 | 8.6 | 10.6 | 10.7 | 3.0 | 2.1 | 5.1 |
| Paraguay | M | 4.7 | 5.4 | 6.3 | 7.2 | 7.4 | 1.6 | 1.1 | 2.7 |
| | F | 3.1 | 4.7 | 6.0 | 7.6 | 7.1 | 2.9 | 1.2 | 4.0 |
| Peru | M | 7.5 | 7.8 | 8.5 | 9.7 | 10.9 | 1.0 | 2.4 | 3.4 |
| | F | 4.2 | 4.7 | 6.7 | 9.1 | 9.3 | 2.5 | 2.6 | 5.0 |
| Uruguay* | M | 6.5 | 7.7 | 8.8 | 10.0 | 10.4 | 2.3 | 1.7 | 4.0 |
| | F | 6.1 | 7.2 | 8.8 | 10.0 | 11.0 | 2.7 | 2.2 | 4.9 |
| Venezuela | M | 3.5 | 5.4 | 7.0 | 8.1 | 8.0 | 3.4 | 1.0 | 4.5 |
| | F | 2.9 | 4.8 | 6.8 | 7.7 | 8.6 | 3.9 | 1.8 | 5.6 |
| **Average LAC** | M | 4.6 | 5.7 | 7.2 | 8.4 | 8.8 | 2.6 | 1.5 | 4.1 |
| | F | 3.7 | 4.9 | 6.6 | 8.0 | 8.9 | 2.9 | 2.3 | 5.2 |
| Taiwan | M | 7.1 | 7.5 | 9.8 | 11.5 | 12.3 | 2.6 | 2.6 | 5.2 |
| | F | 3.7 | 4.4 | 8.2 | 10.5 | 12.2 | 4.5 | 4.1 | 8.5 |

Source: Authors' calculations from household survey data.

*The survey for Argentina and Uruguay cover urban areas only.

## Table 3

**Average Years of Schooling of 15 and 18 year olds**

**In Selected LAC Countries**

| Country | Year | 15 Year Olds | | | 18 Year Olds | | | Change per decade | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Males | Females | Total | Males | Females | 15 yr olds | 18 yr olds | 1960-70** |
| Argentina* | 1980 | 7.7 | 7.3 | 8.2 | 9.7 | 9.6 | 9.8 | | | |
| | 1996 | 8.9 | 9.0 | 8.7 | 10.3 | 10.1 | 10.6 | 0.71 | 0.40 | 0.65 |
| Bolivia* | 1986 | 7.8 | 8.0 | 7.7 | 9.8 | 10.3 | 9.5 | | | |
| | 1995 | 8.0 | 8.1 | 7.8 | 10.0 | 10.4 | 9.7 | 0.14 | 0.18 | 1.14 |
| Brasil | 1981 | 4.0 | 3.9 | 4.2 | 5.3 | 5.1 | 5.4 | | | |
| | 1992 | 4.6 | 4.3 | 4.9 | 5.7 | 5.3 | 6.1 | 0.54 | 0.40 | 0.76 |
| Chile | 1987 | 7.6 | 7.6 | 7.7 | 9.4 | 9.3 | 9.4 | | | |
| | 1996 | 7.7 | 7.6 | 7.8 | 9.9 | 9.8 | 10.0 | 0.09 | 0.63 | 1.07 |
| Costa Rica | 1981 | 6.7 | 6.6 | 6.8 | 7.6 | 7.4 | 7.8 | | | |
| | 1991 | 6.5 | 6.5 | 6.4 | 7.4 | 7.2 | 7.7 | -0.25 | -0.21 | 0.66 |
| Honduras | 1989 | 4.9 | 4.7 | 5.0 | 5.3 | 5.0 | 5.5 | | | |
| | 1998 | 5.6 | 5.3 | 5.9 | 6.2 | 5.8 | 6.6 | 0.81 | 1.03 | 0.71 |
| Mexico | 1984 | 6.7 | 6.5 | 6.9 | 7.3 | 7.6 | 7.1 | | | |
| | 1996 | 7.5 | 7.5 | 7.5 | 8.3 | 8.2 | 8.3 | 0.69 | 0.78 | 1.32 |
| Panama | 1979 | 7.0 | 6.8 | 7.2 | 8.5 | 8.3 | 8.8 | | | |
| | 1991 | 7.5 | 7.3 | 7.7 | 8.9 | 8.5 | 9.2 | 0.41 | 0.30 | 0.64 |
| Peru | 1985 | 6.9 | 7.0 | 6.7 | 8.3 | 8.4 | 8.1 | | | |
| | 1994 | 7.8 | 7.8 | 7.7 | 9.9 | 9.9 | 9.9 | 1.03 | 1.82 | 1.28 |
| Uruguay* | 1981 | 7.7 | 7.7 | 7.6 | 9.0 | 8.9 | 9.2 | | | |
| | 1992 | 8.1 | 8.0 | 8.3 | 10.0 | 9.8 | 10.3 | 0.43 | 0.88 | 0.95 |
| Venezuela | 1981 | 6.3 | 5.9 | 6.6 | 7.4 | 7.1 | 7.8 | | | |
| | 1993 | 7.0 | 6.7 | 7.3 | 8.4 | 8.0 | 8.8 | 0.59 | 0.79 | 0.69 |

Source: Authors'calculations from household survey data. **Last column of the table refers to the change in mean years of schooling Between the 1960s and 1970s decade, computed from Table 1.

*Urban surveys.

## Table 4

**Base Regressions**

**Dependent Variable: Cohort average years of schooling**

| Independent Variable | Country Fidex Effects Regressions | | | | | | Random Effects Estimation | |
|---|---|---|---|---|---|---|---|---|
| | Tot. Population | | Males | | Females | | | |
| | Coeff | t' Stat. | Coeff | t' Stat. | Coeff | t' Stat. | Coeff | z' Stat. |
| Agricultural land per capita (100,000) | -0.250 | *-7.46* | -0.272 | *-8.05* | -0.246 | *-6.82* | -0.080 | *-5.42* |
| Capital per worker (1/10000) | 3.184 | *0.17* | 5.237 | *0.37* | 7.757 | *1.12* | 9.043 | *5.92* |
| Health conditions | 0.033 | *1.45* | 0.010 | *0.40* | 0.060 | *2.34* | 0.081 | *5.50* |
| % of urban population | 0.032 | *1.64* | 0.046 | *2.14* | 0.030 | *1.50* | 0.079 | *10.72* |
| Terms of Trade (100,000) | 0.012 | *8.08* | 0.016 | *6.97* | 0.011 | *6.68* | 0.004 | *1.87* |
| PPP GDP per capita (1,000) | 0.167 | *3.05* | 0.096 | *1.29* | 0.183 | *4.16* | 0.276 | *4.49* |
| Volatility of GDP growth | -2.837 | *-3.28* | -2.402 | *-2.18* | -2.317 | *-2.18* | -3.962 | *-2.07* |
| GDP per capita growth | 0.198 | *0.26* | 0.214 | *0.23* | 0.425 | *1.96* | 4.180 | *3.37* |
| Young depdency rate | -0.444 | *-0.07* | -6.206 | *-2.19* | -3.776 | *-0.43* | -0.377 | *-5.73* |
| Relative cohort size | -0.441 | *-1.51* | -0.340 | *-0.98* | -0.369 | *-1.08* | -0.364 | *-3.16* |
| Trade openness measure (1,000) | 6.179 | *2.04* | 8.283 | *2.52* | 4.210 | *1.44* | 5.008 | *3.64* |
| Mortality/migration | -0.237 | *-0.40* | -0.895 | *-0.89* | -0.451 | *-0.80* | -0.351 | *-1.32* |
| % Catholic religion | | | | | | | 0.016 | *1.98* |
| % Protestant religion | | | | | | | 0.234 | *3.86* |
| English rule of law | | | | | | | -10.099 | *-3.11* |
| Latitude index | | | | | | | 2.375 | *4.43* |
| Year trend | 0.074 | *5.52* | 0.061 | *4.53* | 0.083 | *6.21* | 0.046 | *5.29* |
| Constant | -136.9 | *-5.53* | -109.2 | *-4.43* | -156.6 | *-6.26* | -99.6 | *-6.01* |
| | | | | | | | | |
| Number of obs | 490 | | 500 | | 487 | | 490 | |
| F( 11, 17) | 18,339 | | 4,979 | | 38,096 | | | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.971 | | 0.948 | | 0.967 | | 0.799 | |
| Root MSE | 0.312 | | 0.407 | | 0.351 | | | |
| Prob > F country effects | 90447 | | 43839 | | 94907 | | | |
| Prob > F country effects | 0.000 | | 0.000 | | 0.000 | | | |

Source: Authors' calculations.

