Inter-American Development Bank
Banco Interamericano de Desarrollo

Office of the Chief Economist
Working paper #406

Decomposing Fertility Differences Across World Regions and Over Time: Is Improved Health More Important than Women's Schooling?

by

Jere R. Behrman, Suzanne Duryea and Miguel Székely*

September 2, 1999

Background paper for the Economic and Social Progress Report 2000

* Behrman is the William R. Kenan, Jr. Professor of Economics and Director of the Population Studies Center at the University of Pennsylvania and can be contacted at Economics, McNeil 160, 3718 Locust Walk, University of Pennsylvania, Philadelphia, PA 19104-6297, USA; telephone 215 898 7704, fax 215 898 2124, e-mail jbehrman@econ.sas.upenn.edu. Duryea and Székely are Economists in the Office of the Chief Economist, Inter-American Development Bank, 1300 New York Ave. NW, Washington, DC 20577; telephone 1 202 623 3589 and 1 202 623 2907; fax 1 202 623 2481; e-mail { HYPERLINK mailto:suzanned@IADB.ORG } and miguels@iadb.org.
Behrman collaborated with Duryea and Székely on this paper as a consultant to the Inter-American Development Bank. The authors wish to thank participants at the IDB Conference on Human Development in Latin America, and David Lam and Paul Schultz for comments.

Abstract: There is a recent renewal of interest in the relation between shifts in age structures of populations and various economic outcomes. These shifts are triggered by changes in fertility and mortality that take place some years before becoming apparent in the standard age structure and that may create windows of opportunity for subsequent development. A large number of countries in the world are still experiencing, or probably about to experience, fertility declines. This paper first characterizes differences in fertility and mortality and in related dependency ratios across regions and over time. The paper then uses a panel of 96 countries covering the period 1965-1995 to decompose the differences in fertility rates between developed and developing countries and the differences in fertility between 1960 and 1995 for several developing regions and for 22 individual countries in the Latin American and Caribbean region. These decompositions indicate that the main correlates of fertility differences across space and over time are female schooling and health, with the former having larger associations with differential fertility among regions/countries at a point of time and the latter having larger associations with fertility declines over time. This suggests that the importance of associations of increased female schooling relative to those of improved health may be overstated in the literature, which is substantially based on inferring longitudinal relations from cross-sectional data.

Keywords: Fertility, schooling, health, age structure, dependency ratios, and demographic transition.

JEL Classification: J11, J13, and O11

The Office of the Chief Economist (OCE) also publishes the *Latin American Economic Policies Newsletter*, as well as working paper series and books, on diverse economic issues. Visit our Home Page at: { HYPERLINK http://www.iadb.org/oce }. To obtain a complete list of OCE publications, and to read or download them, please visit our Web Site at: http://www.iadb.org/oce/32.htm

Introduction

In the 1990s the economics literature has had a renewed interest in how demographic conditions at a point in time may shape current and subsequent economic options. One major reason for the renewed interest in demographics is the possibility that the earlier stages of the demographic transition may offer a "window of opportunity" for increased economic growth due to reduced dependency ratios.[1] There are still large numbers of countries in which the proportions of elderly are negligible and in which most of the current or near-term-future age structure shift is in the relative weight of individuals away from the "young" age group towards the "working-age" group.[2] This shift may present a window of opportunity by increasing transitorily, but still possibly for decades, the share of the working age population with increased savings, enhanced schooling and greater economic growth resulting.[3] Perhaps the best example of this possibility being realized are the cases of several countries in East Asia, which registered the highest rates of economic growth in the world in the past three decades, precisely at the times at which large age structure shifts from young to working-age population were taking place. Bloom and Williamson (1999) estimate that demographics, in particular age-structure shifts, provided this region with a boost that accounted for about a third of its very high economic growth during this period.

This change in the age structure through shifts in the relative shares of broad age groups is triggered by fertility and mortality declines that take place some time before the changes in dependency ratios are manifested. With constant age-specific fertility and mortality rates, a population would grow at a steady rate and the age structure would remain invariant. Age structure shifts of the kind described above would not be observed. However, if fertility and

[1] Another major reason for the increased interest in demography is that some of the most developed economies and some of the recently more quickly developing countries have rapidly increasing shares of "old" populations, triggering important consequences, such as imposing pressures on pension systems, saving rates, public health, and other key economic services and variables. The continuation of this age structure shift is expected to have even larger effects in the future, with substantial policy implications.

[2] Throughout this paper we use "young" to refer to the 0-14 age group, "working-age" to refer to the 15-64 age group, and "old" to the 65 and older age group. Similarly we use "young dependency ratio" to refer to the ratio of the population in the 0-14 age group to that in the 15-64 age group and "old dependency ratio" to refer to the ratio of the population in the 65 and older age group to that in the 15-64 age group.

[3] See for instance Bloom and Williamson (1999), Behrman, Duryea and Székely (1999), ADB (1997) and IDB

mortality decline at different rates, as is the case during the stereotypical demographic transition from a high-fertility/high-mortality steady state to a low-fertility/low-mortality steady state, population growth and dependency ratios vary. In reality, as we document later, differences in age structures and dependency ratios across countries today are due mainly to differences in fertility rates and to paces at which fertility has declined over time.

This paper sheds light on the factors that are associated with differences in fertility across regions, and differences in the rate at which fertility has declined over time. Although many developed countries and even some developing ones have reached a stage where fertility is not likely to be reduced much further in the future, the topic is of interest because the majority of countries in the world are, or soon are likely to be, experiencing important fertility declines. When fertility decreases very rapidly as in the fast-economic-growing East Asian economies between 1950 and 1990 (particularly in the 1970s), the potential demographic benefit associated with population movements from young to working ages comes earlier and the effects are stronger. Therefore, for both predictions of future economic developments and for policy considerations, it is useful to identify the factors that are associated with sharper fertility reductions.

In addition to considering differences across broad regions in the world, we take a closer look within Latin America and the Caribbean (LAC). This region is of interest for at least two reasons. First, LAC is the region that in the next two to three decades on average will be experiencing the fastest demographic transition.[4] Second, LAC includes a wide range of country age structures, from some that are similar to countries with the youngest populations in the world to others that are more like the developed economies with older populations. Therefore, we can determine whether our conclusions from our aggregate regional analysis can be extended to particular countries with widely varying age structures.

The literature on fertility determinants recognizes that there may be many factors that are associated with such fertility declines. Prices of child quality may fall relative to prices of child quantity. Information about family planning options may improve. Better health and longer life expectancies may induce less fertility and more human resource investment.

(1998).

[4] See Behrman, Duryea and Székely (1999) for details.

But conventional wisdom gives primacy to empirical associations between fertility declines and increased women's schooling. Surveys of the literature on fertility repeatedly suggest that the strongest empirical association between fertility declines and observed variables in micro and aggregate studies is the inverse one between women's schooling and their fertility. Birdsall (1988), for instance, summarizes the empirical literature as finding that: "Female education above about four years...bears one of the strongest and most consistent negative relationships to fertility" (p. 514) and that "[empirical] work has strongly confirmed the hypothesis that parents' education, especially a mother's education above the primary level, will be associated with lower fertility...." (p. 533). Schultz (1997) summarizes the literature as implying that: "...increasing education of women is generally associated with lower fertility, certainly after a threshold of about four years of schooling, a level which may be roughly equivalent to functional literacy.…" (p. 381) and summarizes his own aggregate estimates as indicating that: "The education of women is the dominant factor associated with the decline in fertility in the cross section and over time." (p. 416). The World Bank (1991, p. 55) asserts that "educating women [is] a key to development" and then explains this claim by presenting graphs from cross-country data that show that higher schooling for women (holding constant schooling for men) is associated with substantially reduced total fertility rates (as well as reduced infant mortality rates).

In this paper we explore aggregate empirical associations of fertility with women's schooling and with other variables over the last half of the 20th century. Section 1 documents differences in young and old dependency ratios, fertility, and mortality and population growth rates across regions and over time for major world regions. Differences among countries within LAC are also examined. Section 2 discusses our approach and presents econometric results on associations between total fertility rates and a series of aggregate variables from various international data sources. Section 3 uses these econometric results to decompose differences in fertility across regions and over time, while section 4 focuses only on the LAC region. Section 5 concludes.

Our decompositions indicate that the main correlates of fertility differences across space and over time are female schooling and health. The former has larger associations with differential fertility in cross sections among regions/countries as is emphasized in the previous literature. But the latter has larger associations with fertility declines over time. This suggests that the importance of associations of increased female schooling relative to those of improved health may be overstated in the literature, which is substantially based on inferring longitudinal relations from cross-sectional data.

1. Regional Trends in Dependency Ratios, Fertility, Mortality and Population Growth Rates

In the stereotypic demographic transition, in the first stage mortality drops quickly and then fertility declines more slowly, with the result being high population growth and an increase in the young dependency ratio. In the next stage continuing fertility declines with mortality declining more slowly reduce population growth so that the young dependency ratio starts decreasing. The faster is the decrease in the young dependency ratio the greater is the "demographic opportunity" presented by a high working-age population share and low dependency ratios. But as the population continues to age, the old dependency ratio increases with a concomitant reduction in the working age share despite the continuing decline in the young dependency ratio.

The time paths of the young and old dependency ratios across regions over the past half-century indicate wide varieties of experiences. Figure 1 plots the young dependency ratios of Africa, LAC, North America, Europe, East Asia and the rest of Asia for 1950-1995, calculated from the United Nations Population Statistics, 1998 revision (see United Nations 1998). Africa has the highest young dependency ratio throughout this period -- in 1995 about 3.4 times larger than that observed for Europe, the region with the lowest ratio. The African young dependency ratio also has changed relatively little in comparison with the other developing regions. It increased a little until about 1980 but currently still is quite high and declining only slowly because of sustained high recent fertility rates. Asia and LAC have had young dependency ratios throughout this half century that have been below those for Africa, but considerably higher than those for North America and Europe. They show the inverted "U" shaped trend in young dependency ratios that is characteristic of the demographic transition, with the peak in young dependency ratios around 1970. East Asian young dependency ratios have been lower than have been those for the rest of Asia and LAC throughout this period, though they increased considerably between 1950 and 1960. They then peaked a little earlier in the 1960s and declined more sharply after the peak than in the rest of Asia and in LAC so that by 1995 they were much closer to those in North America and Europe than to those in the rest of Asia and LAC. The young dependency ratios for North America and even more so for Europe have been below those for developing countries throughout the past half-century, generally considerably below with the sole exception of East Asia recently. They both had a peak around 1960 due to the "baby boom" (that was much stronger in North America than in Europe) and tended to decline thereafter (though with a slight baby boom "echo" in North America in the 1990s), but with lesser rates of decline than the somewhat later declines in Asia (particularly East Asia) and LAC.

Over this past half century, thus, the sharpest decline in young dependency ratios was for East Asia between 1970 and 1990. During this period, therefore, this region had the greatest "demographic opportunity" among all of the world regions. The next sharpest decline was in North America between about 1960 and about 1980 due to the "baby boom." LAC has had a substantial decline starting around 1970 that is ongoing, but not at as fast a rate as East Asia in 1970-1990 or North America in 1960-1980. Therefore, though LAC has an ongoing "demographic opportunity" and the currently fastest decline in the young dependency ratios among all of the regions, this "opportunity" is not as large as experienced earlier by East Asia due to the less rapid decline in young dependency ratios in LAC than in East Asia. Asia (excluding East Asia) has a pattern of youth dependency ratios similar to LAC, with somewhat slower rates of growth before the peak around 1970 and somewhat slower declines after that peak. Thus the rest of Asia has somewhat less of a current "demographic opportunity" than LAC and much less than East Asia had earlier. Africa, finally, is in the midst of a slow decline in young dependency ratios that promises a very small "demographic opportunity" though later in the 21st century this region is predicted to have the fastest decline (though no where near as fast as that in East Asia in 1970-1990 or even in LAC and the rest of Asia currently).

Figure 2 presents the old dependency ratios by region. The main feature of this figure is that Europe and North America have old dependency ratios way above those of the other regions. The old dependency ratios in these two developed regions, moreover, have been increasing at more rapid rates than in the other regions for most of the 45-year period covered. The differences among the developing country regions are very small in comparison with the differences between the developing and the developed regions. Among the developing regions, over the entire period the old dependency ratios are positively associated with most indicators of recent development levels, with East Asia highest, LAC next, then the rest of Asia and then Africa. East Asia has had somewhat more variance over time than the other developing regions, and in recent years the East Asian ratio has been increasing at an accelerated rate. Thus, what primarily differentiates the age structure and dependency ratios in East Asia from the other developing regions is the relative size of its working age population.

