From: M. Livi-Bacci, A Concise History of World Population, (4th ed.), Malden, MA: Blackwell, 2007.

5

The Populations of Poor Countries

1 An Extraordinary Phase

As the rich countries of the world complete a phase of population expansion, the poor countries have embarked upon an extraordinary and nonrepeatable one of their own. The characteristics of this growth cycle are well described by the dry figures charting recent demographic growth in the so-called less-developed countries – namely those countries whose populations live, by western standards, in poverty.[1] The 1900 population of the poor countries, about one billion, had multiplied fivefold by the year 2000; in about a century these countries matched the expansion of the rich countries in the two centuries following the Industrial Revolution. That speed of growth is extraordinary. Between 1900 and 1920, we estimate the growth rate of the poor countries to have been about 0.6 percent per year; this rate doubled for the period 1920–50 (about 1.2 percent) and once again (almost) since 1950 (2.1 percent). In the 1960s a maximum rate of 2.4 percent was reached, followed by gradual decline in the three decades from 1970 (table 5.1). By contrast, the western countries (Europe and its overseas projections) only rarely exceeded a rate of 1 percent during their two centuries of expansion. Since the 1950s the poorer part of the world has grown at twice that rate.

The reasons for this difference are, on the surface, rather simple, though the underlying reality is complex. In the rich world the demographic transition came about slowly as a result of a gradual decline in mortality, accompanied by a similar decline in fertility. Slow mortality decline, as described in the previous chapter, was the result of an accumulation of knowledge, especially medical knowledge, which helped to bring infectious diseases under control

Table 5.1 World population, rich and poor countries (1900–2000)

Year	Population (millions)			Annual growth rate (%)[a]			% share		
	Rich	Poor	World	Rich	Poor	World	Rich	Poor	World
1900	563	1,071	1,634	–	–	–	34.5	65.5	100
1920	654	1,203	1,857	0.75	0.58	0.64	35.2	64.8	100
1930	727	1,309	2,036	1.06	0.84	0.92	35.7	64.3	100
1940	794	1,473	2,267	0.88	1.18	1.07	35.0	65.0	100
1950	813	1,709	2,521	0.24	1.49	1.06	32.2	67.8	100
1960	916	2,106	3,022	1.19	2.09	1.81	30.3	69.7	100
1970	1,008	2,688	3,696	0.96	2.44	2.01	27.3	72.7	100
1980	1,083	3,368	4,440	0.72	2.26	1.83	24.4	75.9	100
1990	1,148	4,118	5,266	0.58	2.01	1.71	21.8	78.2	100
2000	1,172	4,867	6,055	0.21	1.67	1.40	19.4	80.4	100

Note: [a]Over previous date.

Source: UN estimates; for 1900, author's estimate.

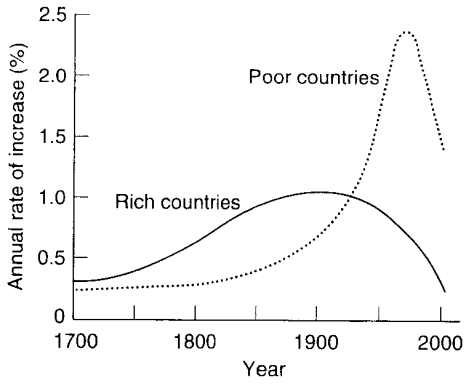


Figure 5.1 Comparison of demographic transitions: rates of increase for poor and rich populations (1700–2000)

– beginning at the end of the nineteenth century and continuing up to the present day. In the poor world mortality levels remained high until recently. In 1950, for example, average life expectancy in poor countries was still below 40. However, from the mid-twentieth century onward, that knowledge slowly accumulated by the rich countries was rapidly transferred to the poor ones and mortality dropped dramatically. Fertility, largely dependent upon slowly changing cultural factors, either did not follow the trend in mortality or else did so slowly, and the two indices assumed widely divergent levels.

As mentioned above, the apparent simplicity of this process is misleading. The poor world is divided into societies characterized by vastly different environmental, cultural, and political settings, and these differences are reflected in the demographic behavior of individual populations. Nor has the poor world been isolated from the rich, so that a degree of knowledge and technology transfer took place before the 1950s. Still, taking these factors into account, the fact remains that demographic change in the poor world in recent decades has on average proceeded rapidly as compared to the path previously followed by the rich (figure 5.1).