# Table 5

**Base Regressions**

**Dependent Variable: Years of completed schooling by individual**

| Independent Variable | Country Fidex Effects Regressions | | | | | | Random Effects Estimation | |
|---|---|---|---|---|---|---|---|---|
| | Tot. Population | | Males | | Females | | | |
| | Coeff | t' Stat. | Coeff | t' Stat. | Coeff | t' Stat. | Coeff | z' Stat. |
| Agricultural land per capita (100,000) | -0.353 | *-2.50* | -0.413 | *-2.85* | -0.298 | *-2.14* | -0.230 | *-9.24* |
| Capital per worker (1/10000) | 9.6 | *11.45* | 9.7 | *11.63* | 9.5 | *10.89* | 6.9 | *7.20* |
| Health conditions | 0.041 | *3.87* | 0.046 | *4.31* | 0.037 | *3.45* | 0.065 | *9.86* |
| % of urban population | 0.458 | *8.17* | 0.475 | *8.40* | 0.441 | *7.79* | 0.125 | *5.19* |
| Terms of Trade (100,000) | 0.194 | *14.42* | 0.202 | *15.07* | 0.186 | *13.64* | 0.098 | *5.88* |
| PPP GDP per capita (1,000) | 0.680 | *8.17* | 0.667 | *7.95* | 0.691 | *8.23* | 0.029 | *10.02* |
| Volatility of GDP growth | -2.968 | *-5.22* | -3.016 | *-5.48* | -2.920 | *-4.94* | -6.156 | *-9.24* |
| GDP per capita growth | 1.337 | *3.76* | 1.382 | *3.94* | 1.296 | *3.59* | 0.188 | *5.13* |
| Young depdency rate | -0.149 | *-4.89* | -0.143 | *-4.60* | -0.154 | *-4.99* | -0.190 | *-6.22* |
| Relative cohort size | -0.612 | *-1.46* | -0.575 | *-1.39* | -0.641 | *-1.51* | -0.449 | *-1.58* |
| Trade openness measure (1,000) | 0.017 | *1.16* | 0.017 | *1.22* | 0.016 | *1.08* | 0.033 | *2.02* |
| Mortality/migration | -1.058 | *-1.05* | -1.073 | *-1.10* | -1.041 | *-1.00* | -0.337 | *-1.39* |
| % Catholic religion | | | | | | | 0.138 | *5.58* |
| % Protestant religion | | | | | | | 1.984 | *8.13* |
| English rule of law | | | | | | | -10.996 | *-8.38* |
| Latitude index | | | | | | | 0.735 | *9.53* |
| Year trend | 0.561 | *12.13* | 0.570 | *12.28* | 0.554 | *11.92* | 0.113 | *8.39* |
| Constant | -100.0 | *-11.63* | -101.4 | *-11.77* | -99.0 | *-11.44* | -25.1 | *-10.02* |
| Number of obs | 383862 | | 184627 | | 199235 | | 383862 | |
| F( 11, 17) | 168 | | 168 | | 161 | | | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.721 | | 0.722 | | 0.721 | | 0.434 | |
| Root MSE | 2.445 | | 2.481 | | 2.408 | | | |

Source: Authors' calculations.

# Table 6

**Base Regressions**

**Dependent Variable: % completing primary conditional on enrolling**

| Independent Variable | Country Fidex Effects Regressions | | | | | | Random Effects Estimation | |
|---|---|---|---|---|---|---|---|---|
| | Tot. Population | | Males | | Females | | | |
| | Coeff | t' Stat. | Coeff | z' Stat. | Coeff | z' Stat. | Coeff | z' Stat. |
| Agricultural land per capita (100,000) | -0.257 | *-7.29* | -0.273 | *-6.03* | -0.216 | *-6.48* | -0.062 | *-7.83* |
| Capital per worker (1/10000) | 10.259 | *0.96* | 5.446 | *0.46* | 15.794 | *1.78* | 29.223 | *10.94* |
| Health conditions | 0.115 | *0.46* | 0.171 | *0.56* | 0.101 | *0.46* | 0.506 | *6.53* |
| % of urban population | 0.492 | *2.65* | 0.417 | *1.75* | 0.542 | *3.37* | 0.431 | *10.96* |
| Terms of Trade (100,000) | 0.153 | *3.49* | 0.176 | *3.55* | 0.135 | *3.32* | 0.065 | *2.43* |
| PPP GDP per capita (1,000) | 0.415 | *0.46* | 0.377 | *0.39* | 0.214 | *0.23* | 0.566 | *1.74* |
| Volatility of GDP growth | -23.196 | *-1.92* | -32.279 | *-2.22* | -19.767 | *-1.44* | -61.863 | *-5.93* |
| GDP per capita growth | 8.766 | *1.33* | 8.657 | *0.97* | 14.875 | *2.22* | 9.088 | *1.37* |
| Young depdency rate | -0.273 | *-2.50* | -0.210 | *-1.86* | -0.347 | *-3.09* | -0.477 | *-13.69* |
| Relative cohort size | -0.563 | *-2.16* | -0.250 | *-0.89* | -1.083 | *-3.31* | -0.297 | *-1.29* |
| Trade openness measure (1,000) | 4.459 | *0.19* | 37.934 | *1.00* | 8.650 | *0.35* | 23.181 | *1.06* |
| Mortality/migration | 0.346 | *0.29* | 0.505 | *0.38* | 0.543 | *0.46* | -1.442 | *-4.14* |
| % Catholic religion | | | | | | | 0.027 | *6.47* |
| % Protestant religion | | | | | | | 0.566 | *17.39* |
| English rule of law | | | | | | | -30.115 | *-17.21* |
| Latitude index | | | | | | | 2.028 | *7.15* |
| Year trend | 0.380 | *4.33* | 0.459 | *4.67* | 0.337 | *3.60* | 0.268 | *5.65* |
| Constant | -676.5 | *-4.11* | -821.1 | *-4.45* | -609.3 | *-3.44* | -508.5 | *-5.60* |
| | | | | | | | | |
| Number of obs | 490 | | 482 | | 469 | | 490 | |
| F( 11, 17) | 373 | | 256 | | 159 | | | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.975 | | 0.959 | | 0.971 | | 0.867 | |
| Root MSE | 2.031 | | 2.469 | | 2.359 | | | |
| Prob > F country effects | 29831 | | 12787 | | 17757 | | | |
| Prob > F country effects | 0.000 | | 0.000 | | 0.000 | | | |

Source: Authors' calculations.

**Table 7**

Decomposition of the change in cohort average years of schooling

| | 10-year change 1950s-70s | | | 10-year change 1970s-80s | | |
|---|---|---|---|---|---|---|
| Variable | Total | Males | Females | Total | Males | Females |
| Observed change in years of schooling | 1.89 | 1.69 | 2.08 | 1.17 | 0.84 | 1.50 |
| Observed slowdown between 1970s and 1980s | | | | -0.72 | -0.85 | -0.58 |
| | | | | | | |
| Change predicted by full model | 1.91 | 1.66 | 2.14 | 0.89 | 0.78 | 1.21 |
| Difference between observed and predicted | -0.02 | 0.03 | -0.06 | 0.27 | 0.05 | 0.29 |
| Predicted slowdown between 1970s and 1980s | | | | -1.01 | -0.88 | -0.93 |
| | | | | | | |
| Change explained by factor endowments | 0.00 | 0.01 | -0.01 | -0.05 | -0.04 | -0.06 |
| Health conditions | 0.17 | 0.05 | 0.32 | 0.15 | 0.05 | 0.28 |
| Share of urban population | 0.32 | 0.47 | 0.30 | 0.30 | 0.44 | 0.28 |
| Macro economic variables | 0.41 | 0.30 | 0.38 | -0.48 | -0.41 | -0.39 |
| Demography | -0.06 | 0.01 | -0.02 | -0.08 | -0.05 | -0.06 |
| Change predicted by all independent variables | 0.85 | 0.84 | 0.97 | -0.15 | -0.02 | 0.05 |
| | | | | | | |
| (%) Change explained by factor endowments | 0.23 | 0.61 | -0.52 | -4.02 | -5.02 | -3.86 |
| (%) Health conditions | 9.16 | 3.11 | 15.30 | 12.87 | 5.45 | 18.40 |
| (%) Share of urban population | 17.20 | 27.95 | 14.64 | 25.79 | 52.29 | 18.80 |
| (%) Macro economic variables | 21.78 | 17.53 | 18.12 | -41.14 | -49.54 | -25.91 |
| (%) Demography | -3.25 | 0.86 | -0.75 | -6.65 | -5.48 | -3.78 |
| (%) of change explained by macro variables | 45.12 | 50.06 | 46.79 | -13.16 | -2.29 | 3.64 |
| | | | | | | |
| Predicted change in average schooling in the 1980s with macroeconomic conditions of the 1970s | | | | 1.79 | 1.49 | 1.98 |
| | | | | | | |
| Predicted slowdown in average schooling in the 1980s with macroeconomic conditions of the 1970s | | | | -0.10 | -0.19 | -0.10 |

Source: Authors'calculations.