The dependency ratios of populations as summarized in Figures 1 and 2, as already mentioned, are consequences of the demographic transition that in turn is triggered by changes in fertility and mortality. Fertility and mortality determine the rate of growth of the population and thus the relative size of each generation and the population weight of each age group.[5]

Figure 3 presents the regional total fertility rates (TFR), defined as the number of children that would be born to a woman exposed to the age-specific birth rates of the period for the age range 15-49.[6] Africa is the developing country region with the highest fertility and where fertility has declined most slowly. Europe also has had a slow fertility decline in this period, but in this case the reason is that this region had the lowest levels already in the 1950s. The second highest fertility rates are found in Asia (excluding East Asia) and LAC. In these two regions, fertility rates were somewhat lower than in Africa in 1950, but they subsequently declined much faster, with the result that in 1995 their fertility rates were about half of those observed in Africa. The declines were somewhat greater in LAC than in Asia (excluding East Asia). In 1950 fertility rates in East Asia were also very similar to those in LAC but during the 1950s fertility in this region started to decline sharply and faster than in any other region in the world. By 1995, fertility in East Asia was between North American and European levels. But in LAC, the region with the second fastest reduction, fertility in 1995 still was at levels well above those for North America, East Asia and Europe. The difference between LAC and East Asia was 0.2 in 1950, but had increased by a factor of over four to almost 1.0 in 1995.

The differences in mortality across regions between 1950 and 1995, presented in Figure 4, have been much smaller than have been those for fertility. While fertility rates diverged significantly between East Asia and LAC since 1950, crude mortality rates converged from 1960

[5] Migration also plays a role, but this is usually a minor role at the national level.
[6] The correlation of the TFR with the crude birth rate, which is not age-standardized, is .98.

on. These two regions have very similar rates in 1995 (although mortality in East Asia remains somewhat higher). Differences in mortality rates between these two regions and the rest of Asia are also relatively small. Likewise the differences between East Asia and LAC on one hand and Europe and North America on the other in recent years are quite small, with the former having lower crude mortality rates than the latter because mortality rates increase substantially as old age dependency ratios increase. Therefore, the differences that we observe in age structures, dependency ratios and average ages of the population are due basically to differential fertility and not due to differential mortality.

The combination of rather high fertility and low mortality rates places Asia and LAC close to the world average in terms of annual rates of population growth. Figure 5 shows that LAC still has a population growth rate over 1 per cent, which is normally considered the threshold to enter the fourth stage of demographic transition in which the population growth falls to replacement levels. Given the reduction in fertility experienced by East Asia since 1955, population growth rates in that region are now about half those observed in LAC, and are very similar to the rates observed in some of the most developed regions in the world. According to the UN population projections, LAC will reach the same population growth rates currently observed in East Asia (0.6 per cent per year) only in the year 2030, even though these regions had similar age structures in 1950.

Differences within LAC

The case of LAC is especially interesting. According to the United Nations projections LAC is the region that will register the largest age structure changes in the next 30 years. These changes are fairly predictable because they are consequence of fertility declines observed in the past or currently taking place. However, within the region there are a number of countries where the transition has been relatively slow and where there is still scope for major reductions in fertility that could trigger more rapid demographic transitions later in the next century.

Differences in age structure within LAC are quite apparent when looking at the young dependency ratios in Table 1. For the countries with the youngest populations such as Honduras, Nicaragua and Guatemala, the young dependency ratios in 1995 were twice as large as in the countries with the oldest populations, including Barbados, Argentina and Uruguay.[7] One interesting aspect of the table is that by 1950 about half of the countries had young dependency ratios between 0.7 and 0.8 suggesting that some decline in these ratios already had occurred. But by 1995 the ranking among this group of countries had changed significantly due to differences in the paces at which fertility had fallen.

The largest fertility declines in LAC are observed in the countries with the highest fertility in 1950. One might expect the countries with the highest initial fertility to register a larger decline because fertility has a lower bound and fertility rates across countries therefore tend to converge. The correlation coefficient between the change in the total fertility rate and the rate in 1950 is -0.83, so it appears that the countries in LAC are in fact converging to lower fertility levels. Countries such as the Dominican Republic, that that had the highest fertility in 1950, had the largest decline; Uruguay, which is the country with the lowest rate in 1950, had the smallest change. Nevertheless, there are some cases such as Haiti, Guatemala, Paraguay and Bolivia that had some of the highest rates in 1950, but in which the reductions have been slower than expected on the basis of this correlation.

With the exceptions of specific cases such as Haiti, Uruguay and Argentina, there seem to have been relatively small differences in death rates across the countries in the region by 1995.[8] There were much sharper differences within the region in 1950, but death rates declined more in the countries with higher mortality in 1950, and convergence has been faster in terms of death rates than for fertility. An extreme case is the comparison between Guatemala and Barbados. Guatemala had death rates almost twice as large as Barbados in 1950, but by 1995 death rates were very similar. On the other hand fertility in Guatemala was 1.5 times higher than Barbados in 1950, but almost three times higher in 1995. This is an example of the fact that the age structure differences observed within LAC today are primarily due to fertility rate differentials and not to mortality rate differentials.

The age structure and dependency ratio shifts expected in the next decades in LAC will be due mainly to fertility reductions. As can be seen in Figures 3 and 4 and Table 1, the countries

[7] There are only marginal differences in old dependency ratios among countries in LAC. The only two countries where old dependency ratios are relatively high are Barbados and Uruguay, which are almost at East Asian levels.
[8] Death rates are high in Haiti because this country has the highest infant mortality rate, and are high in Uruguay and Argentina because relatively large proportions of the populations in these countries are old.

in LAC with the highest fertility rates were still way above the world average fertility in 1995, which suggests that there is still scope for substantial reduction. However, in terms of mortality, most LAC countries were below the world average in 1995 already; with few exceptions, major declines are not expected in the future. In fact, death rates tend to increase with the shift of the population toward the older age group, as noted above, so crude mortality rates may well increase in many countries in LAC.

In summary, there are substantial differences in dependency ratios among regions and within LACC and the differences in dependency ratios that we observe today across regions in are primarily due to the dynamics of fertility. In some countries and regions fertility has declined at much faster paces than in others and have triggered subsequent shifts in dependency ratios that have strong implications for various economic outcomes. Because fertility, rather than mortality, changes are expected to be the major determinant of near-term future changes in dependency ratios and because there is still scope for significant reductions in fertility in several countries and regions, it is of interest to investigate with what factors have differential changes in fertility rates among countries and regions and within countries and regions, been associated.

2. Correlates of Fertility Differences and Fertility Declines for Major World Regions

Why did LAC and East Asia develop demographically along different paths after the 1950s, even though they seemed to look very much alike in that decade? And why have some countries within LAC experienced much sharper fertility reductions than others? There is a huge literature (much of which is reviewed in Birdsall 1988, Schultz 1997 and Behrman 1999a) that attempts to explain what factors determine fertility. Some of the factors that are highlighted in this literature are:

- Culture and religion: Religious beliefs and cultural patterns usually have strong associations with the roles that women and men play in society. By influencing the way women allocate their time between home and market activities and within the household, and by providing incentives and/or constraints to the use of contraceptive methods, they influence decisions of how many children to have. Differences in religious or cultural patterns could therefore have strong associations with fertility.

- Health and the epidemiological transition: The more precarious are health conditions, the lower the probability of survival of each child, and therefore the larger the number of pregnancies required to be able to have offspring that result in any target number of adult children. If health conditions improve and reduce infant mortality rates and increase life expectancies, people will perceive increased probabilities of survival to adulthood and can achieve their expected desired family size with fewer births. Further, with longer expected life times, the returns to human resource investments are greater, thus shifting the incentives towards investing in more child quality relative to child quantity.
- The roles of children: In societies in which child labor is productive (e.g. communities with predominantly agricultural activities on family farms) the income-generating potential of children can be high relative to child costs, which provides incentives for having many children. Children also may be sources of old age security in the absence of good capital markets and public programs for old-age support, so couples may decide to have more children to reduce the risk of not being able to support their standard of living after retirement or if struck by illness or disabilities. Both of these possibilities are likely to be reduced with urbanization and market development.
- Income/wealth and quality effects: If children are "normal" goods that provide utility to parents, people would tend to have more children the higher their income level, and the lower the economic cost of raising each of them. However, if the "quality" of each child can be substituted for the quantity of children in the satisfaction of parents' preferences, rather than having more children richer parents might invest in higher quality for each child, thus reducing fertility. The relation between income and fertility therefore is theoretically ambiguous if prices of quality change with income (Becker 1991, Becker and Lewis 1973, Willis 1973). Empirical evidence on the relations among fertility, child quality and income suggests that people choose more "quality" and not more quantity of children as their income increases, though many of the available studies do not identify well the effect of prices for quality separate from the effect of income.

- Schooling and labor market opportunities: Both the schooling of men and women may influence the number of children born through various channels. Schooling may affect the ability to achieve a latent desired number of births. If the schooling of women increases their awareness and use of contraceptive methods or increases their bargaining power relative to husbands' higher preferences for children, then more educated women can achieve fewer undesired births (Rosenzweig and Schultz 1985, 1987). If additional schooling increases productivity within the household -- for example, by more efficient use of health services -- then the resulting reduction in the cost of child quality also may lead parents to shift to fewer but higher-quality children.[9] If women have better market opportunities because of the acquisition of human capital, the opportunity cost of their time invested in child care increases with schooling, so they tend to have fewer children if the increased opportunity cost is large enough to offset the potential positive income effect (Kremer and Chen 1999). Similarly, if the reward paid in the labor market for a fixed amount of schooling increases, the opportunity cost of the time invested in raising children increases, and the desired number of children tends to decline (with the net effect depending on the income versus the price effects once again). As noted in the introduction, conventional wisdom and much of the past empirical literature suggests that women's schooling is the dominant factor associated with fertility declines, though in most studies exactly what causal role women's schooling is playing is not identified.

We combine several international data sources with information for most of the countries in the world for 1950-1995 to explore whether there are correlations in real world data that may be related to some of the above possibilities. We stress, however, that with such data, we (and others) can only describe associations among some of the existing variables and not test causal explanations. The latter requires rich microdata that permit the estimation of the underlying

[9] For empirical evidence of increased home productivity related to women's schooling in developing country contexts see Behrman, Foster, Rosenzweig and Vashishtha (1999) and Lam and Duryea (1999). But such results depend on the nature of labor markets for women. If the schooling returns are relatively high in labor markets, in contrast to rural India and Brazil (the contexts for the two studies mentioned in the previous sentence), increased schooling for women, once there is control for differential endowments and marriage market outcomes that are associated with women's schooling, may reduce women's time in home production and therefore more female schooling may have a negative impact on outcomes such as child schooling, as found for the United States in Behrman and Rosenzweig (1999).

models of behvior in particular institutional and market contexts. We think that the question of to what extent there are associations in data with a large geographical and time sweep, nevertheless, is interesting and can raise important questions about what might be the important casual variables. If the associations are high with a particular variable, for example, that suggests that either that variable or variables that are highly correlated with it probably have an important causal relation with fertility.

Associations between Total Fertility Rates and Other Aggregate Variables

To examine associations between a number of aggregate variables that relate to the possible fertility determinants discussed above and fertility we regress the total fertility rate on various socio-economic variables using random effect specifications (Tables 2 and 3).[10] Because variables such as urban population share and average schooling levels change slowly over time, we use observations for every five years from 1960-1995 with each country contributing up to 8 observations. Table A1 in the Appendix presents summary statistics for all the variables included in the regressions.

We begin by examining the static relationship between the total fertility rate (TFR) and religion in column 1 of Table 2. The TFR is regressed on three variables indicating the proportions of the population classified as belonging to the Muslim, Catholic, and Protestant religions, respectively with other religion acting as the omitted category.[11] These estimates imply that countries that are 100% Muslim have an average of 2.6 births more than countries that are 100% Protestant and 2.0 births more than countries that are 100% Catholic. However when latitude and GDP per capita are added in regression 3, the share of the population that is Protestant is associated with higher fertility than the Catholic share, while GDP per capita and latitude have strong negative associations with fertility.

The main reason for introducing latitude is that we want to account for the fact that certain geographic areas are more prone to disease and mortality than are others. The hypothesis is that children living in these areas face a lower probability of survival to adulthood, and thus,

[10] All the demographic variables used in this section are taken from the United Nations Population Statistics, 1998 revision.

couples chose to have more children for any future desired family size. Due to the lack of alternative indicators we introduce the latitude of the main city of each country as a proxy for geographic conditions because this is a way of distinguishing between tropical and temperate areas (the higher the value of the index, the further away is the main city of the country from the Equator).[12] The estimates in regressions 2 and 3 indicate that higher fertility rates are significantly and strongly associated with being closer to the Equator. The fit of the regression with inclusion of the latitude and GDP variables increases substantially and is associated with over half of the variation in the country fertility rates.

Adding more variables to the specifciation in regression 3 reveals strong collinearity among average schooling, GDP, urbanization and latitude.[13] The addition of average schooling for the whole population in equation 5, and of schooling for both men and women and the urban population share in regression 6 reduces greatly the magnitude of the effects of GDP and latitude. Latitude no longer has a significant association with fertility. Higher average schooling of women is associated with a larger marginal decline in fertility than a similar increase in average schooling for men. Women's schooling is specified in levels in regression 7 to allow for a non-linear relationship between women's schooling and fertility.[14] This specification yields a better fit than the preceeding ones and is consistent with about two-thirds of the sample variance in fertility.

The correlation of women's schooling with urbanization and latitude perhaps indicates that women have more opportunities in more urbanized countries, and the latitude and

---

[11] These variables were taken from La Porta, et. al (1998). Note that although the number of observations seems to be large, there is no variability in these three variables over time, so the *real* number of observations is equal to the number of countries in our data (which is 159).