Table 5.2 describes global demographic diversity as measured by a number of now-familiar indices (for 1950–5 and 2000–5) for poor and rich, for large continental areas, and for India and China – these last two countries contain half the total population of the poor world. These data permit us to make three general observations regarding the distinctive characteristics of rich and poor countries, the changing demography of the poor countries during recent decades, and interregional differences.

Table 5.2 Demographic indicators of world population (1950–2005)

Region	Population (millions)		Annual rate of growth (%)		Birth rate per 1,000		Death rate per 1,000		Total fertility rate		Life expectancy at birth	
	1950	2005	1950–5	2000–5	1950–5	2000–5	1950–5	2000–5	1950–55	2000–5	1950–55	2000–5
World	2,521	6,465	1.77	1.33	37.3	22.1	19.7	8.9	4.99	2.65	46.5	64.7
More developed countries	813	1,211	1.21	0.27	22.0	11.2	10.2	10.1	2.77	1.56	66.6	74.6
Less developed countries	1,709	5,253	2.04	1.59	44.4	24.9	24.2	8.6	6.16	2.9	40.9	62.8
Africa	221	906	2.15	2.36	48.2	38.0	26.6	13.9	6.58	4.98	37.8	48.8
Eastern Asia	671	1,524	1.80	0.60	40.8	15.7	23.3	7.0	5.71	1.66	42.9	72.3
South-Central Asia	499	1,611	2.05	1.63	44.7	27.0	24.8	8.8	6.06	3.2	39.3	63.0
Southeast Asia	182	556	2.08	1.38	44.3	23.1	24.7	7.3	6.03	2.52	40.5	66.8
Western Asia	50	214	2.70	2.09	45.3	26.2	21.8	6.6	6.38	3.36	45.2	67.8
Europe	547	728	1.0	0.03	20.9	10.3	10.6	11.3	2.56	1.4	66.2	73.7
Latin America and the Caribbean	167	561	2.65	1.57	42.0	23.1	15.6	6.5	5.89	2.55	51.4	71.0
North America	172	331	1.7	0.85	24.6	13.8	9.4	8.3	3.47	1.99	69	77.4
Oceania	13	33	2.21	1.29	27.7	17.9	12.3	7.7	3.84	2.32	60.9	74.0
China	555	1,316	1.53	0.75	43.6	16.2	25.0	6.9	6.22	1.7	40.8	71.5
India	358	1,103	2.0	1.64	44.1	25.5	25.0	8.9	5.97	3.07	38.7	63.1

Source: United Nations, *World Population Prospects. The 2004 Revision* (New York, 2005).

The differences between poor and rich populations are enormous: life expectancy today (2000–5) for the poor populations is 63, for the rich 75; the average number of children per woman is 2.9 as compared to 1.6; and the poor population rate of increase at 1.6 percent is six times that of the rich world, though the gap between mortality and fertility levels was greater in the 1970s than it is today. It is also worth noting that around 1950, at the beginning of demographic transition in the developing countries, mortality levels for these countries corresponded more or less to the European rates of the mid-nineteenth century (life expectancy at birth being about 40); not so for fertility, as the developing-country level of 6.2 children per woman considerably exceeds western levels of a century before (generally below 5). The difference lies in the effectiveness with which the European populations exercised the Malthusian check on marriage (late marriage and high rates of the never married), a check only rarely encountered among the poor populations.

If we compare the situation at the beginning and the end of the 50-year period considered, we find that the poor-country growth rate has declined by only a small amount (from 2 to 1.6 percent) since deaths and birth rates have experienced comparable amounts of absolute decline. However, in relative terms, the drop in mortality (64 percent) has been much greater than that in the birth rate (44 percent). And though the level of detail in table 5.2 is not very fine, it nonetheless reveals great disparities within the developing world, a world which includes both the African (transition barely initiated) and Chinese (transition nearly complete) populations: while these populations had similar total fertility rates and life expectancies in 1950–5, the respective values 50 years later were 5 as compared to 1.7 children per woman and 49 as compared to 71 years of life expectancy. In the various continental areas, and even more so in the various populations that inhabit them, we find a gamut of intermediate situations.