**Table 8**

Decomposition the slowdown in the accumulation of human capital
Between the 1950-1970 and the 1970-1980s decades
(Expressed in Years of schooling)

| Country | Total Slowdown | Factor Endowm. | Health conditions | Urban Share | Macro eco. variables | Demography | Unexplained |
|---|---|---|---|---|---|---|---|
| Dominican Republic | -2.07 | -0.01 | -0.03 | 0.02 | 0.52 | -0.04 | -2.53 |
| Costa Rica | -1.78 | -0.08 | -0.02 | 0.02 | -2.25 | 0.03 | 0.52 |
| Nicaragua | -1.72 | -0.25 | -0.08 | -0.02 | -2.24 | -0.01 | 0.88 |
| Panama | -1.64 | -0.19 | -0.03 | -0.12 | -0.87 | 0.04 | -0.46 |
| Ecuador | -1.28 | -0.15 | 0.03 | 0.14 | -0.68 | 0.03 | -0.66 |
| Peru | -1.16 | 0.06 | -0.04 | -0.19 | -1.16 | -0.04 | 0.21 |
| Colombia | -0.95 | -0.09 | 0.01 | -0.10 | -0.26 | 0.10 | -0.61 |
| El Salvador | -0.94 | -0.16 | -0.14 | 0.05 | -0.75 | 0.06 | -0.00 |
| Brasil | -0.84 | -0.44 | -0.04 | 0.04 | -0.26 | -0.05 | -0.10 |
| Chile | -0.83 | 0.09 | 0.03 | -0.10 | -1.19 | 0.05 | 0.29 |
| Uruguay | -0.72 | 0.11 | 0.03 | 0.08 | -1.34 | -0.07 | 0.47 |
| Venezuela | -0.66 | 0.01 | -0.07 | -0.16 | -1.04 | -0.02 | 0.62 |
| Jamaica | -0.55 | 0.25 | -0.04 | -0.09 | 1.49 | -0.46 | -1.70 |
| Paraguay | -0.37 | 0.00 | -0.01 | 0.17 | -3.25 | 0.09 | 2.63 |
| Honduras | -0.34 | 0.03 | -0.04 | -0.08 | -0.49 | -0.16 | 0.41 |
| Argentina | -0.10 | 0.13 | 0.02 | -0.04 | -2.18 | 0.50 | 1.47 |
| Mexico | 0.04 | 0.12 | 0.01 | -0.04 | -1.80 | 0.02 | 1.74 |
| Bolivia | 0.42 | -0.18 | 0.09 | 0.26 | -0.90 | -0.04 | 1.19 |
| | | | | | | | |
| Average LAC | -0.86 | -0.04 | -0.02 | -0.01 | -1.04 | 0.00 | 0.24 |

Source: Authors' calculations.

# Appendix Tables A

## Table A1

Description of Household Surveys

| Country | Year | Sample size | | Coverage | Name of Survey |
|---|---|---|---|---|---|
| | | households | individuals | | |
| Argentina | 1996 | 3,459 | 11,749 | Urban | Encuesta Permanente de Hogares |
| Bolivia | 1996 | 8,311 | 35,648 | National | Encuesta Nacional de Empleo |
| Brazil | 1995 | 85,270 | 334,263 | National | Pesquisa Nacional por Amostra de Domicilios |
| Chile | 1996 | 33,636 | 134,262 | National | Encuesta de Caracterizacion Socioeconomica Nacional |
| Colombia | 1997 | 32,441 | 143,398 | National | Encuesta Nacional de Hogares-Fuerza de Trabajo |
| Costa Rica | 1995 | 9,631 | 40,613 | National | Encuesta de Hogares de Propositos Multiples |
| Dominican Republic | 1996 | 548 | 24,041 | National | Encuesta Nacional de Fuerza de Trabajo |
| Ecuador | 1995 | 5,810 | 26,941 | National | Encuesta de Condiciones de Vida |
| El Salvador | 1995 | 8,482 | 40,004 | National | Encuesta de Hogares de Propositos Multiples |
| Honduras | 1998 | 6,494 | 32,696 | National | Encuesta Permanente de Hogares de Propositos Multiples |
| Jamaica | 1996 | 1,823 | 6,997 | National | Jamaica Survey of Living Conditions |
| Mexico | 1996 | 14,042 | 64,916 | National | Encuesta Nacional de Ingreso Gasto de los Hogares |
| Nicaragua | 1993 | 4,458 | 24,542 | National | Encuesta Nacional de Hogares sobre Medicion de Niveles de Vida |
| Panama | 1997 | 9,875 | 40,320 | National | Encuesta de Hogares |
| Paraguay | 1995 | 4,667 | 21,910 | National | Encuesta de Hogares |
| Peru | 1997 | 3,843 | 19,745 | National | Encuesta Nacional de Hogares sobre Medicion de Niveles de Vida |
| Uruguay | 1995 | 20,057 | 64,930 | Urban | Encuesta Continua de Hogares |
| Venezuela | 1997 | 15,948 | 76,965 | National | Encuesta de Hogares por Muestreo |
| | | | | | |
| USA | 1996 | 50,311 | 131,854 | National | Consumer Expenditure Survey |
| Taiwan* | 1995 | 14,706 | 43,409 | National | Survey of Personal Income Distribution, Taiwan area |

*Accessed through the Luxembourg Income Study.

# Appendix Tables B

## Table B1

Proportion of the original population born in each birth cohort, that is still observed in 1995

| | Year of Birth | | | | | | | | | | | Average | % net |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | 1920-24 | 1925-29 | 1930-34 | 1935-39 | 1940-44 | 1945-49 | 1950-54 | 1955-59 | 1960-64 | 1965-69 | 1970-74 | 1920-74 | migration 95' |
| El Salvador | 37 | 47 | 55 | 60 | 63 | 64 | 60 | 60 | 54 | 61 | 73 | 58 | -0.7 |
| Jamaica | 29 | 36 | 41 | 41 | 44 | 45 | 47 | 51 | 58 | 70 | 78 | 49 | -3.8 |
| Bolivia | 28 | 41 | 51 | 58 | 62 | 65 | 63 | 75 | 70 | 80 | 79 | 61 | -0.5 |
| Nicaragua | 31 | 42 | 50 | 56 | 60 | 62 | 61 | 72 | 71 | 80 | 81 | 61 | -1.6 |
| Uruguay | 46 | 59 | 69 | 76 | 76 | 79 | 80 | 81 | 83 | 84 | 84 | 74 | -0.5 |
| Mexico | 44 | 55 | 63 | 69 | 73 | 77 | 75 | 82 | 80 | 84 | 84 | 72 | -1.7 |
| Peru | 40 | 53 | 62 | 70 | 75 | 78 | 74 | 84 | 80 | 88 | 87 | 72 | -0.6 |
| Honduras | 39 | 49 | 58 | 64 | 69 | 72 | 68 | 81 | 77 | 89 | 87 | 68 | -0.4 |
| Dominican Republic | 40 | 52 | 63 | 69 | 74 | 76 | 73 | 83 | 82 | 90 | 89 | 72 | -1.2 |
| Colombia | 38 | 49 | 57 | 62 | 67 | 72 | 73 | 82 | 83 | 90 | 91 | 69 | 0.0 |
| Panama | 49 | 58 | 69 | 74 | 83 | 85 | 84 | 90 | 88 | 93 | 91 | 79 | -0.5 |
| Ecuador | 45 | 57 | 68 | 75 | 80 | 83 | 82 | 91 | 89 | 95 | 94 | 78 | 0.0 |
| Brazil | 38 | 51 | 62 | 70 | 77 | 82 | 83 | 90 | 90 | 95 | 94 | 76 | 0.0 |
| Chile | 43 | 55 | 66 | 73 | 79 | 83 | 84 | 90 | 90 | 95 | 95 | 77 | -0.4 |
| Paraguay | 39 | 50 | 55 | 55 | 63 | 69 | 73 | 87 | 91 | 97 | 97 | 70 | 0.0 |
| Venezuela | 48 | 65 | 80 | 91 | 97 | 103 | 104 | 105 | 100 | 100 | 100 | 90 | 0.0 |
| Argentina | 48 | 63 | 74 | 84 | 91 | 94 | 95 | 97 | 97 | 100 | 100 | 86 | 0.3 |
| Costa Rica | 57 | 71 | 80 | 89 | 93 | 96 | 95 | 100 | 100 | 103 | 103 | 90 | 2.8 |
| Average LAC | 41 | 53 | 62 | 69 | 74 | 77 | 76 | 83 | 82 | 89 | 89 | 72 | -0.5 |
| | | | | | | | | | | | | | |
| United States | 55 | 69 | 81 | 91 | 98 | 101 | 104 | 106 | 109 | 110 | 110 | 1 | 1.4 |
| Korea | 34 | 49 | 59 | 73 | 76 | 78 | 76 | 93 | 87 | 92 | 97 | -0 | -0.2 |

Source: Calculations from the United Nations Population Statistics, 1998 revision. Net migration in 1995 is presented as a share of the total population.