[12] The data was taken from Sachs and Warner (1995). This variable does not vary over time and so the real number of observations is equal to the number of countries.

[13] The data on the proportion of urban population is taken from the United Nations (1998). For the period 1950-1992, the source for the PPP adjusted GDP per capita is the Penn World Tables. The World Bank Development Indicators (1998) provide a series of PPP adjusted GDP per capita for the period 1980-1997. We use the growth rates from the World Bank (using the same definition as in the the Penn World Tables) to extend the Penn Tables series up to 1995. The measure of schooling that we use -- the stock of schooling of the population over 25 years of age as presented by Barro and Lee (1993) – depends on the age structure. For example one country may have a higher proportion completing some secondary school than another with identical age-specific schooling because the former country has a younger population and there is a secular positive trend in schooling. If we assume the measurement error in the Barro-Lee data is uncorrelated with fertility this would bias the schooling coefficient estimates toward zero.

[14] See Lam and Duryea (1999) for the case of Brazil using micro-data. The marginal effect of schooling is found to be larger at lower levels of schooling.

urbanization variables in the previous regressions are in part capturing this effect. In the case of religion, it is interesting that now the magnitudes of the coefficients have been reversed. The largest coefficient estimate is now found for the proportion Protestant. This suggests that religion and schooling are highly correlated and that perhaps the effect of religion on the total fertility rate is acting through schooling. Women in Muslim and Catholic countries have higher total fertility rates, but this may be mainly because there is a relation between religion and schooling. Among the three female schooling levels in column 7, the largest estimated association is for the primary school level. Going from no schooling to primary has a larger association with the total fertility rate than going either from primary to secondary or from secondary to higher schooling.

In Table 3 we add some health indicators to the equation. Regression 8 includes the share of the population with access to potable water to proxy health conditions, which has the expected negative relationship with fertility. While it is beyond the scope of this paper to map out the different pathways of the collinear variables it is noteworthy that women's schooling retains a significant negative association with fertility throughout the specifications. This is consistent with the considerable emphasis on women's schooling in the previous literature that is noted in the introduction. To conclude that men's schooling has no assoication with fertility because it does not have significant coefficienct estimates in these regressions might be erroneous because both men's and women's schooling may be determinants of health measures such as available potable water.[15] In other words if men's schooling is a major determinant of income or GDP and thus of the capacity to provide potable water, after controlling for water and GDP there may be no direct effect of men's schooling on fertility even if there is an important indirect effect through potable water. The overall results in regressions 9 and 10, where we use different proxies for health conditions, are similar to those just discussed.[16] The health indicators have significant negative associations with fertility while female schooling remains significant in all cases.

Unfortunately most of our measures of health conditions included so far are unavailable for the full period as well as incomplete for the full sample of countries. For example, the data

[15] Schultz (1993) also reports that the differences between men's and women's schooling as reported in the Barro-Lee data are mainly measurement error and are not highly correlated with the difference as calculated from micro-data.
[16] All these health related variables are taken from the World Bank World Development Indicators, 1998.

on potable water are available only after 1970 and the immunization variables and the sanitation variable are available only after 1980. The sanitation variable is available for only 79 countries of the 96 countries included in the Barro-Lee data set while the potable water variable is avaiable for only 86 countries.

Given these limitations we prefer to use a health measure that we constructed based on parents' survival expectations for their children. We do not use the infant mortality rate or life expectancy at birth as measures of improvements in survival because high rates of fertility also cause high infant mortality rates associated with close birth spacing. Instead we purge the life expectancy measure of the influence of mortality before age one to investigate associations between fertility and improvements in health outcomes after age one.[17]

Specifically, we predict a measure of life expectancy at age one (e_1) using the infant mortality rate (imr) and life expectancy at birth (e_0) as follows. Life expectancy at birth is equal to the average share of the first year lived (L_0) plus the number of additional years lived after exact age one (e_1) for those who survive to age one (l_1):

(1) $$e_0 = L_0 + l_1 e_1.$$

Because $l_1 = 1-q_0$, where q_0 is the probability of dying at age 0 (before age one), equation (1) can be rewritten as:

(2) $$e_1 = (e_0 - L_0)/(1-q_0)$$

Because $L_0 = (1-q_0) + q_0 a_0$ and:

(3) $$q_0 = imr / (1+(1-a_0)imr)$$

both q_0 and L_0 are functions of a_0, the fraction of the year lived for those who die at age 0. According to Conde, et.al. (1980), a_0 can be estimated by a_0=.08816+1.4304(imr). So, if we

[17] All information on life expectancy and infant mortality is taken from the UN (1998).

substitute L_0 and q_0 into equation (2), we can estimate e_1 with the UN's published values of e_0 and imr by:

(4) $$e_1 = (e_0 – (1-q_0)- q_0a_0)/(1- q_0).$$

The mortality that we purge before age one matches published data on the difference between e_1 and e_0 for the 1990s.[18]

Equation 11 in Table 3 presents the results of using e_1 as our proxy for health, which increases the number of countries and observations for the period 1960-1995. The sign, magnitude and statistical significance of the coefficients for religion, urbanization and the schooling variables do not vary significantly between equations 8 and 11, indicating that these coefficients are robust to different ways of incorporating information on health variables. However, the coefficient for latitude and GDP per capita remain insignificant but change from negative to positive, and from positive to negative, respectively. This indicates that e_1 is capturing some aspects of health that are correlated with geographic conditions and GDP, that are not accounted for by the proportion of the population with access to potable water.

To this point we have focused on regressions estimated with random effects that use both cross-country and within-country across-time variation. To test whether the magnitudes and significance of the coefficient estimates are sensitive to the method of estimation, we also present country fixed effect regressions in columns 12 and 13. The first of these excludes the health-related variables, while the second uses e_1. The main differences between the equations excluding health (regressions 7 and 12) are that the coefficient estimate of the proportion of urban population doubles in magnitude, the sign for the coefficient estimate for male schooling becomes very small and insignificant, and the coefficient estimate for female schooling becomes larger when controlling for all time-invariant country effects. Thus, there are country-specific characteristics that are strongly correlated with urbanization and schooling. Excluding them biases these coefficients downward. Perhaps the most surprising of these results is the effect on male schooling. Because the coefficient estimate is not significant, it supports the hypothesis

[18] Our estimates of (e_0-e_1) are very close to those reported for 1995 by the UN's 1997 Demographic Yearbook, Table 22. For example additional life expectancy at age one is .5 years lower in Canada than at age zero according to our calculations which is the value reported in Table 22. The additional life expectancy in Paraguay and Brazil is 1.8 years higher at age one than at age zero since these countries have a much higher estimated a_0 and *imr* than

that, after controlling for income, male schooling has no additional association with fertility. Comparing regressions 12 and 13 shows that once survival after age one is included in the regression, men's schooling is associated with an insignificant but positive increase in fertility. The coefficients on women's schooling are diminished slightly by the addition of the health indicator but are higher in the fixed effect specification than in the random effect specification.

3. Decomposing Associations of Various Aggregate Variables with Differences in Fertility among Regions and Over Time

In this section we use the regression coefficient estimates in column 11 in Table 3 to decompose the differences in fertility across regions that are documented in Section 1. We multiply each coefficient by the mean of the variable in question to obtain the "predicted" fertility.[19] In Table A3 in the Appendix we use these predicted values to decompose the difference in the total fertility rate between several developing regions and the TFR in developed countries with data from 1990-1995. For instance, the first column of Table A3 indicates that there is an actual difference in fertility of 1.68 between the world average and the average for developed countries. Our regression results predict a 2.08 point difference, so there is an overestimation of 0.40. This means that there are some unobserved factors that reduce the fertility difference between the developing and developed countries to about a fifth less than predicted by the observed variables used in these simulations.

The dominant factors that are associated with the difference between fertility in the developed and the developing countries are summarized in Figure 6. According to our estimates, the two key variables are the differences in female schooling and in health. Female schooling differentials are consistent with about three-quarters of the difference (76%) with that for secondary school most important (39%) and that for tertiary school next (22%). Better health in the developed than in the developing world as represented by our life-expectancy-at-age-one variable are consistent with about half of the difference (51%). These two sets of variables alone, thus, are associated with more than the observed difference (127%), with partial offsets

Canada.

[19] Summary statistics for each variable and region can be found in Table A2 in the Appendix.

associated somewhat with the total net effect of the other observed variables but primarily with differences in unobserved variables (-24%). Among the other observed variables, religious differences have a relatively large association (-17%), though, as noted in Section 2, within the multivariate specification the associations with religion are different from what frequently is assumed. In particular, developed countries have higher proportions of Protestant populations than the average developing country (see Table A2), which are associated with a negative part of the difference in fertility. Had the developing countries had smaller differences in the distribution of the population by religion with respect to the developed countries, fertility rates would actually be higher. The other three observed variables are associated on net with 15% of the difference between the developing and developed countries' fertilities: 9% for PPP GDP per capita, 5% for schooling of males, 3% for the percentage urban population, and –2% for latitude. Once there are controls for female schooling, life expectancy at age one and religion, none of these other observed variables has a very large association with regional fertility differentials – though, as noted, they may have causal effects that work through some other variables.

Similar patterns are obtained when comparing Africa, Asia (excluding East Asia) and LAC with the developed countries (see Figure 6). The main differences are that, for Africa, where health is relatively precarious, this variable is associated with a somewhat higher proportion of the difference between this region and the developed country average and female schooling and religion are associated with somewhat smaller proportions of the difference. For Asia (excluding East Asia), the opposite is the case – there are somewhat larger associations for female schooling and religion and smaller ones for health. For LAC, as for Asia (excluding East Asia), the association with female schooling is larger (80%) and that for health is smaller (34%) than for all developing countries combined, but – as for Africa – that with religion is relatively small (and positive in sign for LAC). For female schooling for LAC, differences in secondary schooling have particularly large associations (61%) and those for tertiary schooling also are relatively large (27%). Because LAC has a higher proportion of its female population over 25 years of age with completed schooling at the primary level than do the developed countries, differences in this schooling level are associated negatively with the fertility difference (-8%).

The decomposition for the difference between East Asia and the developed countries is much different that are those between the other developing countries and the developed countries that are summarized in the previous paragraph. In this case, the difference in TFR is quite small and negative, indicating that on average East Asian countries have a lower fertility rate than the average developed country (though as noted above in Section 1, it in fact is higher than for Europe but lower than for North America).[20] The lower levels of female schooling in East Asia and of health in East Asia in comparison with those in the developed countries by themselves predict a higher fertility rate in this region than in the developed countries. But the associations with religious differences, which act in the opposite direction, also appear to be very large and more-or-less offset the associations with differences in female schooling and in health.

In sum, these decompositions indicate that the key variables that are associated with differences in fertility rates in the developing and the developed world are differences in female schooling, health and religion. To check for the robustness of these conclusions, we perform the same decomposition as in Table A3, but instead of using the coefficients from equation 11, we use the fixed effects coefficients in equation 13 to control for all fixed country differences, not only religion and geographic location. The results are presented in Table A4 in the Appendix. The fixed effect equation generates larger differences between the predicted and the observed TFR, but in this case also we arrive at the conclusion that the key associations are with differences in female schooling and health (the religious variables are absorbed into the country fixed effects). The main difference with Table A3 with regard to the observed variables is that differences in male schooling are associated negatively with the fertility difference in the country fixed effects estimates.

Decomposing changes over time

We use the same basic procedure to decompose the changes in TFR in each region between 1960 and 1995.[21] Table A5 presents the full decomposition while Figure 7 summarizes the results. In each case we estimate the predicted fertility rate for 1960 using the coefficients in equation 11 and the average value of each variable. For all developing countries, the TFR declined by 2.09 between 1960 and 1995. 1.75 (84%) is associated with changes in the observed

[20] Because of this small negative difference, the proportional differences in the right side of Table A3 are relatively large in absoulte magnitudes and opposite in sign from those for the other developing country regions even though the values in the left side of the table generally are similar in sign and magnitude to those for the other developing country regions.

variables in the equation. Changes in health (45%), female secondary schooling (22%) and female tertiary schooling (14%) are associated with most of change in fertility rates. This general conclusion applies to the individual developing regions, albeit with some differences in the details. In Africa, the expansion of primary schooling had a larger association with fertility change than did changes in secondary or in tertiary schooling, and changes in health were much more important in proportional terms (79%) than in other developing country regions. In Asia (excluding East Asia), LAC and East Asia the associations with improvements in health -- while less important in proportional terms than in Africa -- have had much larger absolute associations with fertility changes – associated with reductions of 1.31, 1.06 and 1.36, respectively. In East Asia, further, changes in female secondary schooling were associated with a larger part of the decomposition than in any other developing country region. According to Table A2 in the Appendix, by 1960 around 12.4% of all females over 25 years of age in this region had secondary schooling, but the share increased to 32.0% by 1995, which is the largest absolute increase in schooling registered between 1960 and 1965.