This diversity is better displayed by examining these same indices for the 25 demographically largest nations of the several continents that make up the developing world (and contain over 80 percent of its population).[2] Figures 5.2 and 5.3 (for 1950–5 and 1995–2000) place each of these nations in the strategic space of growth defined by life expectancy (e_0) and number of children per woman (*TFR*), according to the scheme described in chapter 1, section 5. The differences are obvious but require some interpretation. The space occupied in 1950–5 is more compact than that occupied in 1995–2000; fertility and mortality vary little, and almost all the countries occupy the space above the isogrowth curves of 2 percent. In 1995–2000 the populations occupied a larger space, and most fell below the 2 percent growth curve (and some between 0 and 1), a clear sign that the demographic transition is well advanced. Extremes, however, endure: countries with "old regime" life

expectancies (Ethiopia at barely 43) and others whose level approaches that of the developed countries (Argentina, Chile); populations without birth control (Ethiopia, Congo) and others with fertility levels below 2 children per woman (China, South Korea, Thailand).

A final observation confirms the initiation of an irreversible transition. At the earlier date (figure 5.2) there appears to be no relation between mortality and fertility, since fertility is generally high throughout the poor countries (due to the limited spread of voluntary fertility limitation), regardless of the level of mortality. Mortality, on the other hand, had dropped in many countries as a result of the massive infusion of knowledge and technology from the 1940s onward. At the later date (figure 5.3) there is a clear and negative correlation between e_0 and *TFR*, as the high life-expectancy countries are also those with reduced fertility. This came about in part because increased material well-being influences life expectancy and fertility in opposite directions, but also because improved survival has begun to have a direct influence on fertility, making high levels of the latter unnecessary and more expensive. Once this process has begun, it tends to perpetuate itself until mortality has completed its decline.

2 The Conditions of Survival

Reduced mortality and establishment of the chronological age-linked succession of death are prerequisites to development. Moreover, a reduction in infant

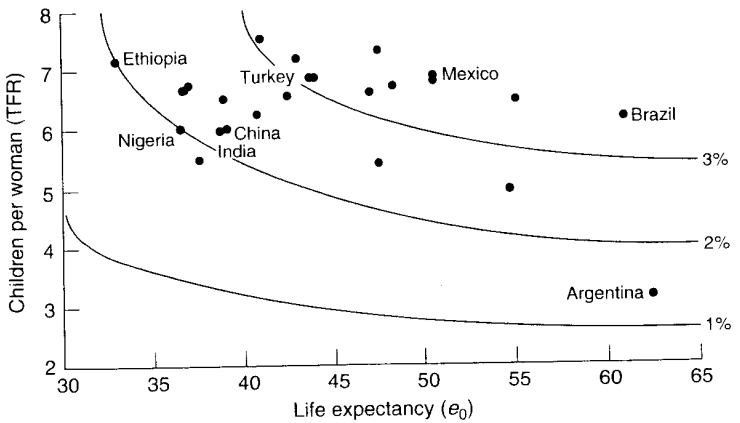


Figure 5.2 Relationship between life expectancy (e_0) and average number of children per woman (*TFR*) for 25 large less-developed countries (1950–5)

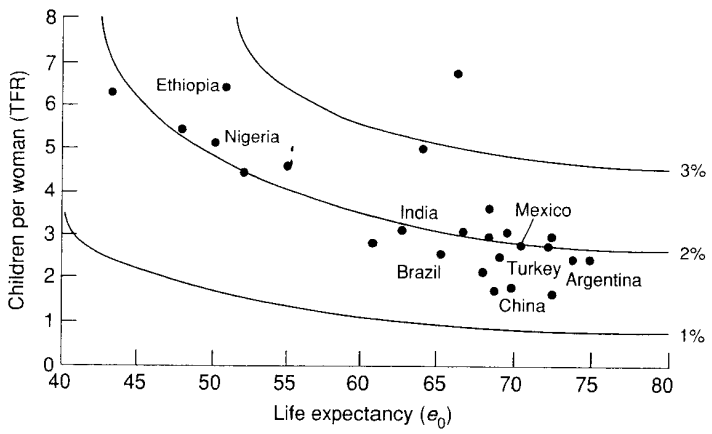


Figure 5.3 Relationship between life expectancy (e_0) and average number of children per woman (*TFR*) for 25 large less-developed countries (1995–2000)

and child mortality is one of the necessary conditions for fertility decline and the shift from a regime of demographic "waste" to one of demographic "economy." Beyond these fairly simple observations, we need to expand somewhat the general discussion of poor-world mortality decline. First, we should consider the reasons behind the different rates of survivorship improvement for the various poor populations, which as a whole increased life expectancy during the half-century between the early 1950s and the beginning of the new millennium at a rate of 5 months per calendar year; regional rates ranged from less than 3 months per year in Africa to 7 months in China, and the differences are greater still if we consider smaller areas.