## Table B2

Death Rate per 1,000, Net of Infant Mortality

| Country | 5-year Interval | | | | | | Average |
|---|---|---|---|---|---|---|---|
| | 1950-54 | 1960-64 | 1970-74 | 1980-84 | 1990-94 | 1995-99 | 1950-99 |
| Argentina | 7.8 | 7.7 | 8.2 | 8.1 | 8.0 | 7.8 | 8.0 |
| Venezuela | 8.2 | 6.6 | 5.3 | 4.7 | 4.3 | 4.4 | 5.7 |
| Paraguay | 8.5 | 8.0 | 7.1 | 5.9 | 4.9 | 4.5 | 6.9 |
| Jamaica | 8.7 | 6.9 | 7.0 | 6.1 | 6.0 | 5.6 | 6.8 |
| Costa Rica | 9.0 | 6.0 | 4.5 | 3.7 | 3.7 | 3.8 | 5.2 |
| Uruguay | 9.6 | 8.8 | 9.1 | 9.5 | 9.6 | 9.3 | 9.3 |
| Chile | 9.8 | 8.7 | 7.3 | 6.1 | 5.5 | 5.5 | 7.4 |
| Brazil | 10.2 | 8.6 | 7.3 | 6.9 | 6.5 | 6.6 | 7.8 |
| Panama | 10.2 | 7.9 | 6.4 | 5.1 | 4.9 | 4.8 | 6.7 |
| Colombia | 11.3 | 7.9 | 6.6 | 5.5 | 5.8 | 5.3 | 7.2 |
| Mexico | 12.4 | 8.9 | 7.1 | 5.2 | 4.5 | 4.5 | 7.5 |
| El Salvador | 13.5 | 9.7 | 7.1 | 8.6 | 5.8 | 5.5 | 8.8 |
| Dominican Republic | 13.8 | 9.8 | 6.7 | 4.8 | 4.6 | 4.7 | 7.8 |
| Ecuador | 13.9 | 10.1 | 8.2 | 6.1 | 5.1 | 5.0 | 8.6 |
| Nicaragua | 14.5 | 11.4 | 8.7 | 7.1 | 5.1 | 4.6 | 9.3 |
| Honduras | 15.0 | 11.9 | 9.3 | 6.7 | 4.9 | 4.5 | 9.5 |
| Peru | 15.1 | 12.1 | 8.9 | 6.7 | 5.6 | 5.6 | 9.6 |
| Bolivia | 17.0 | 14.9 | 13.0 | 9.8 | 8.0 | 7.4 | 12.5 |
| Average LAC | 11.6 | 9.2 | 7.6 | 6.5 | 5.7 | 5.5 | 8.0 |
| | | | | | | | |
| United States | 9.2 | 9.2 | 9.1 | 8.6 | 9.0 | 8.6 | 9.0 |
| Korea | 28.5 | 10.4 | 8.2 | 6.3 | 6.2 | 6.2 | 10.3 |

Source: Authors' calculations from UN Population Statistics, 1998 revision.

Yearly death rates net of infant mortality are calculated by [(nd-{(nb*imr)/1000})/5]/[tp/1000]
where imr=infant mortality rate; nd=number of deaths in thousands for five years
nb=number of births in thousands for five years; and tp=total population.

## Table B3

**Distribution of the Population by Schooling Level, Mexico 1994 and 1996**

| | Year of Birth | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1930 -1934 | 1935 -1939 | 1940 -1944 | 1945 -1949 | 1950 -1954 | 1955 -1959 | 1960 -1964 | 1965 -1969 |
| **Mexico 1994** | | | | | | | | |
| No schooling | 35.9 | 33.9 | 28.4 | 20.5 | 18.8 | 13.3 | 8.9 | 6.5 |
| Primary incomplete | 33.8 | 33.3 | 30.9 | 32.3 | 25.4 | 23.9 | 19.1 | 15.4 |
| Primary complete | 16.4 | 15.1 | 19.4 | 19.0 | 20.7 | 20.9 | 20.8 | 21.2 |
| Secondary incomplete | 6.4 | 8.6 | 7.7 | 12.4 | 15.0 | 18.9 | 23.9 | 26.0 |
| Secondary complete | 4.3 | 4.5 | 7.7 | 9.0 | 10.3 | 10.5 | 14.6 | 18.3 |
| University | 3.2 | 4.7 | 6.0 | 6.8 | 9.8 | 12.6 | 12.8 | 12.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| | | | | | | | | |
| **Mexico 1996** | | | | | | | | |
| No schooling | 33.8 | 33.5 | 22.7 | 17.6 | 15.6 | 11.2 | 7.1 | 5.8 |
| Primary incomplete | 37.1 | 34.5 | 37.5 | 32.0 | 28.7 | 25.3 | 20.0 | 13.7 |
| Primary complete | 16.2 | 16.7 | 19.2 | 21.8 | 22.0 | 23.2 | 21.5 | 16.6 |
| Secondary incomplete | 5.4 | 6.9 | 10.0 | 14.4 | 14.8 | 16.4 | 23.8 | 30.6 |
| Secondary complete | 3.9 | 4.5 | 4.1 | 5.3 | 7.8 | 8.2 | 11.6 | 14.4 |
| University | 3.6 | 4.0 | 6.6 | 8.9 | 11.2 | 15.6 | 16.1 | 19.0 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: Authors'calculations from the National Household Income and Expenditure Surveys, Mexico 1994 and 1996.

## Table B4

**Demographic Changes in Taiwan During the 1940s and 1950s Decade**

| Year of birth | Year of observation | | | Difference | Difference |
|---|---|---|---|---|---|
| | 1946 | 1951 | 1956 | 1946-51 | 1951-56 |
| 1897-1901 | 225,187 | 233,880 | 214,749 | 8,693 | (19,131) |
| 1902-1906 | 281,452 | 299,456 | 287,553 | 18,004 | (11,903) |
| 1907-1911 | 354,093 | 373,898 | 378,783 | 19,805 | 4,885 |
| 1912-1916 | 385,614 | 448,433 | 455,133 | 62,819 | 6,700 |
| 1917-1921 | 437,435 | 518,241 | 522,689 | 80,806 | 4,448 |
| 1922-1926 | 522,740 | 618,471 | 622,891 | 95,731 | 4,420 |
| 1927-1931 | 670,162 | 730,740 | 719,189 | 60,578 | (11,551) |
| 1932-1936 | 798,677 | 839,345 | 740,385 | 40,668 | (98,960) |
| 1937-1941 | 912,606 | 958,690 | 950,853 | 46,084 | (7,837) |
| 1942-1946 | 927,518 | 943,280 | 926,769 | 15,762 | (16,511) |
| Total | | | | 448,950 | (145,440) |
| | | | | | |
| Tot Population | | | | | |
| (thousands) | 6,091 | 7,869 | 9,390 | 1,778 | 1,521 |
| | | | | | |
| | | | | Total in 5-yr. Period | |
| Thousands of births in 5 year period | | | | 1,161 | 1,955 |
| Thousands of deaths in 5 year period | | | | 399 | 401 |
| Natural increase 5 year period (thousands) | | | | 762 | 1,554 |
| Observed pop. Gwth in 5 yr. Period (thousands) | | | | 1,778 | 1,521 |
| | | | | | |
| Population above school age by schooling level | | | | | |
| Total | 100 | 100 | 100 | | |
| University & college | 0.38 | 1.33 | 1.66 | | |
| Senior High | 1.14 | 3.10 | 3.55 | | |
| Junior high | 2.55 | 5.31 | 6.02 | | |
| Primary | 36.61 | 42.05 | 47.69 | | |
| Literate | 4.34 | 4.79 | 3.95 | | |
| Illiterate | 54.98 | 43.43 | 37.12 | | |

Source: Authors'calculations from the Statistical Yearbook of the Republic of China, 1975.

## Table B5

Proportion of Individuals Enrolled in School

| | | Year of Birth | | | |
|---|---|---|---|---|---|
| Country | Year | 1950-54 | 1955-59 | 1960-64 | 1965-69 |
| Argentina* | 1996 | 1.7 | 2.0 | 2.8 | 7.6 |
| Bolivia | 1996 | 1.2 | 2.9 | 3.8 | 9.1 |
| Brazil | 1995 | 1.4 | 2.3 | 3.3 | 6.1 |
| Chile | 1996 | 0.3 | 0.4 | 1.3 | 3.1 |
| Colombia | 1997 | 1.3 | 1.9 | 3.3 | 4.8 |
| Costa Rica | 1995 | 2.9 | 4.1 | 4.8 | 8.1 |
| Dominican Republic | 1996 | 1.5 | 3.1 | 3.3 | 7.2 |
| Ecuador | 1995 | 0.7 | 1.5 | 2.8 | 5.9 |
| El Salvador | 1995 | 0.6 | 1.6 | 3.3 | 5.8 |
| Honduras | 1998 | 0.8 | 1.7 | 2.5 | 4.0 |
| Jamaica | 1996 | 0.6 | 1.2 | 1.3 | 1.9 |
| Mexico | 1996 | 1.4 | 2.1 | 2.2 | 3.3 |
| Panama | 1995 | 1.8 | 3.3 | 3.5 | 7.6 |
| Paraguay | 1995 | 0.0 | 0.0 | 1.8 | 4.0 |
| Peru | 1997 | 1.4 | 3.3 | 2.7 | 5.5 |
| Uruguay* | 1995 | 0.9 | 1.6 | 3.1 | 9.4 |
| Venezuela | 1995 | 0.0 | 0.0 | 0.0 | 5.8 |

Source: Authors' calculations from household surveys.

*Surveys cover urban areas only.