Table A6 in the Appendix presents the same decomposition, but in this case we use the coefficient estimates from the fixed effects regression in equation 13. The conclusions from the previous table estimated with random effects are robust to this specification also. After controlling for country differences, the main variables associated with the fertility declines in each region are female schooling and health.

In Section 1 we documented the fact that around 1950 East Asia and LAC registered similar fertility rates, but that since that decade, fertility declined much faster in East Asia. Therefore it is of interest to decompose the difference in the reduction in TFR between these two regions. Table 4 presents the decomposition. The estimates are obtained by subtracting the predicted change in East Asia from the predicted change in LAC for each independent variable. If we use the coefficient estimates from the random effects estimation in equation 11, we find that the equation over-predicts the differences in changes in the TFR between East Asia and Latin America by .30 (the actual difference is -.68 and the predicted difference is -.98). Differences in changes in female schooling (76%) and in health (43%) are associated with most of the difference in the speed at which the TFR reduced, but differences in changes in GDP per

[21] Average values for the independent variables for the 1960s are presented in Table A2 in the appendix.

capita (20%) also has a fairly substantial association.[22] According to Table 3 GDP per capita has a negative association with fertility, and the simulation suggests that growth in East Asia is one of the reasons why fertility declined faster than in LAC (see Table A2). But even in this case, different changes in female schooling and in health had more predominant associations with the differential changes in fertility. Table 4 also includes a decomposition using the fixed effect coefficient estimates. The main difference with the random effects is that after controlling for all country-specific characteristics, differential changes in female secondary schooling are associated with a larger share of the difference in fertility decline between East Asia and LAC and differential changes in health have a somewhat more modest association with the differential fertility declines between East Asia and LAC.

4. A Look within LAC

Can the conclusions to this point be extended to the case of specific countries? LAC provides a good setting for looking into this question, because this region includes some countries that have characteristics similar to some of the East Asian countries with the oldest populations and other countries that have populations that are as young as in some of the African countries. In this section we perform simulations similar to those in the previous section, but rather than considering regions, we use data from 22 individual LAC countries. Table A7 in the Appendix presents the average values of the independent variables used in our simulations, for 1960 and 1995.

Table 5 decomposes the difference in TFR between each of the LAC countries in our sample in 1995 and the total fertility rate in Uruguay in that year. We choose Uruguay as a reference point because this is the country with the lowest fertility in LAC in 1960, as well as one of the lowest fertility rates in LAC in 1995. It is also of interest because it is perhaps the country most advanced in the demographic transition.

On average, the observed variables considered are associated with 68% of the difference between the TFR in each country and Uruguay. On average, 58% of the total difference is

[22] These three associations total more than 100% but are offset primarily by unobserved differences in the changes that are –41% of the total.

associated with differences in female secondary schooling, 25% with differences in female tertiary schooling, 21% with differences in female primary schooling, and 33% with differences in health. Latitude, GDP per capita and male schooling are not associated with particularly large portions of the differences between Uruguay and the rest of the countries, even though Uruguay is usually regarded as one of the most developed countries in the region in terms of output and schooling levels.[23] Therefore, generally speaking the conclusions from the previous section hold within LAC.[24]

Finally, Table 6 presents the decomposition of the change in the total fertility rate for each individual country, between 1960 and 1995. On average, the independent variables are associated with around 68% of the decline registered between these years. Female secondary (13%) and tertiary schooling (12%) and health (38%) are associated with most of the fertility decline on average. The largest fertility declines within LAC are observed in the Dominican Republic and Costa Rica, where the TFR was reduced by more than 4. In these two countries female schooling and health are associated with an overwhelming proportion of the shift.

Nevertheless, there are some cases that deviate from the general pattern. For example, in Argentina, Barbados, Costa Rica, Dominican Republic, Ecuador, Jamaica, Panama, Trinidad and Tobago and Uruguay, there was a reduction in the proportion of females with primary schooling (see Table A7), and because primary schooling is associated with lower fertility, this variable has a positive association with the TFR. However, this reduction corresponds to a shift toward secondary schooling, which completely compensates for the effect. Two other cases that deviate from the general pattern are Bolivia and Brazil, where the proportion of females with secondary schooling is associated with an increase in fertility rather than a decline. According to Table A7, the reason is that the share of females above 25 years of age with secondary schooling decreased in these countries between 1960 and 1995, while the share with primary and higher schooling increased. The increases in the latter two schooling levels fully offset the positive association with changes in female secondary schooling.

[23] Urbanization is relatively high in Uruguay and is associated with a large part of the difference in TFR with the Dominican Republic, Guatemala, Haiti, Honduras and Trinidad and Tobago but is not very important in comparisons with other countries in LAC.

[24] The same set of decompositions were performed using the fixed effects coefficients, and the same basic conclusions hold.

In sum, the results presented in this section suggest that, similarly to the case of the cross-regional analysis, differences of female schooling and health are consistent with most of the differences in fertility rates around 1995 between Uruguay, which is a country with relatively low fertility, and the rest of the LAC countries. Changes in these two variables, but particularly in the health indicator, also are consistent with most of the reduction in fertility among countries in LAC in the past 30 years.

5. Conclusions

There is a recent renewal of interest in the relation between shifts in the dependency ratios of a population and various economic outcomes in developing countries. These shifts are triggered by changes in fertility and mortality that take place some years before becoming apparent by affecting dependency ratios. Sharp fertility declines are associated with shifts in dependency ratios that can create a window of opportunity for subsequent development. A large number of countries in the world are still experiencing, or at the verge of experiencing, fertility declines.

This paper first shows that differences in fertility are much more important than differences in mortality in understanding recent differences in dependency ratios across countries. It then sheds light on the factors that are associated with differences in fertility across regions, and differences in the rate at which fertility has declined over time. We use econometric estimates to decompose the differences in fertility rates between developed and developing countries, as well as the differences in fertility between 1960 and 1995 for several developing regions. We perform a similar analysis for 22 countries in the Latin American and Caribbean region.

In all cases we conclude that the main factors associated with fertility differences and changes through time are differences in female schooling and in health related to life expectancies. The relevant weights of the associations of these two variables tend to differ somewhat depending on whether the focus is on fertility differentials among countries and regions in 1995 or on fertility declines between 1960 and 1995. Female schooling differentials have stronger associations with such fertility differences among regions/countries in 1995, but differential changes in health tend to have larger associations for fertility declines between 1960 and 1995.

Female schooling long has been emphasized as strongly associated with fertility declines – usually based on associations such as we present here rather than persuasive estimates of casual effects. The consensus in the previous literature, in fact, seems to be that the inverse association between female schooling and fertility is the largest association in most empirical experience, as we discuss in the introduction.

Some, but less attention has been paid to the possible importance of health. Yet we find that the associations between differences in health and in regional/country fertility rates are quite strong in may cases. Moreover, in most cases, the associations between changes in fertility over time have larger associations with changes in health as represented by life expectancies than with changes in female schooling. Because it is the dynamic changes in fertility that are really of interest for most purposes rather than inferences about dynamics that may be misleadingly made from cross-sectional comparisons, this suggests that the importance of associations of increased female schooling relative to those of improved health may be overstated in the literature, which is substantially based on inferring longitudinal relations from cross-sectional data. Therefore, both for understanding and for considering promising policy alternatives that may have high payoff in terms of economic growth through accentuating "demographic windows of opportunity" it would be valuable to have careful studies that identify what are the causal factors underlying the strong associations that we report in this study between fertility differences and differences in health as well as those between fertility differences and differences in female schooling.