Survivorship improvement is achieved, first of all, by means of the reduction of infant and child mortality. The United Nations[3] estimates that the probability of a newborn dying before his or her fifth birthday was 94 per thousand in 2000–5 for the less-developed countries as a whole, but variation among regions was great: 159 per thousand in Africa, 100 in southern central Asia, 41 in eastern Asia, 35 in Latin America. By comparison, this level in the rich countries is barely 10 per thousand. If the other countries of the poor world were to reduce their infant and child mortality to the level of China and eastern Asia (41 per thousand), life expectancy would increase by seven years in Africa and three in southern Asia.[4] In other words, elimination of infant mortality differences would eliminate much of the disparity in life expectancy and so is a primary objective in the quest for improved survivorship: its reduction not only represents a considerable decline in general

mortality, but also favors the modernization of reproductive behavior and improves the level of health at an age crucial to the development and subsequent efficiency of the survivors.

The causes of high infant mortality are many and complex: from infectious diseases typical of infancy (measles, diphtheria, whooping cough, polio, tetanus); to a high incidence of diarrhea and gastroenteritis resulting from poor sanitation; to the combined action of malnutrition, poverty, and infection; to the existence of vast malarial areas. With reference to children below 5 years of age living in 42 poor countries, 33 percent of deaths are from neonatal pathologies, 22 percent from diarrhea, 21 percent from pneumonia, 9 percent from malaria, and 3 percent from AIDS. There are solutions to all of these problems: the diseases typical of infancy can be combated with programs of vaccination and immunization; diarrhea and gastroenteritis with improved environmental conditions and hygiene; malaria with disinfestation; and malnutrition with programs of diet supplementation and, in many areas, by discouraging early weaning. When illnesses do occur, medical intervention can often prevent their lethality; in many instances diarrhea, which kills by repeatedly attacking and dehydrating the infant, can be cured by simple rehydration methods administered by family members.[5] There are solutions, but only providing that the material resources, technical knowledge, and collective and individual awareness necessary to implement them – that is to say, education and development – exist.

A clear, if summary, picture of the conditions accompanying infant mortality is provided by table 5.3, which records several health indices for selected countries. High infant and child mortality go hand in hand with lack of professional assistance at delivery, lack of access to safe water, low immunization, and a high incidence of stunted growth. Figure 5.4 shows the relationship, for 53 poor countries, between mortality at ages 0–4 and the percentage of the population served by adequate sanitation systems (sewage etc.); the inverse correlation is quite evident.

The complexity of the causes of high infant mortality makes intervention difficult when attempting to pass from a "medium" level (the result of initial progress) to a low one like that of the developed countries. I shall return to this question after having discussed the general mortality situation for the various populations, which is most concisely expressed by life expectancy (e_0). In figure 5.5 life expectancy for 1995–2000 is compared with the classic index of well-being – per capita GDP (in international dollars) – for 25 poor countries.[6] As can be seen from the figure, this relationship is similar to that for the western countries (see chapter 4, figure 4.4): there is a big increase in life expectancy as per capita GDP increases from very low levels, but a gradual attenuation of survivorship improvement with subsequent increases in production. In other

Table 5.3 Infant and child mortality and health indices (*c.*2000)