# Appendix Tables C

## Table C1

Proportion of the population in each birth cohort completing at least some primary
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 39.3 | 58 | 72.5 | 84.2 | 87.9 | 33.2 | 15.4 | 48.6 |
| El Salvador | 45.2 | 59 | 68.6 | 81.4 | 85.6 | 23.4 | 17.0 | 40.4 |
| Nicaragua | 49.3 | 57.6 | 67.1 | 77.9 | 83.9 | 17.8 | 16.8 | 34.6 |
| Bolivia | 54.1 | 61.9 | 75.4 | 88.8 | 95.5 | 21.3 | 20.1 | 41.4 |
| México | 59.7 | 71.5 | 83.1 | 91.1 | 94.8 | 23.4 | 11.7 | 35.1 |
| Brasil | 60.9 | 70.1 | 80 | 88 | 91.5 | 19.1 | 11.5 | 30.6 |
| Venezuela | 64.9 | 81.5 | 90.8 | 94.7 | 95.9 | 25.9 | 5.1 | 31.0 |
| Ecuador | 72.2 | 80.6 | 87.4 | 94.3 | 97 | 15.2 | 9.6 | 24.8 |
| Colombia | 74.1 | 82.4 | 89.2 | 93.9 | 96.3 | 15.1 | 7.1 | 22.2 |
| Dominican Republic | 75.3 | 79.2 | 88.5 | 92.1 | 93.6 | 13.2 | 5.1 | 18.3 |
| Perú | 76.2 | 82.8 | 89.4 | 96.4 | 97.4 | 13.2 | 8.0 | 21.2 |
| Costa Rica | 79.7 | 87 | 94.6 | 96.6 | 98 | 14.9 | 3.4 | 18.3 |
| Panama | 84.6 | 88.2 | 93.8 | 98 | 98.4 | 9.2 | 4.6 | 13.8 |
| Paraguay | 86.1 | 91.5 | 93.5 | 96.8 | 97.7 | 7.4 | 4.2 | 11.6 |
| Chile | 87.7 | 91.9 | 96.6 | 98.3 | 98.6 | 8.9 | 2.0 | 10.9 |
| Jamaica | 91.3 | 95.2 | 97 | 97.1 | 95.9 | 5.7 | -1.1 | 4.6 |
| Uruguay* | 94.8 | 97.8 | 98.8 | 98.6 | 99.2 | 4.0 | 0.4 | 4.4 |
| Argentina* | 100 | 100 | 100 | 100 | 100 | 0.0 | 0.0 | 0.0 |
| Average LAC | 72.0 | 79.8 | 87.0 | 92.7 | 94.8 | 15.1 | 7.8 | 22.9 |
| Korea | 67.8 | 90.7 | 98.4 | 99.6 | 99.7 | 30.6 | 1.3 | 31.9 |
| Taiwan | 71.7 | 76.5 | 96.2 | 99.5 | 99.8 | 24.5 | 3.6 | 28.1 |
| USA | 99.2 | 99.5 | 99.5 | 99.7 | 99.8 | 0.3 | 0.3 | 0.6 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997

*Surveys cover urban areas only.

## Table C2

Proportion of the population in each birth cohort completing at least primary
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 11.7 | 22.2 | 36.4 | 48.5 | 64.2 | 24.7 | 27.8 | 52.5 |
| El Salvador | 14.5 | 28 | 36.5 | 53.3 | 59.3 | 22.0 | 22.8 | 44.8 |
| Brasil | 15 | 20.4 | 34.1 | 48.8 | 55.2 | 19.1 | 21.1 | 40.2 |
| Nicaragua | 16.3 | 24.6 | 34.8 | 49.4 | 57.8 | 18.5 | 23.0 | 41.5 |
| Dominican Republic | 21.6 | 23.6 | 44.3 | 59.3 | 67.2 | 22.7 | 22.9 | 45.6 |
| México | 22.3 | 33.2 | 52.5 | 70 | 83.1 | 30.2 | 30.6 | 60.8 |
| Paraguay | 26.7 | 36.4 | 51 | 65.2 | 72.6 | 24.3 | 21.6 | 45.9 |
| Bolivia | 27.3 | 37.5 | 48.9 | 63.5 | 79.1 | 21.6 | 30.2 | 51.8 |
| Costa Rica | 32.7 | 51.6 | 72.7 | 84.3 | 87 | 40.0 | 14.3 | 54.3 |
| Chile | 32.9 | 42.3 | 60.6 | 77.7 | 85.3 | 27.7 | 24.7 | 52.4 |
| Ecuador | 33.8 | 38.8 | 58.1 | 77.3 | 86.9 | 24.3 | 28.8 | 53.1 |
| Venezuela | 40 | 57 | 73.4 | 84 | 87.2 | 33.4 | 13.8 | 47.2 |
| Colombia | 41.4 | 49.7 | 60.6 | 76 | 82.5 | 19.2 | 21.9 | 41.1 |
| Perú | 49.3 | 61.6 | 68.4 | 83.2 | 89.1 | 19.1 | 20.7 | 39.8 |
| Panama | 50.8 | 62.6 | 77.4 | 90.1 | 91.8 | 26.6 | 14.4 | 41.0 |
| Uruguay* | 59.5 | 73 | 84.3 | 93 | 96.5 | 24.8 | 12.2 | 37.0 |
| Argentina* | 73 | 82.5 | 88.7 | 94.2 | 97.5 | 15.7 | 8.8 | 24.5 |
| Jamaica | 74.6 | 85.8 | 93.54 | 95.9 | 95.9 | 18.9 | 2.4 | 21.3 |
| Average LAC | 35.7 | 46.2 | 59.8 | 73.0 | 79.9 | 24.0 | 20.1 | 44.2 |
| Korea | 66.2 | 88.6 | 97.9 | 99.4 | 99.7 | 31.7 | 1.8 | 33.5 |
| Taiwan | 68.3 | 71.6 | 92.7 | 98.9 | 99.6 | 24.4 | 6.9 | 31.3 |
| USA | 97.3 | 97.9 | 98.7 | 99.1 | 99.3 | 1.4 | 0.6 | 2.0 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997
*Surveys cover urban areas only.

## Table C3

Proportion of the population in each  completing primary conditional on completing first grade
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Brasil | 24.5 | 29.1 | 42.6 | 55.5 | 60.4 | 18.1 | 17.8 | 35.9 |
| Dominican Republic | 28.6 | 29.8 | 50.1 | 64.4 | 71.8 | 21.5 | 21.7 | 43.2 |
| Honduras | 29.8 | 38.3 | 50.2 | 57.7 | 73.1 | 20.4 | 22.9 | 43.3 |
| Paraguay | 30.9 | 39.7 | 54.5 | 67.4 | 74.3 | 23.6 | 19.8 | 43.4 |
| El Salvador | 32.2 | 47.4 | 53.2 | 65.5 | 69.3 | 21.0 | 16.1 | 37.1 |
| Nicaragua | 33.0 | 42.7 | 51.9 | 63.4 | 68.9 | 18.9 | 17.0 | 35.9 |
| México | 37.4 | 46.4 | 63.2 | 76.8 | 87.7 | 25.8 | 24.5 | 50.3 |
| Chile | 37.5 | 46.0 | 62.7 | 79.1 | 86.5 | 25.2 | 23.8 | 49.0 |
| Costa Rica | 41.0 | 59.3 | 76.8 | 87.3 | 88.8 | 35.8 | 12.0 | 47.8 |
| Ecuador | 46.8 | 48.1 | 66.5 | 82.0 | 89.6 | 19.7 | 23.1 | 42.8 |
| Bolivia | 50.5 | 60.7 | 64.8 | 71.5 | 82.9 | 14.3 | 18.1 | 32.4 |
| Colombia | 55.9 | 60.3 | 67.9 | 80.9 | 85.7 | 12.0 | 17.8 | 29.8 |
| Panama | 60.0 | 70.9 | 82.6 | 92.0 | 93.3 | 22.6 | 10.7 | 33.3 |
| Venezuela | 61.6 | 69.9 | 80.9 | 88.7 | 91.0 | 19.3 | 10.1 | 29.4 |
| Uruguay* | 62.8 | 74.6 | 85.3 | 94.3 | 97.3 | 22.5 | 12.0 | 34.5 |
| Perú | 64.6 | 74.5 | 76.6 | 86.4 | 91.5 | 12.0 | 14.9 | 26.9 |
| Argentina* | 73 | 82.5 | 88.7 | 94.2 | 97.50 | 15.7 | 8.8 | 24.5 |
| Jamaica | 81.8 | 90.2 | 96.4 | 98.7 | 100.0 | 14.6 | 3.6 | 18.2 |
| Average LAC | 48.7 | 57.7 | 69.0 | 79.4 | 85.2 | 20.3 | 16.3 | 36.6 |
| Korea | 97.6 | 97.7 | 99.4 | 99.8 | 99.9 | 1.8 | 0.5 | 2.3 |
| Taiwan | 95.3 | 93.6 | 96.4 | 99.3 | 99.8 | 1.1 | 3.4 | 4.5 |
| USA | 98.1 | 98.5 | 99.1 | 99.4 | 99.5 | 1.0 | 0.4 | 1.4 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997
*Surveys cover urban areas only.