Figure 1

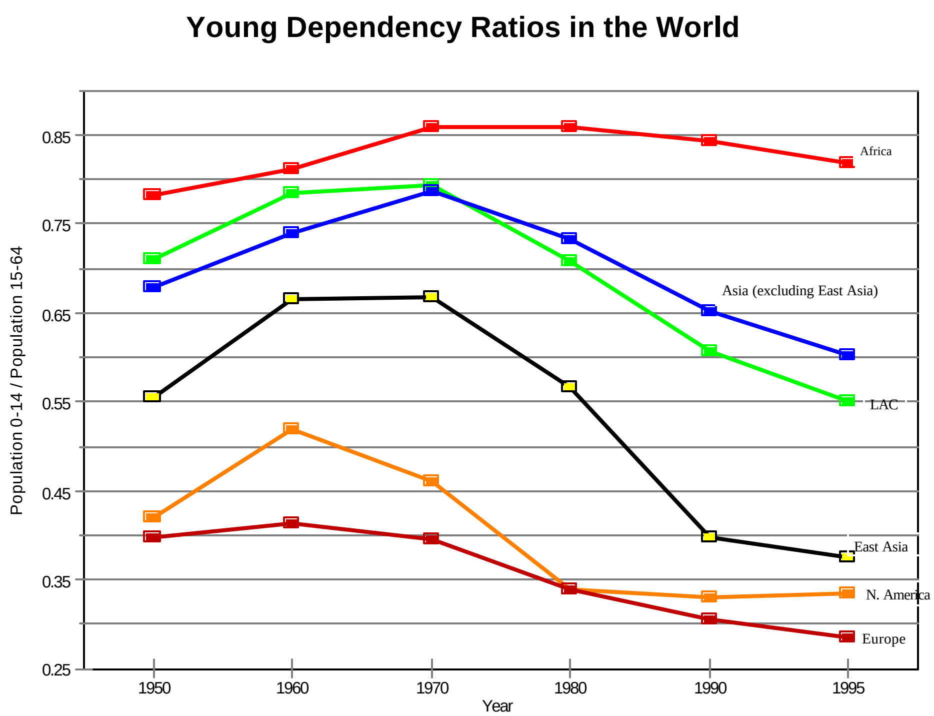


Figure 2

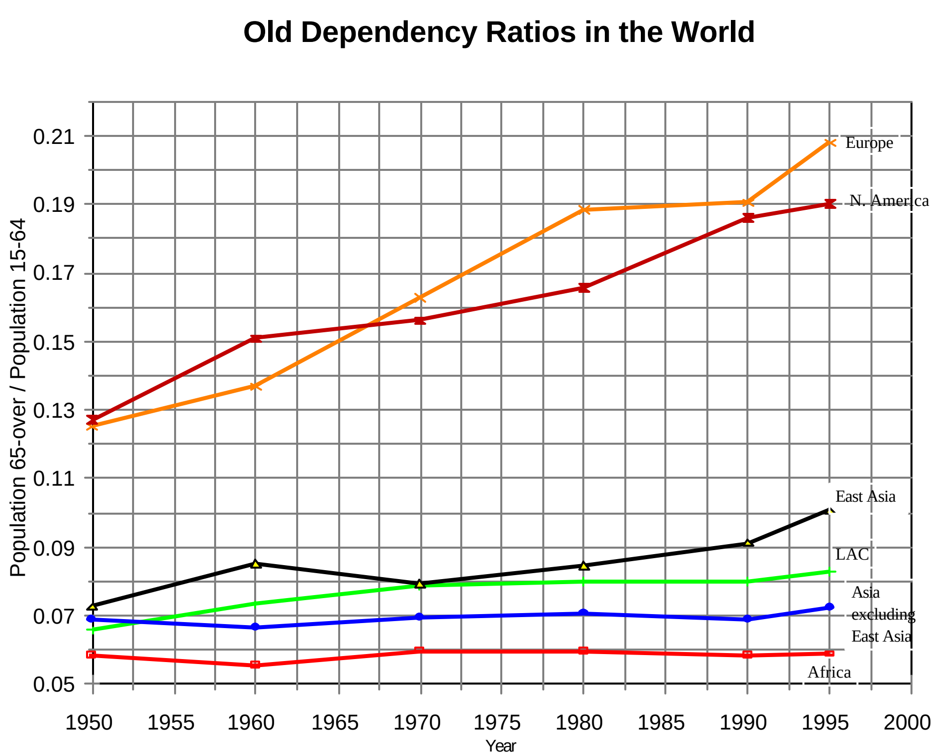


Figure 3

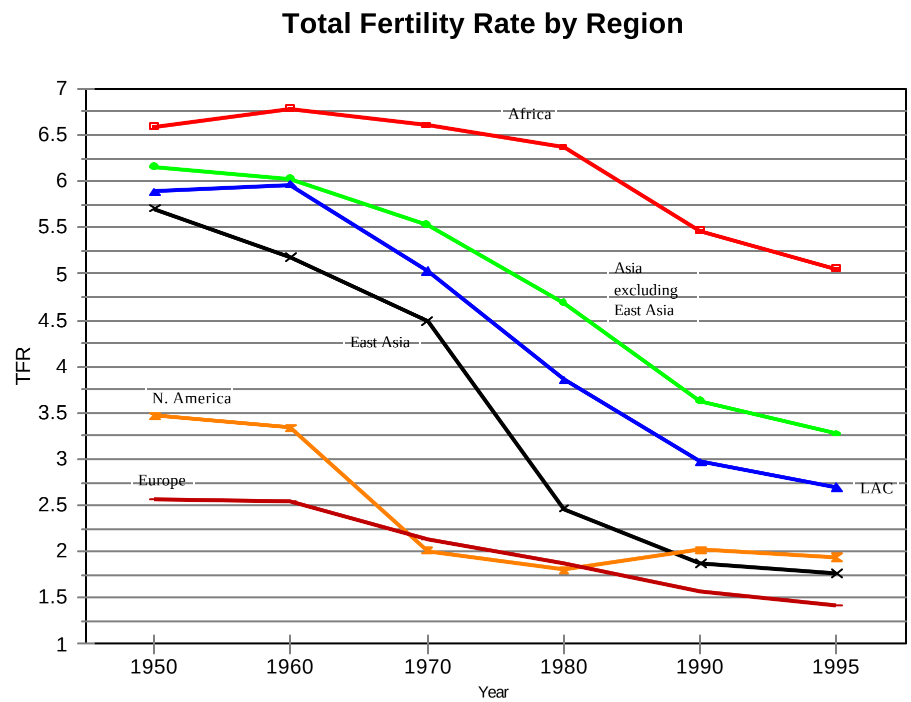


Figure 4

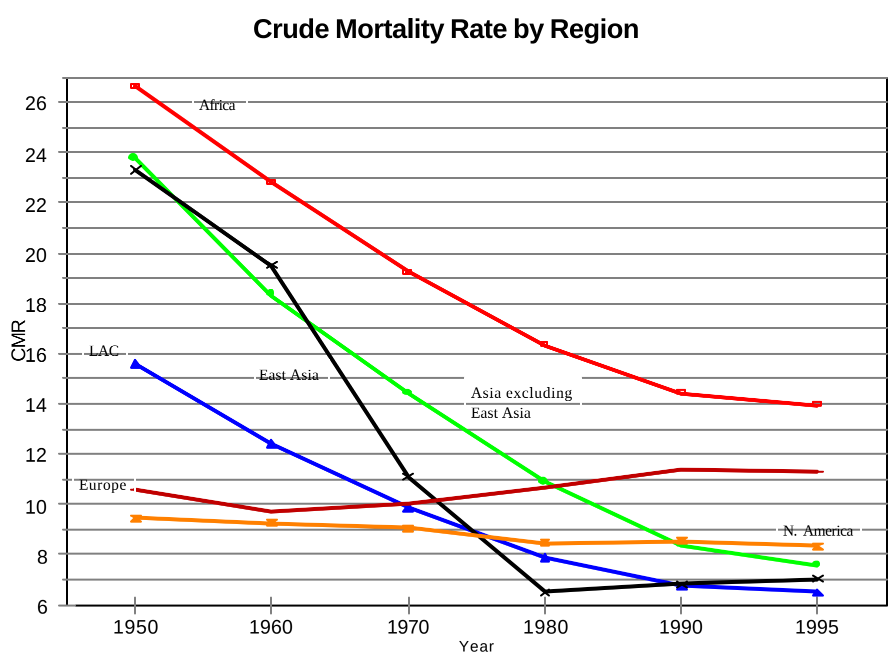


Figure 5

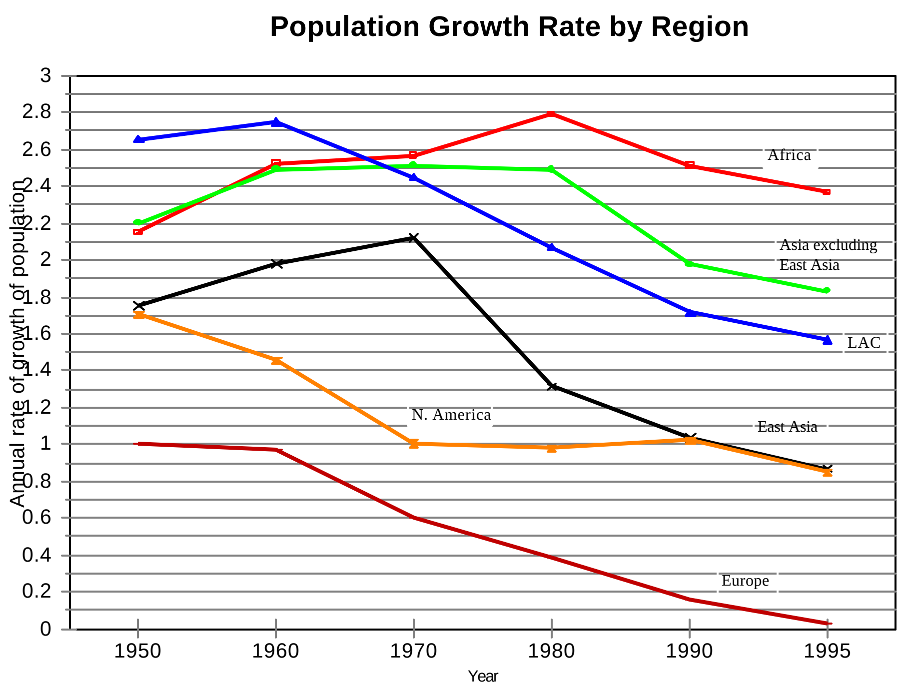


Figure 6

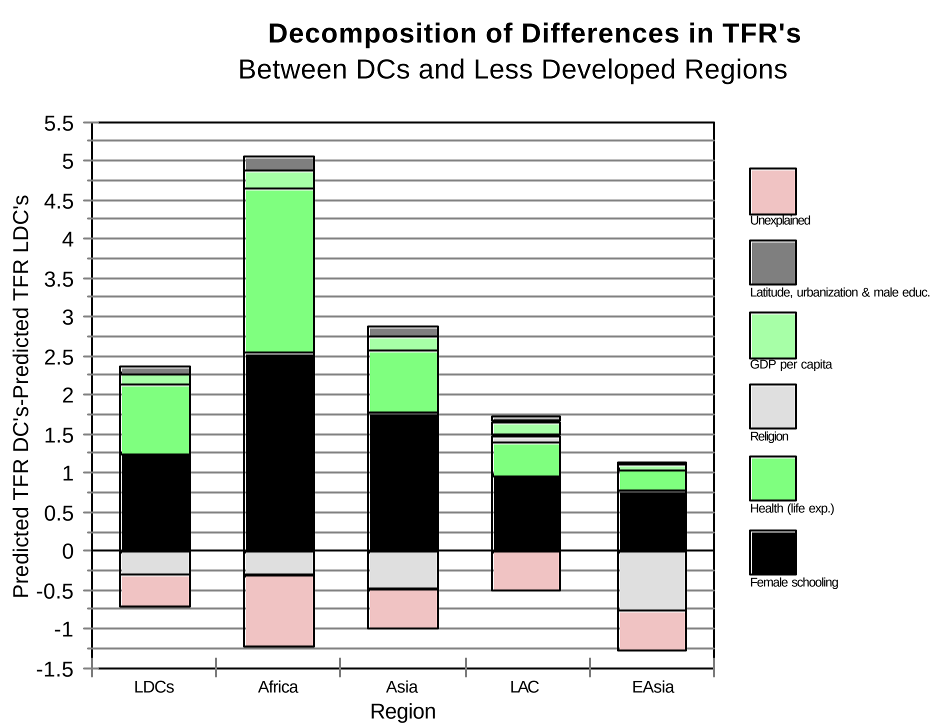
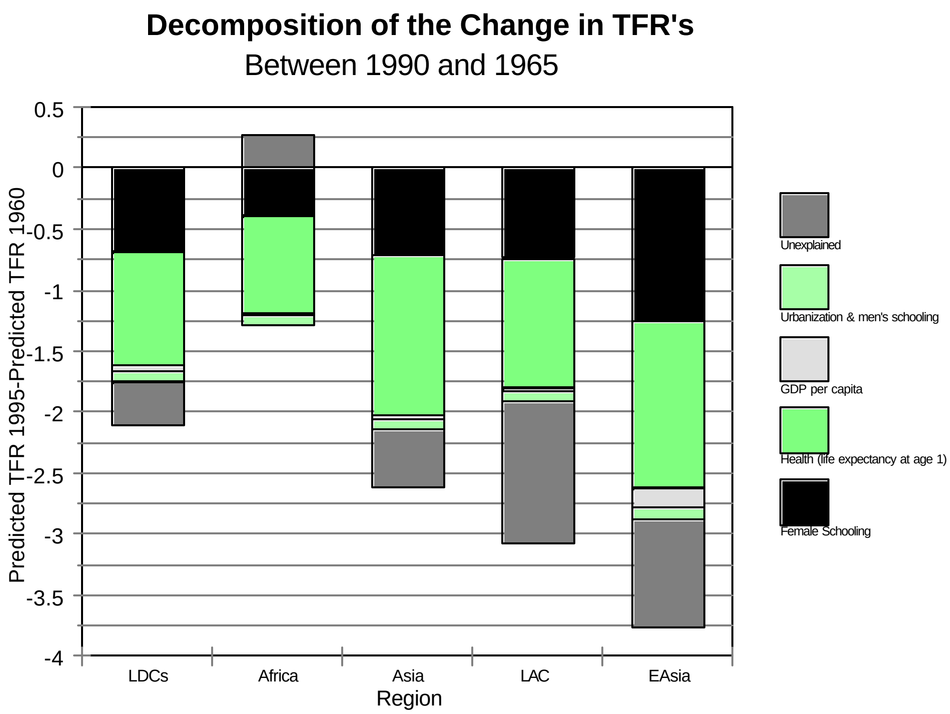


Figure 7



Decomposition of the Change in TFR's
Between 1990 and 1965
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
Predicted TFR 1995-Predicted TFR 1960
LDCs
Africa
Asia
LAC
EAsia
Region
Unexplained
Urbanization & men's schooling
GDP per capita
Health (life expectancy at age 1)
Female Schooling

Table 1

Young Depdendency, Fertility, Mortality and Population Growth in Latin America

Country	Young Dependency			Total Fertility Rate			Crude Death Rate			Population Growth Rate		
	1950	1995	Change	1950	1995	Change	1950	1995	Change	1950	1995	Change
Honduras	0.86	0.82	-0.03	7.5	4.3	-3.2	22.8	5.4	-17.4	3.1	2.7	-0.3
Dominican Republic	0.85	0.58	-0.28	7.4	2.8	-4.6	20.3	5.3	-15.0	3.0	1.6	-1.4
Nicaragua	0.84	0.87	0.02	7.3	4.4	-2.9	22.7	5.8	-16.9	3.0	2.7	-0.3
Guatemala	0.83	0.87	0.05	7.1	4.9	-2.2	22.4	7.4	-15.0	2.9	2.6	-0.2
Costa Rica	0.82	0.57	-0.25	6.7	2.8	-3.9	12.6	3.8	-8.8	3.5	2.5	-1.0
El Salvador	0.80	0.64	-0.15	6.5	3.2	-3.3	19.9	6.1	-13.8	2.6	2.0	-0.6
Venezuela	0.80	0.61	-0.19	6.5	3.0	-3.5	12.3	4.7	-7.6	4.0	2.0	-2.0
Colombia	0.79	0.56	-0.22	6.8	2.8	-4.0	16.3	5.8	-10.5	2.9	1.9	-1.0
Mexico	0.78	0.59	-0.19	6.9	2.8	-4.1	17.0	5.1	-12.0	2.7	1.6	-1.1
Peru	0.76	0.60	-0.15	6.9	3.0	-3.9	21.6	6.4	-15.1	2.6	1.7	-0.8
Bolivia	0.75	0.73	-0.02	6.8	4.4	-2.4	24.4	9.1	-15.3	2.0	2.3	0.3
Brazil	0.75	0.50	-0.25	6.2	2.3	-3.9	15.4	7.2	-8.2	3.1	1.3	-1.8
Suriname	0.74	0.57	-0.18	6.6	2.2	-4.4	12.6	6.0	-6.6	3.0	0.4	-2.6
Trinidad & Tobago	0.73	0.48	-0.25	5.3	1.6	-3.6	11.2	5.9	-5.3	2.5	0.5	-2.0
Panama	0.72	0.54	-0.18	5.7	2.6	-3.1	13.3	5.1	-8.2	2.5	1.6	-0.9
Ecuador	0.72	0.61	-0.10	6.7	3.1	-3.6	19.4	6.0	-13.4	2.6	2.0	-0.7
Paraguay	0.70	0.76	0.05	6.5	4.2	-2.3	11.2	5.4	-5.8	2.2	2.6	0.4
Bahamas, The	0.70	0.49	-0.21	4.1	2.6	-1.5	10.7	4.9	-5.8	2.3	1.8	-0.5
Belize	0.67	0.77	0.11	6.7	3.7	-3.0	12.6	4.2	-8.4	3.0	2.4	-0.6
Haiti	0.64	0.81	0.18	6.3	4.4	-1.9	27.5	12.4	-15.1	1.5	1.7	0.2
Chile	0.62	0.46	-0.16	4.9	2.4	-2.5	13.6	5.6	-8.0	2.1	1.4	-0.8
Jamaica	0.60	0.56	-0.04	4.2	2.5	-1.7	11.5	5.9	-5.6	1.9	0.9	-1.0
Barbados	0.54	0.35	-0.19	4.7	1.5	-3.2	13.2	8.2	-5.0	1.5	0.5	-1.0
Argentina	0.47	0.47	0.00	3.2	2.6	-0.5	9.1	7.9	-1.2	2.0	1.3	-0.7
Uruguay	0.44	0.40	-0.04	2.7	2.4	-0.3	10.5	9.4	-1.1	1.2	0.7	-0.4

Source: United Nations Population Statistics (1998).

Table 2

Random Effect Estimations with Total Fertility Rate as Dependent Variable

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
% Muslim religion	0.0263	0.0236	0.0275	0.0260	0.0095	0.0094	0.0018
	5.89	*7.67*	*8.62*	*8.31*	*2.55*	*2.48*	*0.51*
% Catholic religion	0.0059	0.0019	0.0060	0.0129	0.0083	0.0098	0.0124
	1.36	*0.62*	*1.98*	*4.43*	*2.71*	*3.10*	*4.39*
% Protestant religion	-0.0012	0.0096	0.0173	0.0132	0.0145	0.0161	0.0168
	-0.18	*2.03*	*3.63*	*2.90*	*3.03*	*3.29*	*3.87*
Latitude		-6.3976	-4.3697	-1.5255	-0.4085	-0.2061	0.3392
		-13.11	*-8.45*	*-2.95*	*-0.74*	*-0.36*	*0.65*
PPP GDP per capita (mult by 1000)			-0.1758	-0.0647	-0.0057	-0.0017	-0.0427
			-12.94	*-4.68*	*-0.32*	*-0.10*	*-2.36*
% urban population				-0.0547	-0.0276	-0.0288	-0.0149
				-18.33	*-6.76*	*-7.04*	*-3.75*
Avg. schooling population>25					-0.4829		
					-12.94		
Avg. schooling males>25						-0.1126	-0.1114
						-1.97	*-2.23*
Avg. schooling females>25						-0.3833	
						-6.29	
% of females>25 with primary							-0.0412
							-12.00
% of females>25 with secondary							-0.0463
							-7.29
% of females>25 with higher							-0.0702
							-6.51
Constant	3.67	5.60	5.45	6.51	7.20	7.04	7.45
	12.70	*22.62*	*22.37*	*27.04*	*27.71*	*25.58*	*30.10*
Number of obs	1264	1264	944	909	632	631	631
n	158	158	131	126	96	96	96
T	8.0	8.0	6.5	6.5	6.3	6.3	6.3
R-sq within			0.12	0.44	0.59	0.60	0.67
between	0.25	0.64	0.74	0.74	0.78	0.77	0.80
overall	0.20	0.51	0.63	0.68	0.74	0.73	0.77
chi2(3)	50	277	468	898	1,028	1,041	1,328

Source: Authors' estimations. 'z' stastic presented in italics below the coefficients.

Table 3

Estimations with Total Fertility Rate as Dependent Variable
Including Health-Related Variables

Variable	Random Effects Regressions (8)	(9)	(10)	(11)	Fixed Effects Regressions (12)	(13)
% Muslim religion	0.0087	0.0058	0.0029	0.0037		
	2.22	*1.42*	*0.59*	*1.13*		
% Catholic religion	0.0106	0.0100	0.0072	0.0107		
	3.59	*3.14*	*2.22*	*4.10*		
% Protestant religion	0.0171	0.0166	0.0153	0.0113		
	3.50	*3.45*	*3.15*	*2.80*		
Latitude	-0.9371	-1.6538	-1.5262	0.1646		
	-1.53	*-2.55*	*-2.21*	*0.34*		
PPP GDP per capita (mult by 1000)	0.0017	0.0104	0.0021	-0.0187	-0.0383	-0.0204
	0.05	*0.47*	*0.08*	*-1.08*	*-2.10*	*-1.16*
% urban population	-0.0072	-0.0123	-0.0130	-0.0022	-0.0305	-0.0114
	-1.40	*-2.30*	*-2.29*	*-0.56*	*-5.20*	*-1.82*
Avg. schooling population>25						
Avg. schooling males>25	-0.0396	-0.0129	-0.0699	-0.0251	-0.0114	0.0640
	-0.51	*-0.19*	*-0.79*	*-0.53*	*-0.21*	*1.19*
Avg. schooling females>25						
% of females>25 with primary	-0.0332	-0.0397	-0.0333	-0.0273	-0.0502	-0.0408
	-6.80	*-7.30*	*-4.89*	*-7.72*	*-12.16*	*-9.80*
% of females>25 with secondary	-0.0317	-0.0394	-0.0232	-0.0408	-0.0615	-0.0593
	-3.00	*-5.34*	*-1.94*	*-6.80*	*-8.99*	*-9.04*
% of females>25 with higher education	*-0.0386*	-0.0328	-0.0265	-0.0566	-0.0892	-0.0814
	-2.14	*-2.16*	*-1.34*	*-5.53*	*-7.96*	*-7.56*
% Population with access to potable water	-0.0204					
	-6.15					
% of children under 12 immunized for DTP		-0.0047				
		-2.13				
% of children under 12 imm. For measles		-0.0037				
		-1.78				
% Population with access to sanitation			-0.0116			
			-2.83			
Health conditions (Life exp. Purged from imr)				-0.0909		-0.0800
				-9.11		*-7.04*
Constant	*7.5*	7.1	7.3	11.7	9.2	12.6
	25.54	*21.65*	*19.54*	*22.50*	*47.22*	*24.37*
Number of obs	197	195	106	631	631	631
n	86	91	79	96	96	96
T	1.82	1.83	1.21	6.27	6.57	6.57
R-sq within	0.70	0.67	0.46	0.69	0.67	0.70
between	0.87	0.81	0.85	0.83	0.76	0.80
overall	0.85	0.77	0.86	0.80	0.74	0.77
chi2(3)	763	541	403	1594	180	176

Source: Authors' estimations. 'z' stastic presented in italics below the coefficients.

Table 4

Decomposition of the Change in Fertiliy Between 1960 and 1995
Difference Between East Asia and Latin America

Variable	Random Effects Absolute	Random Effects (%)	Fixed Effects Absolute	Fixed Effects (%)
Difference in Change in TFR	-0.69	1.00	-0.69	1.00
Predicted difference	-0.98		-1.08	
Difference observed-predicted	0.29	-0.41	0.39	-0.57
PPP GDP per capita	-0.14	0.20	-0.15	0.21
% urban population	0.01	-0.01	0.03	-0.05
Schooling males 25 and over	-0.02	0.04	0.06	-0.09
% Females primary schooling	-0.12	0.17	-0.18	0.26
% Females secondary schooling	-0.40	0.59	-0.59	0.85
% Females higher schooling	-0.00	0.00	-0.00	0.00
Life expectancy at age 1	-0.30	0.43	-0.26	0.38

Source: Authors' calculations.

Table 5

Decomposition of the Difference in Total Fertility Rates Between
Uruguay and each Latin American Country

Country	Total Fertility Rate	Predicted Difference	Difference Observed-Predicted	Independent Variabl Religion	Latitude Index	PPP GDP Per capita	(%) Urban Population	Avg. Years of schooling Males	(%) females Primary schooling	(%) females Secondary schooling	(%) females Higher schooling	Life expectancy at age 1
Argentina	0.28	0.14	0.14	0.030	0.002	-0.007	0.005	-0.034	-0.068	0.196	-0.045	0.062
Barbados	-0.83	-0.85	0.03	-0.542	-0.037	-0.034	0.095	-0.043	0.134	-0.481	0.249	-0.193
Bolivia	2.14	2.76	-0.62	0.034	-0.029	0.062	0.069	0.037	0.544	0.852	0.272	0.917
Brazil	-0.05	1.52	-1.57	0.004	-0.042	0.023	0.029	0.072	-0.290	0.978	0.243	0.498
Chile	0.05	0.09	-0.04	-0.082	-0.005	0.001	0.013	0.006	-0.027	0.098	0.164	-0.078
Colombia	0.47	1.15	-0.68	0.063	-0.053	0.029	0.040	0.063	0.117	0.318	0.289	0.284
Costa Rica	0.47	0.41	0.06	0.052	-0.016	0.024	0.091	0.025	-0.139	0.632	-0.085	-0.175
Dominican Republic	0.51	2.03	-1.52	0.068	-0.026	0.052	0.196	0.062	0.552	0.750	0.181	0.193
Ecuador	0.87	1.10	-0.24	0.071	-0.057	0.041	0.071	0.014	0.238	0.632	-0.124	0.217
El Salvado	0.90	2.09	-1.19	0.075	-0.037	0.057	0.099	0.066	0.041	0.987	0.413	0.390
Guatemala	2.72	3.08	-0.36	0.080	-0.035	0.055	0.112	0.089	0.623	0.921	0.475	0.761
Haiti	2.14	4.52	-2.37	0.047	-0.026	0.080	0.130	0.083	1.125	0.917	0.594	1.565
Honduras	2.17	1.84	0.33	0.073	-0.033	0.069	0.104	0.068	0.093	0.697	0.430	0.335
Jamaica	0.19	0.00	0.19	-0.250	-0.024	0.047	0.081	0.057	-0.213	-0.045	0.464	-0.116
Mexico	0.49	0.81	-0.31	0.045	-0.018	-0.016	0.036	0.003	0.191	0.249	0.255	0.062
Nicaragua	2.24	2.25	-0.02	0.082	-0.037	0.068	0.063	0.073	0.407	0.909	0.249	0.435
Panama	0.31	0.10	0.21	0.003	-0.044	0.033	0.076	-0.025	0.423	0.004	-0.368	-0.002
Paraguay	1.92	1.23	0.69	0.067	-0.018	0.057	0.085	0.038	-0.273	0.652	0.362	0.254
Peru	0.76	1.31	-0.54	0.067	-0.042	0.047	0.043	0.012	0.478	0.318	0.040	0.343
Trinidad & Tobago	-0.57	-0.02	-0.54	-0.425	-0.040	-0.051	0.196	0.004	-0.232	0.016	0.475	0.034
Venezuela	0.70	0.85	-0.15	0.044	-0.046	-0.026	0.010	0.037	0.033	0.701	-0.017	0.109
Average	0.852	1.256	-0.404	-0.019	-0.032	0.029	0.078	0.034	0.179	0.491	0.215	0.281
(%) of difference	1	1.475	-0.475	-0.022	-0.037	0.034	0.092	0.039	0.210	0.576	0.253	0.330

Source: Authors´calculations

Table 6

Decomposition of the Change in the Total Fertility Rate Between 1960 and 1995

Country	Change in Total Fertility	Predicted Change	Difference Observed-Predicted	Independent Variable						
				PPP GDP Per capita	(%) Urban Population	Avg. Years of schooling Males	(%) females Primary schooling	(%) females Secondary schooling	(%) females Higher schooling	Life expectancy at age 1
Argentina	-0.40	-1.36	0.96	-0.022	-0.039	-0.065	0.456	-0.567	-0.572	-0.548
Barbados	-2.92	-1.52	-1.40	-0.078	-0.025	-0.076	0.882	-1.044	-0.345	-0.832
Bolivia	-2.13	-1.66	-0.47	-0.010	-0.043	0.024	-0.727	0.648	-0.164	-1.386
Brazil	-3.76	-1.76	-2.00	-0.042	-0.079	-0.013	-0.773	0.310	-0.328	-0.836
Chile	-2.70	-1.88	-0.82	-0.044	-0.045	-0.026	-0.027	-0.204	-0.385	-1.149
Colombia	-3.85	-1.85	-2.01	-0.035	-0.063	-0.019	-0.033	-0.395	-0.289	-1.012
Costa Rica	-4.01	-1.60	-2.41	-0.035	-0.029	-0.039	0.333	-0.241	-0.572	-1.019
Dominican Republic	-4.43	-1.85	-2.57	-0.022	0.000	-0.036	0.423	-0.347	-0.419	-1.455
Ecuador	-3.39	-2.35	-1.04	-0.028	-0.056	-0.065	0.090	-0.298	-0.719	-1.275
El Salvado	-3.36	-2.33	-1.03	-0.012	-0.015	-0.048	-0.666	-0.033	-0.204	-1.348
Guatemala	-1.79	-2.04	0.25	-0.010	-0.016	-0.033	-0.270	-0.139	-0.130	-1.441
Haiti	-1.72	-1.38	-0.34	0.002	-0.036	-0.054	-0.369	-0.143	-0.017	-0.763
Honduras	-2.86	-2.96	0.10	-0.006	-0.048	-0.047	-0.571	-0.363	-0.181	-1.742
Jamaica	-2.35	-1.67	-0.68	-0.019	-0.049	-0.048	0.410	-1.011	-0.147	-0.810
Mexico	-3.95	-2.67	-1.28	-0.063	-0.057	-0.092	-0.112	-0.775	-0.334	-1.238
Nicaragua	-2.65	-2.20	-0.45	0.002	-0.051	-0.032	-0.158	-0.094	-0.289	-1.578
Panama	-3.07	-2.24	-0.84	-0.034	-0.035	-0.078	0.404	-0.567	-0.883	-1.042
Paraguay	-2.16	-1.14	-1.02	-0.015	-0.034	-0.028	-0.117	-0.338	-0.232	-0.378
Peru	-3.65	-2.86	-0.79	-0.014	-0.064	-0.055	-0.085	-0.554	-0.504	-1.580
Trinidad & Tobago	-3.32	-1.58	-1.75	-0.065	0.000	-0.042	0.158	-0.722	-0.130	-0.776
Uruguay	-0.38	-1.05	0.67	-0.020	-0.023	-0.036	0.251	-0.599	-0.255	-0.367
Venezuela	-3.39	-2.40	-0.98	-0.008	-0.068	-0.051	-0.393	-0.330	-0.611	-0.941
Average	-2.829	-1.924	-0.905	-0.026	-0.040	-0.044	-0.041	-0.355	-0.350	-1.069
(%) of difference	1	0.680	0.320	0.009	0.014	0.015	0.014	0.125	0.124	0.378

Source: Authors´calculations

Appendix

Table A1

Summary Statistics for Dependent and Independent Variables

Varaible	Obs	Mean	Stdev	Min	max
Total fertility rate	2,107	4.6	2.0	0.00	8.49
% of population muslimreligion	5,796	24.5	36.1	0.00	99.70
% of population catholic religion	5,796	29.7	35.3	0.00	97.30
% of population protestantreligion	5,724	12.3	20.9	0.00	97.80
Latitude index	5,832	0.3	0.2	0.01	0.72
PPP GDP per capita	5,175	3,751	3,954	221	33,946
% of urban population	1,930	42.1	25.0	0.35	100.00
Years of schooling 25 and over	754	4.2	2.8	0.04	12.00
Years of schooling females 25 and over	752	3.7	2.9	0.00	11.85
Years of schooling males 25 and over	752	4.7	2.8	0.08	12.47
% of females over 25 with primary educat	752	37.5	24.4	0.00	93.90
% of females over 25 with secondary edu	763	14.0	14.4	0.00	64.90
% of females over 25 with higher educatio	771	3.4	5.0	0.00	36.00
% of population with potable water	553	63.4	29.6	1.00	100.00
% of children under 12 w/DPT immuniza	2,123	65.6	27.1	0.20	100.00
% of children under 12 w/measels immun	1,939	63.6	26.5	0.01	100.00
% of population with sanitation	413	65.5	31.7	0.30	100.00
Life expectancy (purged from imr)	2,100	62.1	10.4	25.70	79.30

Source: Authors' calculations from various sources.