## Table C4

Primary completion rates among those completing first grade

| Country | | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|---|
| | | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Argentina* | Male | 73.7 | 84.4 | 89.1 | 94.8 | 97.2 | 15.3 | 8.1 | 23.5 |
| | Female | 72.5 | 80.6 | 88.3 | 93.6 | 97.7 | 15.8 | 9.4 | 25.2 |
| Bolivia | M | 44.8 | 62.6 | 66.4 | 74.5 | 85.0 | 21.6 | 18.6 | 40.2 |
| | F | 60.4 | 58.0 | 62.7 | 68.6 | 81.0 | 2.3 | 18.3 | 20.6 |
| Brazil | M | 63.4 | 67.8 | 76.2 | 82.4 | 83.9 | 12.7 | 7.8 | 20.5 |
| | F | 59.9 | 63.0 | 73.0 | 82.1 | 85.6 | 13.1 | 12.6 | 25.6 |
| Chile | M | 60.7 | 68.4 | 81.6 | 89.8 | 93.8 | 20.9 | 12.2 | 33.1 |
| | F | 60.8 | 69.7 | 78.7 | 90.2 | 94.9 | 17.9 | 16.2 | 34.1 |
| Colombia | M | 55.4 | 61.6 | 68.6 | 81.0 | 84.3 | 13.2 | 15.7 | 28.9 |
| | F | 56.4 | 59.0 | 67.3 | 80.9 | 86.8 | 11.0 | 19.5 | 30.5 |
| Costa Rica | M | 46.9 | 59.7 | 80.1 | 87.4 | 87.4 | 33.2 | 7.3 | 40.5 |
| | F | 35.8 | 58.9 | 73.7 | 87.2 | 90.2 | 37.9 | 16.5 | 54.4 |
| Dominican Republic | M | 28.6 | 30.3 | 52.9 | 69.7 | 71.7 | 24.3 | 18.8 | 43.0 |
| | F | 28.6 | 29.4 | 47.3 | 58.6 | 72.0 | 18.7 | 24.7 | 43.3 |
| Ecuador | M | 45.8 | 49.2 | 67.9 | 83.7 | 91.1 | 22.1 | 23.1 | 45.3 |
| | F | 47.8 | 47.1 | 64.8 | 80.5 | 88.1 | 16.9 | 23.3 | 40.3 |
| El Salvador | M | 32.4 | 49.5 | 57.7 | 70.2 | 68.8 | 25.3 | 11.1 | 36.3 |
| | F | 31.9 | 45.3 | 49.1 | 61.7 | 69.8 | 17.2 | 20.7 | 37.9 |
| Honduras | M | 27.3 | 35.5 | 51.5 | 59.2 | 72.7 | 24.2 | 21.2 | 45.4 |
| | F | 32.9 | 40.7 | 49.3 | 56.3 | 73.5 | 16.4 | 24.2 | 40.6 |
| Jamaica | M | 75.1 | 87.0 | 98.2 | 100.0 | 100.0 | 23.1 | 1.8 | 24.9 |
| | F | 88.1 | 94.0 | 94.4 | 97.3 | 100.0 | 6.3 | 5.6 | 11.9 |
| Mexico | M | 39.7 | 45.7 | 67.4 | 80.9 | 88.1 | 27.6 | 20.7 | 48.3 |
| | F | 46.7 | 49.8 | 63.0 | 75.6 | 85.8 | 16.3 | 22.8 | 39.1 |
| Nicaragua | M | 38.0 | 41.0 | 54.4 | 67.0 | 65.6 | 16.4 | 11.2 | 27.6 |
| | F | 28.9 | 44.1 | 49.5 | 60.1 | 71.9 | 20.5 | 22.4 | 43.0 |
| Panama | M | 56.9 | 71.2 | 82.6 | 91.0 | 91.8 | 25.7 | 9.2 | 34.9 |
| | F | 63.4 | 70.7 | 82.6 | 92.9 | 94.7 | 19.1 | 12.2 | 31.3 |
| Paraguay | M | 30.3 | 40.7 | 53.1 | 68.1 | 76.4 | 22.8 | 23.3 | 46.1 |
| | F | 31.6 | 38.7 | 55.9 | 66.7 | 72.1 | 24.3 | 16.2 | 40.5 |
| Peru | M | 67.6 | 78.7 | 83.7 | 89.0 | 94.6 | 16.1 | 10.9 | 27.0 |
| | F | 60.5 | 68.7 | 69.4 | 83.7 | 88.9 | 8.8 | 19.5 | 28.3 |
| Uruguay* | M | 63.9 | 74.0 | 84.8 | 93.5 | 97.3 | 20.9 | 12.5 | 33.4 |
| | F | 62.1 | 75.2 | 85.8 | 94.9 | 97.4 | 23.7 | 11.6 | 35.3 |
| Venezuela | M | 63.2 | 72.6 | 80.6 | 89.4 | 90.4 | 17.4 | 9.8 | 27.2 |
| | F | 59.8 | 67.3 | 81.2 | 88.0 | 91.5 | 21.3 | 10.4 | 31.7 |
| **Average LAC** | M | 50.8 | 60.0 | 72.0 | 81.8 | 85.6 | 21.3 | 13.5 | 34.8 |
| | F | 51.6 | 58.9 | 68.7 | 78.8 | 85.7 | 17.1 | 17.0 | 34.1 |
| Taiwan | M | 96.5 | 95.1 | 97.6 | 99.4 | 99.9 | 1.2 | 2.3 | 3.5 |
| | F | 93.3 | 91.7 | 95.0 | 99.3 | 99.7 | 1.7 | 4.7 | 6.4 |

Source: Authors' calculations from household survey data.

*Urban areas only.

## Table C5

Proportion of Children Enrolled in School, by Age

| Country | Age | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| Paraguay | 60 | 89 | 95 | 95 | 97 | 97 | 93 | 83 | 67 | 55 | 50 | 39 | 36 | 31 | 19 | 15 |
| El Salvador | 62 | 79 | 85 | 89 | 88 | 91 | 86 | 83 | 73 | 63 | 56 | 49 | 35 | 33 | 23 | 23 |
| Honduras | 73 | 90 | 92 | 93 | 95 | 92 | 83 | 67 | 53 | 47 | 39 | 30 | 26 | 21 | 17 | 22 |
| Brazil | 74 | 87 | 92 | 93 | 94 | 93 | 91 | 88 | 82 | 75 | 66 | 58 | 47 | 37 | 29 | 25 |
| Colombia | 80 | 90 | 93 | 94 | 94 | 91 | 90 | 87 | 79 | 76 | 70 | 60 | 46 | 38 | 31 | 28 |
| Costa Rica | 82 | 97 | 99 | 100 | 98 | 97 | 94 | 84 | 77 | 64 | 58 | 50 | 39 | 37 | 31 | 25 |
| Dominican Republic | 82 | 91 | 94 | 97 | 98 | 98 | 96 | 97 | 93 | 90 | 80 | 73 | 62 | 54 | 39 | 35 |
| Ecuador | 83 | 92 | 96 | 96 | 97 | 94 | 90 | 75 | 67 | 60 | 56 | 52 | 38 | 33 | 28 | 24 |
| Bolivia | 87 | 98 | 97 | 99 | 98 | 96 | 93 | 88 | 79 | 77 | 72 | 67 | 54 | 48 | 36 | 42 |
| Panama | 90 | 97 | 99 | 98 | 99 | 98 | 96 | 92 | 85 | 81 | 70 | 68 | 52 | 36 | 31 | 30 |
| Chile | 91 | 98 | 99 | 99 | 99 | 99 | 98 | 98 | 95 | 88 | 82 | 73 | 56 | 41 | 31 | 27 |
| Peru | 92 | 98 | 99 | 98 | 98 | 98 | 97 | 94 | 90 | 85 | 79 | 59 | 47 | 43 | 34 | 34 |
| Venezuela | 92 | 96 | 97 | 97 | 97 | 97 | 96 | 93 | 86 | 77 | 68 | 55 | 45 | 41 | 35 | 31 |
| Mexico | 95 | 97 | 98 | 97 | 96 | 96 | 91 | 84 | 76 | 65 | 55 | 44 | 33 | 29 | 27 | 21 |
| Uruguay* | 97 | 100 | 100 | 99 | 99 | 99 | 97 | 92 | 84 | 78 | 69 | 58 | 46 | 39 | 33 | 28 |
| Jamaica | 97 | 99 | 100 | 99 | 100 | 100 | 99 | 99 | 96 | 91 | 81 | 44 | 25 | 16 | 7 | 3 |
| Argentina* | 100 | 100 | 100 | 100 | 100 | 100 | 99 | 91 | 82 | 74 | 67 | 61 | 52 | 46 | 34 | 42 |

Source: Authors' calculations from household survey data.

*Urban areas only.

## Table C6

Proportion of Children that are observed at 8 years of age in the first survey and in a later survey at an oder age, that have not completed at least one year of schooling

| Country | | Total | Boys | Girls |
|---|---|---|---|---|
| Brazil | | | | |
| | 1993 | 54.8 | 58.3 | 51.4 |
| | 1995 | 19.5 | 22.7 | 16.2 |
| Chile | | | | |
| | 1994 | 0.6 | 0.7 | 0.4 |
| | 1996 | 0.8 | 1.1 | 0.5 |
| Costa Rica | | | | |
| | 1993 | 18.7 | 20.5 | 16.9 |
| | 1995 | 2.9 | 3.2 | 2.6 |
| Honduras | | | | |
| | 1992 | 38.1 | 36.5 | 39.5 |
| | 1996 | 6.4 | 8.3 | 4.3 |
| Mexico | | | | |
| | 1994 | 12.3 | 13.4 | 10.9 |
| | 1996 | 3.1 | 3.2 | 3.1 |
| Panama | | | | |
| | 1995 | 1 | 1.3 | 0.7 |
| | 1997 | 0.96 | 1.18 | 0.73 |
| Peru | | | | |
| | 1994 | 14.6 | 15.5 | 13.9 |
| | 1997 | 0.7 | 0.9 | 0.6 |
| Uruguay | | | | |
| | 1992 | 6.2 | 7.8 | 4.5 |
| | 1995 | 2 | 1.4 | 2.8 |

Source: Authors' calculations from household survey data.

## Table C7

Proportion of the population in each birth cohort with at least some secondary
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 3.9 | 11.1 | 18 | 24.6 | 32.3 | 14.1 | 14.3 | 28.4 |
| Nicaragua | 6.7 | 11.9 | 22.6 | 36.9 | 42.7 | 15.9 | 20.1 | 36.0 |
| México | 8.1 | 15.7 | 32.5 | 47.1 | 66.3 | 24.4 | 33.8 | 58.2 |
| El Salvador | 8.7 | 16.3 | 21.8 | 41.4 | 50.6 | 13.1 | 28.8 | 41.9 |
| Dominican Republic | 11.1 | 15 | 31.2 | 47.5 | 55.3 | 20.1 | 24.1 | 44.2 |
| Ecuador | 12.9 | 17.8 | 31.4 | 50.4 | 64.2 | 18.5 | 32.8 | 51.3 |
| Venezuela | 13 | 22.7 | 41.7 | 58.4 | 66.8 | 28.7 | 25.1 | 53.8 |
| Paraguay | 13.8 | 17.5 | 28.2 | 37.3 | 44.2 | 14.4 | 16.0 | 30.4 |
| Brasil | 14 | 19.1 | 32 | 44.4 | 49.1 | 18.0 | 17.1 | 35.1 |
| Costa Rica | 14.1 | 26.7 | 37.2 | 52.6 | 48.2 | 23.1 | 11.0 | 34.1 |
| Colombia | 17.2 | 25.1 | 39.4 | 58.2 | 66.3 | 22.2 | 26.9 | 49.1 |
| Uruguay* | 25.9 | 40.7 | 55.8 | 71.1 | 81.2 | 29.9 | 25.4 | 55.3 |
| Panama | 27.6 | 40.3 | 52.5 | 69.3 | 72.7 | 24.9 | 20.2 | 45.1 |
| Chile | 28.1 | 36.2 | 50.7 | 65.8 | 76.4 | 22.6 | 25.7 | 48.3 |
| Perú | 28.8 | 36.8 | 49.1 | 67.6 | 75.4 | 20.3 | 26.3 | 46.6 |
| Argentina* | 31.7 | 45.2 | 55.7 | 63 | 74.1 | 24.0 | 18.4 | 42.4 |
| Jamaica | 42 | 57.4 | 66.2 | 90 | 95.3 | 24.2 | 29.1 | 53.3 |
| Bolivia | 42.4 | 20.8 | 33.5 | 40.1 | 58.3 | -8.9 | 24.8 | 15.9 |
| Average LAC | 19.4 | 26.5 | 38.9 | 53.7 | 62.2 | 19.4 | 23.3 | 42.7 |
| Korea | 27.3 | 51.6 | 77.6 | 93.4 | 98.9 | 50.3 | 21.3 | 71.6 |
| Taiwan | 26.1 | 24.6 | 48.8 | 85.3 | 97.7 | 22.7 | 48.9 | 71.6 |
| USA | 94.5 | 95.5 | 97.2 | 97.6 | 98 | 2.7 | 0.8 | 3.5 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997
*Surveys cover urban areas only.

## Table C8

Proportion of the population in each birth cohort with Higher Education
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 0.5 | 1.4 | 3.7 | 4.8 | 3.3 | 3.2 | -0.4 | 2.8 |
| Nicaragua | 0.6 | 2.1 | 4.2 | 6.4 | 1.2 | 3.6 | -3.0 | 0.6 |
| México | 1.1 | 2.2 | 7.2 | 7.1 | 6.2 | 6.1 | -1.0 | 5.1 |
| El Salvador | 1.2 | 1.2 | 2.4 | 4.9 | 4 | 1.2 | 1.6 | 2.8 |
| Paraguay | 2.4 | 2.9 | 4.5 | 5.3 | 3.6 | 2.1 | -0.9 | 1.2 |
| Venezuela | 2.4 | 2.7 | 3.9 | 3.7 | 3 | 1.5 | -0.9 | 0.6 |
| Colombia | 2.5 | 4.9 | 8.5 | 10.4 | 10.3 | 6.0 | 1.8 | 7.8 |
| Brasil | 2.8 | 4.3 | 8.2 | 7.2 | 4.2 | 5.4 | -4.0 | 1.4 |
| Ecuador | 3.1 | 2.7 | 9 | 13.7 | 8.5 | 5.9 | -0.5 | 5.4 |
| Dominican Republic | 3.3 | 2.6 | 10.1 | 13.7 | 7.4 | 6.8 | -2.7 | 4.1 |
| Costa Rica | 3.6 | 6 | 8.1 | 8.5 | 6.6 | 4.5 | -1.5 | 3.0 |
| Chile | 3.7 | 7.5 | 13.1 | 12 | 17.4 | 9.4 | 4.3 | 13.7 |
| Bolivia | 5.5 | 7 | 10.9 | 11.9 | 11.9 | 5.4 | 1.0 | 6.4 |
| Uruguay* | 5.8 | 7.5 | 12.1 | 12.2 | 13.6 | 6.3 | 1.5 | 7.8 |
| Panama | 6 | 8.9 | 11.5 | 15 | 12.8 | 5.5 | 1.3 | 6.8 |
| Perú | 7.2 | 5.1 | 6.8 | 13.3 | 14 | -0.4 | 7.2 | 6.8 |
| Argentina* | 7.4 | 7.6 | 12.1 | 15.8 | 13.9 | 4.7 | 1.8 | 6.5 |
| Average LAC | 3.5 | 4.5 | 8.0 | 9.8 | 8.3 | 4.5 | 0.3 | 4.9 |
| Taiwan | 2.7 | 3.6 | 7.8 | 9.5 | 10.9 | 5.1 | 3.1 | 8.2 |
| USA | 17.7 | 23.1 | 29.3 | 25.1 | 27.3 | 11.6 | -2.0 | 9.6 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997
*Surveys cover urban areas only.

## Table C9

Proportion of the population in each birth cohort with secondary complete
(3 Year Moving Averages)

| Country | Year of Birth | | | | | Change | Change | Change |
|---|---|---|---|---|---|---|---|---|
| | 1930 | 1940 | 1950 | 1960 | 1970 | 1930-1950 | 1950-1970 | 1930-1970 |
| Honduras | 2.1 | 7.5 | 14 | 17.4 | 22.4 | 11.9 | 8.4 | 20.3 |
| Nicaragua | 2.7 | 8.1 | 13.2 | 21.6 | 18.1 | 10.5 | 4.9 | 15.4 |
| México | 3.2 | 7.7 | 18.7 | 25.7 | 33.6 | 15.5 | 14.9 | 30.4 |
| El Salvador | 5.5 | 10.1 | 13.1 | 21.2 | 28 | 7.6 | 14.9 | 22.5 |
| Dominican Republic | 6.4 | 8.1 | 21.7 | 33.7 | 32.7 | 15.3 | 11.0 | 26.3 |
| Jamaica | 7.3 | 10.4 | 24.1 | 42.8 | 62.6 | 16.8 | 38.5 | 55.3 |
| Colombia | 7.9 | 13.9 | 22.4 | 34.5 | 42.2 | 14.5 | 19.8 | 34.3 |
| Ecuador | 8.4 | 7.3 | 17.4 | 32.4 | 38.4 | 9.0 | 21.0 | 30.0 |
| Brasil | 8.5 | 12 | 20.6 | 25.8 | 25.4 | 12.1 | 4.8 | 16.9 |
| Costa Rica | 9.1 | 17 | 23.2 | 36.5 | 31.6 | 14.1 | 8.4 | 22.5 |
| Venezuela | 9.3 | 13.2 | 19.9 | 27 | 30.2 | 10.6 | 10.3 | 20.9 |
| Paraguay | 9.9 | 9.2 | 17.1 | 21.6 | 22.2 | 7.2 | 5.1 | 12.3 |
| Bolivia | 10.4 | 13.8 | 20 | 25.5 | 36.4 | 9.6 | 16.4 | 26.0 |
| Uruguay* | 12.6 | 19.5 | 29.4 | 36.8 | 43.6 | 16.8 | 14.2 | 31.0 |
| Chile | 16.3 | 23.7 | 34.9 | 44.1 | 59.7 | 18.6 | 24.8 | 43.4 |
| Panama | 16.4 | 25.6 | 31.8 | 43.9 | 48.2 | 15.4 | 16.4 | 31.8 |
| Perú | 19.5 | 25.8 | 36 | 51.4 | 58.5 | 16.5 | 22.5 | 39.0 |
| Argentina* | 21 | 32.5 | 37.7 | 44.3 | 53.6 | 16.7 | 15.9 | 32.6 |
| Average LAC | 9.8 | 14.7 | 23.1 | 32.6 | 38.2 | 13.3 | 15.1 | 28.4 |
| Korea | 16.8 | 32 | 52.8 | 77.3 | 94.5 | 36.0 | 41.7 | 77.7 |
| Taiwan | 14.9 | 16.2 | 35.6 | 57 | 76.7 | 20.7 | 41.1 | 61.8 |
| USA | 71.9 | 80.4 | 87.7 | 87.4 | 87.5 | 15.8 | -0.2 | 15.6 |

Source: Authors' calculations from household survey data. Data from Korea was taken from the UNESCO Statistical Yearbook, 1997
*Surveys cover urban areas only.