Table A2

Summary Statistics for Dependent and Independent Variables by Region

Variable	World Average	Africa	Asia (Excl. EA)	Latin America	East Asia	Developed
			1960s decade			
Total fertility rate	5.43	6.50	6.13	5.96	5.29	2.87
% of population muslimreligion	24.53	29.95	23.60	1.30	3.60	0.50
% of population catholic religion	29.75	24.04	13.19	73.85	3.06	50.63
% of population protestantreligion	12.25	14.07	10.51	10.72	3.37	32.26
Latitude index	0.29	0.14	0.18	0.18	0.26	0.56
PPP GDP per capita	2,637	775	1,856	2,158	1,267	4,507
% of urban population	33.10	12.05	21.38	42.40	43.32	60.49
schooling males 25 and over	3.83	1.59	3.05	3.46	5.35	6.08
% of females over 25 prim. ed.	38.48	15.12	21.16	48.76	31.13	73.46
% of females over 25 sec. ed.	9.33	2.62	8.15	8.72	12.40	15.38
% of females over 25 high. ed.	1.47	0.24	1.22	1.14	1.09	2.93
Life expectancy at age 1	56.96	44.76	53.41	60.36	58.80	70.63
			1990s decade			
Total fertility rate	3.34	5.49	3.53	2.89	1.53	1.62
% of population muslimreligion	24.53	29.95	23.60	1.30	3.60	0.50
% of population catholic religion	29.75	24.04	13.19	73.85	3.06	50.63
% of population protestantreligion	12.25	14.07	10.51	10.72	3.37	32.26
Latitude index	0.29	0.14	0.18	0.18	0.26	0.56
PPP GDP per capita	5,074	1,049	3,979	3,442	9,781	12,814
% of urban population	51.97	32.33	34.87	61.46	59.57	74.92
schooling males 25 and over	5.82	2.85	5.04	5.19	8.06	8.36
% of females over 25 prim. ed.	36.40	24.94	28.69	49.07	35.77	50.91
% of females over 25 sec. ed.	20.45	5.38	16.62	18.35	31.96	33.05
% of females over 25 high. ed.	6.51	0.50	4.03	7.11	7.07	9.83
Life expectancy at age 1	67.24	53.58	67.86	72.04	73.76	77.08

Source: Authors' calculations from various sources.

Table A3

Decomposition of the Difference in Total Fertility Rates
Between Developed and Developing Regions
(Random effects)

Variable	Absolute Diff. Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia	Proportion Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia
Observed difference in TFR	1.68	3.83	1.87	1.23	-0.14	1.00	1.00	1.00	1.00	1.00
Predicted Difference	2.08	4.73	2.39	1.72	0.37					
Difference observed-predicted	-0.40	-0.91	-0.52	-0.50	-0.51	-0.24	-0.24	-0.28	-0.40	3.72
Religion	-0.29	-0.31	-0.49	0.08	-0.76	-0.17	-0.08	-0.26	0.06	5.53
Latitude index	-0.04	-0.06	-0.06	-0.06	-0.04	-0.02	-0.02	-0.03	-0.05	0.33
PPP GDP per capita	0.16	0.23	0.18	0.19	0.07	0.09	0.06	0.09	0.15	-0.49
% urban population	0.05	0.10	0.09	0.03	0.04	0.03	0.02	0.05	0.03	-0.26
Schooling males 25 and over	0.08	0.15	0.10	0.09	0.02	0.05	0.04	0.05	0.08	-0.16
% Females primary schooling	0.24	0.56	0.45	-0.10	0.26	0.15	0.15	0.24	-0.08	-1.91
% Females secondary schooling	0.66	1.28	0.82	0.75	0.19	0.39	0.33	0.44	0.61	-1.41
% Females higher schooling	0.36	0.70	0.50	0.33	0.33	0.22	0.18	0.27	0.27	-2.42
Life expectancy at age 1	0.86	2.10	0.80	0.42	0.26	0.51	0.55	0.43	0.34	-1.93

Source: Authors' calculations.

Table A4

Decomposition of the Difference in Total Fertility Rates
Between Developed Countries and Developing Regions
(Fixed effects)

Variable	Absolute Diff. Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia	Proportion Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia
Observed difference in TFR	1.68	3.83	1.87	1.23	-0.14	1.00	1.00	1.00	1.00	1.00
Predicted Difference	2.84	5.90	3.71	1.90	1.58					
Difference observed-predicted	-1.17	-2.08	-1.84	-0.68	-1.72	-0.70	-0.54	-0.98	-0.55	12.57
PPP GDP per capita	0.17	0.25	0.19	0.20	0.07	0.10	0.07	0.10	0.17	-0.54
% urban population	0.27	0.50	0.47	0.16	0.19	0.16	0.13	0.25	0.13	-1.36
Schooling males 25 and over	-0.20	-0.39	-0.25	-0.24	-0.06	-0.12	-0.10	-0.13	-0.19	0.40
% Females primary schooling	0.36	0.83	0.68	-0.15	0.39	0.22	0.22	0.36	-0.13	-2.85
% Females secondary schooling	0.96	1.86	1.19	1.09	0.28	0.57	0.49	0.64	0.89	-2.05
% Females higher schooling	0.52	1.01	0.72	0.47	0.48	0.31	0.26	0.39	0.39	-3.48
Life expectancy at age 1	0.75	1.85	0.70	0.37	0.23	0.45	0.48	0.38	0.30	-1.70

Source: Authors' calculations.

Table A5

Decomposition of the Change in Total Fertility
Between 1960 and 1995 by Region
(Random effects)

Variable						Proportion of the Change				
	Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia	Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia
Change in TFR	-2.09	-1.01	-2.60	-3.07	-3.76	1.00	1.00	1.00	1.00	1.00
Predicted change	-1.75	-1.28	-2.14	-1.91	-2.88					
Difference observed-predicted	-0.34	0.27	-0.46	-1.16	-0.88	0.16	-0.26	0.18	0.38	0.23
PPP GDP per capita	-0.05	-0.01	-0.04	-0.02	-0.16	0.02	0.01	0.02	0.01	0.04
% urban population	-0.04	-0.04	-0.03	-0.04	-0.04	0.02	0.04	0.01	0.01	0.01
Schooling males 25 and over	-0.05	-0.03	-0.05	-0.04	-0.07	0.02	0.03	0.02	0.01	0.02
% Females primary schooling	0.06	-0.27	-0.21	-0.01	-0.13	-0.03	0.27	0.08	0.00	0.03
% Females secondary schooling	-0.45	-0.11	-0.35	-0.39	-0.80	0.22	0.11	0.13	0.13	0.21
% Females higher schooling	-0.28	-0.01	-0.16	-0.34	-0.34	0.14	0.01	0.06	0.11	0.09
Life expectancy at age 1	-0.93	-0.80	-1.31	-1.06	-1.36	0.45	0.79	0.51	0.35	0.36

Source: Authors' calculations.

Table A6

Decomposition of the Change in Total Fertility
During 1960-1995 by Region
(Fixed effects)

Variable	Absolute Difference 1960-95					Proportion of the Change				
	Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia	Avg. LDC	Africa	Asia (non-EA)	Latin America	East Asia
Change in TFR	-2.09	-1.01	-2.60	-3.07	-3.76	1.00	1.00	1.00	1.00	1.00
Predicted change	-1.94	-1.45	-2.26	-2.14	-3.22					
Difference observed-predicted	-0.15	0.44	-0.33	-0.93	-0.54	0.07	-0.43	0.13	0.30	0.14
PPP GDP per capita	-0.05	-0.01	-0.04	-0.03	-0.17	0.02	0.01	0.02	0.01	0.05
% urban population	-0.21	-0.23	-0.15	-0.22	-0.18	0.10	0.23	0.06	0.07	0.05
Schooling males 25 and over	0.13	0.08	0.13	0.11	0.17	-0.06	-0.08	-0.05	-0.04	-0.05
% Females primary schooling	0.08	-0.40	-0.31	-0.01	-0.19	-0.04	0.40	0.12	0.00	0.05
% Females secondary schooling	-0.66	-0.16	-0.50	-0.57	-1.16	0.31	0.16	0.19	0.19	0.31
% Females higher schooling	-0.41	-0.02	-0.23	-0.49	-0.49	0.20	0.02	0.09	0.16	0.13
Life expectancy at age 1	-0.82	-0.71	-1.16	-0.93	-1.20	0.39	0.70	0.45	0.30	0.32

Source: Authors' calculations.