# Appendix Tables D

## Table D1a

Summary Statistics for all Countries
1950s Decade

| Variable | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Cohort mean years of schooling | 6.2 | 1.6 | 3.1 | 10.0 |
| Cohort mean years of schooling (Males) | 6.7 | 1.5 | 3.5 | 10.6 |
| Cohort mean years of schooling (Females) | 5.8 | 1.7 | 2.4 | 9.6 |
| Agricultural land per capita (1000) | 342.9 | 554.0 | 5.2 | 1681.2 |
| Capital per worker (1000,000) | 8.3 | 7.3 | 0.3 | 29.0 |
| Health conditions (life ex. at age 1) | 60.8 | 5.9 | 48.7 | 70.4 |
| Proportion of urban population | 44.5 | 14.9 | 21.1 | 79.9 |
| Terms of trade (1,000,000) | 6,800 | 17,000 | 1,670 | 83,800 |
| PPP adjusted GDP per capita | 2,215 | 1,423 | 1,030 | 7,021 |
| Coefficient of variation of GDP growth | 0.38 | 0.15 | 0.13 | 0.82 |
| GDP per capita growth | 1.2 | -1.0 | -3.3 | 9.8 |
| Young dependency rate | 0.030 | 0.024 | 0.001 | 0.079 |
| Relative cohort size | 0.9 | 0.10 | 0.74 | 1.15 |
| Trade Openness | 40.4 | 16.5 | 11.3 | 74.2 |

## Table D1b

Summary Statistics for all Countries
1970s Decade

| Variable | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Cohort mean years of schooling | 8.1 | 1.5 | 5.3 | 10.6 |
| Cohort mean years of schooling (Males) | 8.2 | 1.5 | 4.5 | 10.8 |
| Cohort mean years of schooling (Females) | 7.9 | 1.6 | 4.2 | 11.0 |
| Agricultural land per capita (1000) | 364.2 | 576.1 | 5.1 | 2050.0 |
| Capital per worker (1000,000) | 4.5 | 4.4 | 0.1 | 18.2 |
| Health conditions (life ex. at age 1) | 65.8 | 4.3 | 53.6 | 71.7 |
| Proportion of urban population | 53.6 | 16.3 | 28.9 | 83.1 |
| Terms of trade (1,000,000) | 4,070 | 5,690 | 275 | 30,000 |
| PPP adjusted GDP per capita | 3,089 | 1,570 | 1,237 | 7,753 |
| Coefficient of variation of GDP growth | 0.27 | 0.15 | 0.02 | 0.75 |
| GDP per capita growth | 2.7 | -1.0 | -7.9 | 10.8 |
| Young dependency rate | 0.021 | 0.016 | 0.001 | 0.055 |
| Relative cohort size | 1.0 | 0.09 | 0.78 | 1.28 |
| Trade Openness | 44.5 | 22.6 | 11.8 | 102.0 |

**Table D1c**

Summary Statistics for all Countries

1980s Decade

| Variable | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|
| Cohort mean years of schooling | 9.0 | 1.5 | 5.8 | 11.7 |
| Cohort mean years of schooling (Males) | 9.0 | 1.5 | 5.6 | 11.4 |
| Cohort mean years of schooling (Females) | 9.0 | 1.5 | 5.9 | 12.0 |
| Agricultural land per capita (1000) | 391.7 | 602.8 | 4.8 | 2262.0 |
| Capital per worker (1000,000) | 4.3 | 4.6 | 0.1 | 20.2 |
| Health conditions (life ex. at age 1) | 69.2 | 3.9 | 58.1 | 74.5 |
| Proportion of urban population | 60.0 | 16.1 | 34.3 | 87.9 |
| Terms of trade (1,000,000) | 5,760 | 7,180 | 317 | 33,200 |
| PPP adjusted GDP per capita | 3,296 | 1,467 | 1,374 | 6,857 |
| Coefficient of variation of GDP growth | 0.53 | 0.28 | 0.14 | 1.45 |
| GDP per capita growth | -0.2 | -1.0 | -11.5 | 9.9 |
| Young dependency rate | 0.018 | 0.016 | 0.001 | 0.048 |
| Relative cohort size | 1.2 | 0.12 | 0.91 | 1.62 |
| Trade Openness | 48.5 | 25.0 | 11.5 | 131.9 |

# Table D2

**Robustness Tests**

**Dependent Variable: Cohort average years of schooling (All country fixed effects regressions)**

| Independent | Excl. GDP per capita (1) | | Excl. Bolivia (2) | | Only Age > 28 (3) | | Adjustment 1 (4) | | Adjustment 2 (5) | | Adjustment 3 (6) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| variable | Coeff | z' Stat. | Coeff | z' Stat. | Coeff | z' Stat. | Coeff | z' Stat. | Coeff | z' Stat. | Coeff | z' Stat. |
| Agricultural land per capita (100,000) | -0.226 | *-5.53* | -0.276 | *-6.20* | -0.268 | *-6.54* | -0.224 | *-7.30* | -0.219 | *-7.19* | -0.216 | *-7.15* |
| Capital per worker (1/10000) | 4.884 | *0.26* | 12.867 | *0.64* | 0.499 | *0.02* | 7.831 | *0.46* | 6.890 | *0.40* | 6.155 | *0.36* |
| Health conditions | 0.027 | *1.04* | 0.011 | *0.40* | 0.005 | *0.16* | 0.039 | *1.73* | 0.039 | *1.70* | 0.039 | *1.61* |
| % of urban population | 0.043 | *2.20* | 0.046 | *1.74* | 0.051 | *2.66* | 0.027 | *1.50* | 0.026 | *1.45* | 0.025 | *1.41* |
| Terms of Trade (100,000) | 0.015 | *5.20* | 0.013 | *7.14* | 0.017 | *6.22* | 0.012 | *8.03* | 0.012 | *7.80* | 0.012 | *7.51* |
| PPP GDP per capita | | | 0.169 | *3.36* | 0.077 | *2.01* | 0.170 | *3.72* | 0.165 | *3.60* | 0.159 | *3.52* |
| Volatility of GDP growth | -3.239 | *-3.62* | -2.886 | *-3.14* | -2.062 | *-2.83* | -3.012 | *-3.53* | -2.891 | *-3.59* | -2.967 | *-3.64* |
| GDP per capita growth | 0.986 | *1.42* | 0.304 | *0.40* | 0.675 | *0.88* | 0.176 | *0.25* | 0.017 | *0.02* | 0.046 | *0.06* |
| Young depdency rate | -1.388 | *-0.20* | -6.771 | *-0.94* | -5.822 | *-0.59* | -1.171 | *-0.18* | -1.246 | *-0.19* | -1.056 | *-0.16* |
| Relative cohort size | -0.306 | *-1.02* | -0.402 | *-1.16* | -0.228 | *-0.77* | -0.416 | *-1.37* | -0.396 | *-1.31* | -0.386 | *-1.32* |
| Trade openness measure (1,000) | 5.228 | *2.62* | 9.053 | *3.30* | 5.521 | *2.01* | 5.024 | *1.64* | 4.401 | *1.38* | 3.789 | *1.17* |
| Mortality/migration | -0.403 | *-1.03* | -0.270 | *-0.44* | -1.798 | *-1.90* | -0.294 | *-0.49* | -0.341 | *-0.55* | -0.421 | *-0.70* |
| Year trend | 0.078 | *5.19* | 0.069 | *4.53* | 0.084 | *6.10* | 0.077 | *6.08* | 0.079 | *6.32* | 0.083 | *6.78* |
| Constant | -4.4 | *-5.67* | -127.3 | *-4.36* | -153.8 | *-6.08* | -143.4 | *-6.15* | -147.5 | *-6.40* | -154.0 | *-6.87* |
| | | | | | | | | | | | | |
| Number of obs | 490 | | 462 | | 433 | | 490 | | 490 | | 490 | |
| F( 11, 17) | 679 | | 7,949 | | 19,725 | | 18,628 | | 25,214 | | 33,156 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | | 0.000 | |
| R-squared | | | | | | | | | | | | |
| Root MSE | 0.316 | | 0.299 | | 0.308 | | 0.311 | | 0.312 | | 0.315 | |

Source: Authors' calculations.

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