Table A7

Summary Statistics for Dependent and Independent Variables by Country

Country	Total Fertility Rate	(%) Muslim Religion	(%) Catholic Religion	(%) Protestant Religion	Latitude Index	PPP GDP Per capita	(%) Urban Population	Avg. Years of schooling Males	(%) females Primary schooling	(%) females Secondary schooling	(%) females Higher schooling	Life expectancy at age 1
						Average for 1960						
Argentina	3.12	0.20	91.60	2.70	0.38	4,217	69.5	5.20	74.2	10.6	1.7	67.0
Barbados	4.53	0.20	5.90	33.20	0.14	2,732	34.7	5.16	82.4	15.5	0.5	66.7
Bolivia	6.71	0.00	92.50	2.30	0.19	1,210	38.5	5.97	8.5	24.3	3.3	48.4
Brazil	6.15	0.10	87.80	4.00	0.11	1,535	40.4	3.06	37.3	12.9	0.9	59.0
Chile	5.19	0.00	82.10	1.90	0.33	2,683	63.2	5.19	55.0	21.9	1.3	61.9
Colombia	6.76	0.20	96.60	0.90	0.04	1,633	42.6	3.19	49.5	11.8	0.8	59.5
Costa Rica	6.93	0.00	90.50	5.80	0.27	1,859	35.0	3.89	72.3	7.9	2.4	64.4
Dominican Republic	7.37	0.00	96.60	1.40	0.21	1,110		2.57	50.3	2.4	0.4	55.6
Ecuador	6.70	0.00	96.40	1.90	0.02	1,355	31.3	3.30	49.6	6.5	0.5	57.3
El Salvado	6.70	0.00	96.20	2.40	0.14	1,362	37.4	1.95	29.1	4.3	0.1	54.6
Guatemala	6.96	0.00	94.00	4.90	0.16	1,569	31.0	1.60	22.3	3.3	0.3	49.5
Haiti	6.30	0.00	82.60	12.80	0.21	902	13.9	1.01	0.3	3.3	0.2	48.1
Honduras	7.47	0.10	95.80	2.60	0.17	1,023	20.1	1.89	30.7	3.3	0.2	50.9
Jamaica	4.98	0.10	9.60	55.50	0.22	1,545	30.2	2.31	77.8	5.6	0.2	66.1
Mexico	6.88	0.00	94.70	1.20	0.26	2,542	46.7	2.69	43.9	4.2	0.6	59.4
Nicaragua	7.33	0.00	94.70	4.40	0.14	1,505	37.2	2.27	34.3	4.7	1.5	51.6
Panama	5.83	4.50	85.00	5.20	0.10	1,424	38.5	4.35	54.3	15.3	1.9	62.3
Paraguay	6.52	0.00	96.00	1.90	0.26	1,202	35.1	3.84	60.7	5.0	0.5	66.8
Peru	6.85	0.00	95.10	2.70	0.11	1,792	40.9	3.77	34.4	7.9	1.4	52.5
Trinidad & Tobago	5.20	6.50	35.80	13.20	0.12	4,289		4.66	69.3	11.2	0.3	64.8
Uruguay	2.82	0.00	59.50	1.90	0.37	3,995	79.1	5.03	64.2	14.6	6.5	69.7
Venezuela	6.52	0.00	94.80	1.00	0.09	5,989	54.0	2.99	39.4	4.0	0.5	62.2
						Average for 1995						
Argentina	2.72	0.20	91.60	2.70	0.38	5,416	87.3	7.80	57.5	24.5	11.8	73.0
Barbados	1.62	0.20	5.90	33.20	0.14	6,885	46.0	8.17	50.1	41.1	6.6	75.8
Bolivia	4.58	0.00	92.50	2.30	0.19	1,725	58.1	5.00	35.1	8.4	6.2	63.6
Brazil	2.39	0.10	87.80	4.00	0.11	3,801	76.5	3.59	65.6	5.3	6.7	68.2
Chile	2.49	0.00	82.10	1.90	0.33	5,014	83.6	6.22	56.0	26.9	8.1	74.6
Colombia	2.91	0.20	96.60	0.90	0.04	3,491	71.3	3.94	50.7	21.5	5.9	70.6
Costa Rica	2.91	0.00	90.50	5.80	0.27	3,751	48.1	5.46	60.1	13.8	12.5	75.6
Dominican Republic	2.95	0.00	96.60	1.40	0.21	2,284		4.00	34.8	10.9	7.8	71.6
Ecuador	3.31	0.00	96.40	1.90	0.02	2,862	57.0	5.90	46.3	13.8	13.2	71.3
El Salvado	3.35	0.00	96.20	2.40	0.14	1,989	44.5	3.84	53.5	5.1	3.7	69.4
Guatemala	5.16	0.00	94.00	4.90	0.16	2,114	38.4	2.93	32.2	6.7	2.6	65.3
Haiti	4.58	0.00	82.60	12.80	0.21	790	30.3	3.15	13.8	6.8	0.5	56.5
Honduras	4.61	0.10	95.80	2.60	0.17	1,351	42.2	3.77	51.6	12.2	3.4	70.0
Jamaica	2.63	0.10	9.60	55.50	0.22	2,545	52.6	4.20	62.8	30.4	2.8	75.0
Mexico	2.94	0.00	94.70	1.20	0.26	5,921	72.9	6.34	48.0	23.2	6.5	73.0
Nicaragua	4.68	0.00	94.70	4.40	0.14	1,391	60.8	3.55	40.1	7.0	6.6	68.9
Panama	2.75	4.50	85.00	5.20	0.10	3,255	54.7	7.47	39.5	29.2	17.5	73.7
Paraguay	4.36	0.00	96.00	1.90	0.26	1,980	50.6	4.95	65.0	13.3	4.6	70.9
Peru	3.20	0.00	95.10	2.70	0.11	2,546	69.9	5.97	37.5	21.5	10.3	69.9
Trinidad & Tobago	1.88	6.50	35.80	13.20	0.12	7,754		6.32	63.5	28.9	2.6	73.3
Uruguay	2.44	0.00	59.50	1.90	0.37	5,043	89.6	6.46	55.0	29.3	11.0	73.7
Venezuela	3.14	0.00	94.80	1.00	0.09	6,411	84.9	5.00	53.8	12.1	11.3	72.5

Source: Authors' calculations

REFERENCES

Alam, Nurul, 1995, **"**Birth spacing and infant and early childhood mortality in a high fertility area of Bangladesh: age-dependent and interactive effects," *Journal of Biosocial Science*, 27(4): 393-404.

Asian Development Bank (ADB), 1997, *Emerging Asia: Changes and Challenges*, Manila: Asian Development Bank.

Barro, Robert J., 1991, "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 106 (May), 407-443.

Barro, Robert J. and Jong-Wha Lee, 1993, "International Comparison of Educational Attainment," *Journal of Monetary Economics* 32:3 (December), 363-394.

Barro, Robert J. and Jong-Wha Lee, 1994, "Losers and Winners in Economic Growth," *Proceedings of the World Bank Annual Conference on Development Economics*, 1993, 267-314.

Becker, Gary S., 1991, *A Treatise on the Family*, Cambridge, MA: Harvard University Press, second edition.

Becker, Gary S. and Gregg H. Lewis, 1973, "On the Interaction between the Quantity and Quality of Children," *Journal of Political Economy* 8:2, Part 2, S279-S288.

Behrman, Jere R., 1996, *Human Resources in Latin America and the Caribbean and the Caribbean*, Baltimore: The Johns Hopkins University Press for the Inter-American Development Bank

Behrman, Jere R., 1999a, ? Schooling, Health and Demography in Latin America and the Caribbean around the End of the Century: What Do We Know? What Questions Should be Explored?" Philadelphia, PA: University of Pennsylvania, Background Paper for IPES 2000 for IDB, mimeo.

Behrman, Jere R. , 1999b "Why Micro Matters: Why a Micro Perspective on Population Change and Economic Development is Essential for Good Conditional Predictions and Policy Formation and Evaluation," in Nancy Birdsall and Steven Sinding, eds. *Population Change and Economic Development* (Papers Presented at a Conference Co-Sponsored by Rockefeller Foundation, Packard Foundation and the United Nations Population Fund UNFPA at the Rockefeller Foundation? s Bellagio Center, Lake Como, Italy, November 2-6, 1998) Oxford, UK: Oxford University Press, 1999.

Behrman, Jere R., Suzanne Duryea and Miguel Székely, 1999, "Aging and Economic Option: Latin America in a World Perspective," Office of the Chief Economist, Inter American Development Bank, mimeo.

Behrman, Jere R., Andrew Foster, Mark R. Rosenzweig and Prem Vashishtha, 1999, "Women's Schooling, Home Teaching, and Economic Growth," *Journal of Political Economy* 107:4 (August), 682-714.

Behrman, Jere R. and Mark R. Rosenzweig, 1999, "Does Increasing Women's Schooling Raise the Schooling of the Next Generation?" Philadelphia, PA: University of Pennsylvania, mimeo.

Birdsall, Nancy, 1988, "Economic Approaches to Population Growth," in Hollis Chenery and T.N. Srinivasan, eds., *Handbook of Development Economics*, Amsterdam: North Holland, 477-542.

Birdsall, Nancy and Steven Sinding, eds. *Population Change and Economic Development* (Papers Presented at a Conference Co-Sponsored by Rockefeller Foundation, Packard Foundation and the United Nations Population Fund UNFPA at the Rockefeller Foundation? s Bellagio Center, Lake Como, Italy, November 2-6, 1998) Oxford, UK: Oxford University Press, 1999.

Bloom, David E. and Jeffrey G. Williamson, 1998, "Demographic Transitions and Economic Miracles in Emerging Asia," *The World Bank Economic Review* 12:3 (September), 419-456.

Chamie, Joseph, 1994, "Population Databases in Development Analysis," *Journal of Development Economics* 44:1 (June), 131-146.

Chiang, C.L. "On Constructing Current Life Tables", *Journal of the American Statistical Association* 67:538-541, 1972.

Chiang, C.L. The Life Table and Its Applications, Malabar, Florida, 1984.

Coale, Ansley J. and Edgar M. Hoover, 1958, *Population Growth and Economic Development in Low-Income Countries: A Case Study of India's Prospects*, Princeton, NJ: Princeton University Press.

Conde, J. and D. Waltisperger, Mortality in Developing Countries, New York OECD and UN, 1980.

Duryea, Suzanne and Miguel Szekely, 1998, "Labor Markets in Latin America and the Caribbean: A Supply-Side Story," Washington, DC: Inter-American Development Bank, Office of the Chief Economist, Working Paper Series 374.

Ehrlich, Paul R., 1968, *The Population Bomb*, New York: Ballentine Books.

Gallup, John Luke and Jeffrey D. Sachs with Andrew D. Mellinger, 1998, "Geography and Economic Development," Cambridge, MA: Harvard University, mimeo.

Inter-American Development Bank (IDB), 1996, *Economic and Social Progress in Latin America and the Caribbean: 1996 Report, Special Section - Making Social Services Work*, Baltimore, MD: Distributed by the Johns Hopkins University Press for the Inter-American Development Bank.

Inter-American Development Bank (IDB), 1998, *Economic and Social Progress in Latin America and the Caribbean: 1998-1999 Report, Special Section - Facing Up to Inequality in Latin America and the Caribbean*, Baltimore, MD: Distributed by the Johns Hopkins University Press for the Inter-American Development Bank.

Kelley, Allen C. and William Paul McGreevey, 1994, "Population and Development in Historical Perspective," in Robert Cassen, ed., *Population and Development: Old Debates, new Conclusions*, Washington, D.C.: Overseas Development Council.

Kelley, Allen C. and Robert M. Schmidt, 1994, "Population and Income Change: Recent Evidence," Washington: World Bank Discussion Paper No. 249.

Kelley, Allen C. and Robert M. Schmidt, 1998, "Economic and Demographic Change: A Synthesis of Models, Findings, and Perspectives," revision in Birdsall and Sinding, 1999.

King, Elizabeth M. and M. Anne Hill, eds, 1993, *Women's Education in Developing Countries: Barriers, Benefits, and Policies*, Baltimore and London: The Johns Hopkins University Press, Published for the World Bank.

Kremer. Michael, and D. Chen, 1999 "Income-Distribution Dynamics with Endogenous Fertility", *American Economic Review*, Papers and Proceedings, May.

Lam, David and Suzanne Duryea, 1999. "Effects of Schooling on Fertility, Labor Supply, and Investments in Children, with Evidence from Brazil," *Journal of Human Resources* 34(1):160-192.

La Porta, R., Florencio Lopez de Silanes, Andrei Shleifer, and Robert Vishny, 1998 "The Quality of Government," Harvard University, mimeo.

Namboodiri, K., Demographic Analysis: A Stochastic Approach, p. 85, Academic Press 1991.

National Research Council, 1986, *Population Growth and Economic Development: Policy Questions*, Washington, D.C.: National Academy Press.

Palloni, Alberto and Marta Tienda, 1992, "Demographic Responses to Economic Recessions in Latin America and the Caribbean Since 1990," *Sociological Inquiry* 62:2, 244-270.

Page, John, *et al.*, 1993, *The East Asian Miracle: Economic Growth and Public Policy*, Washington, D.C.: The World Bank.

Rosenzweig, Mark R. and T. Paul Schultz, 1985, "The Supply of and Demand for Births: Fertility and Its Life-Cycle Consequence," *American Economic Review* 75:5 (December), 992-1015.

Rosenzweig, Mark R. and T. Paul Schultz, 1987, "Fertility and Investments in Human Capital: Estimates of the Consequences of Imperfect Fertility Control in Malaysia," *Journal of Econometrics* 36, 163-184.

Rosenzweig, Mark R. and Kenneth. I. Wolpin, 1980, "Testing the Quantity-Quality Model of Fertility: Results of a Natural Experiment - Twins," *Econometrica* 48:1 (January), 227-240.

Schultz, T. Paul, 1990, "Women's Changing Participation in the Labor Force: A World Perspective," *Economic Development and Cultural Change* 38:3 (April), 457-488.

Schultz, T. Paul, 1993, "Returns to Women's Education," in Elizabeth M. King and M. Anne Hill, eds, 1993, *Women's Education in Developing Countries: Barriers, Benefits, and Policies*, Baltimore and London: The Johns Hopkins University Press, Published for the World Bank, 51-99.

Schultz, T. Paul, 1997, "The Demand for Children in Low Income Countries," in M. Rosenzweig and O.Stark, eds., *Handbook of Population and Family Economics Vol. 1A*, Amsterdam: North-Holland Publishing Company, 349-430.

Shane, Barbara, 1997, “Family Planning Saves Lives,” Population Reference Bureau, Washington, DC.

Summers, Robert and Alan Heston, 1991, "The Penn World Table (Mark 5): An Expanded Set of International Comparisons, 1950-1988," *Quarterly Journal of Economics* 106:2 (May), 327-368.

United Nations, 1998, *The Sex and Age Distribution of the World Populations: The 1998 Revision*, New York: United Nations.

Willis, Robert J., 1973, "A New Approach to the Economic Theory of Fertility Behavior, *Journal of Political Economy* 81:2 Part 2, S14-S64.

World Bank, 1991, *World Development Report 1991: The Challenge of Development*, Oxford, UK: Oxford University Press for the World Bank.

Filename:	406
Directory:	L:\All-pprs\Green\Publishd\406
Template:	C:\Microsoft Office\Templates\Normal.dot
Title:	To:
Subject:	
Author:	Jere Behrman
Keywords:	
Comments:	
Creation Date:	09/23/99 11:02 AM
Change Number:	2
Last Saved On:	09/23/99 11:02 AM
Last Saved By:	Inter American Development Bank
Total Editing Time:	0 Minutes
Last Printed On:	05/16/00 11:08 AM
As of Last Complete Printing	
Number of Pages:	44
Number of Words:	9,804 (approx.)
Number of Characters:	55,883 (approx.)