Country	Year of survey	Infant mortality 1000(1q4)	Child mortality 1000(1q4)	% women receiving antenatal care	% deliveries in health institutions	% children 12–23 months receiving vaccination	% children with acute respiratory infections treated in health institutions	% children with diarrhea treated with oral rehydration	Median duration of breast feeding (months)	% children stunted	% children under weight	% children with retarded growth
Africa												
Egypt	2000	43.5	11.3	57.6	51.7	92.2	67.7	37.6	19.4	18.0	4.0	18.7
Ethiopia	2000	97.0	76.7	26.2	4.9	14.3	18.0	19.1	28.4	44.1	44.1	51.2
Nigeria	1999	75.0	76.3	63.6	37.3	16.8	49.7	51.2	18.0	45.5	27.3	
Uganda	2001	88.3	69.3	92.3	36.7	36.7	68.7	43.4	21.1	34.0	22.6	38.6
Asia												
Bangladesh	2000	66.3	29.8	34.7	6.1	60.4	28.3	72.4	30.3	39.4	45.1	44.6
Cambodia	2000	95.0	32.5	38.0	9.8	39.9	37.2	22.5	22.7	35.2	40.0	44.3
India	1999	67.6	29.3	65.2	33.6	39.4	66.5	29.0	25.4	45.5	47.0	
Kazakhstan	1999	61.9	10.1	83.4	98.1	73.1	37.4	31.0	14.7	9.1	3.6	9.7
Latin America												
Colombia	2000	21.4	3.5	90.5	86.8	52.0	–	32.3	13.1	10.5	5.4	13.5
Guatemala	1999	22.2	8.4	61.5	41.7	59.5	40.7	35.3	19.9	34.4	16.9	46.4
Haiti	2000	45.1	14.3	79.2	18.9	33.5	26.2	42.1	18.0	14.7	13.8	21.9
Peru	2000	33.3	13.9	83.5	56.8	56.4	61.6	36.5	21.4	17.4	5.7	25.4

Source: Adapted from A. Maddison, *The World Economy: Historical Statistics* (OECD, Paris, 2003); A. Maddison, *The World Economy. A Millennial Perspective* (OECD, Paris, 2001).

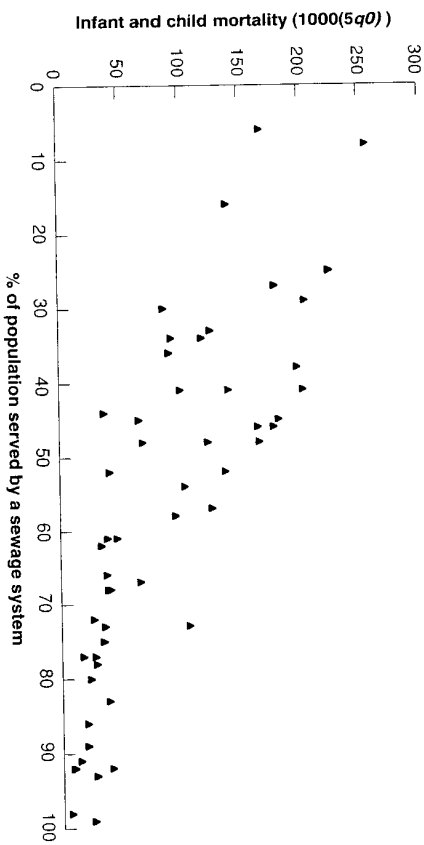


Figure 5.4 Relationship between percentage of the population served by a sewage system and infant and child mortality in 53 less-developed countries (2000)

words, the growth of material well-being is progressively less effective at increasing life expectancy. This relationship is in keeping with an initial phase of considerable mortality reduction linked to the introduction of relatively inexpensive and large-scale technology: antibiotics, DDT disinfestation, certain vaccines.[7] Sri Lanka provides an example of this initial rapid phase of mortality decline:[8] largely owing to DDT spraying begun in the late 1940s and the reduced incidence of malaria, the crude death rate fell from 21.5 per thousand in 1945 to 12.6 per thousand in 1950. Figure 5.6 compares the mortality trends in two areas of the island having the highest and lowest incidence of malaria; the effect of the 1946–7 disinfestation on the otherwise gradual rate of decline is obvious.

Further improvements in survivorship are not so easily achieved. In the 1970s, as poor-country mortality decline showed signs of slacking, criticism mounted against the creation in these countries of health programs which emulated rich country models and so depended upon the development of sophisticated and expensive hospitals, clinics, and schools. It was argued that these programs often were unable to serve the whole population and that, while good at diagnosis and cure, they did not attack the causes of high mortality.[9] At the end of the 1970s, the international health organizations (WHO and UNICEF) embarked upon a new strategy (called Primary Health Care, or PHC) which involved active community participation and used paramedical personnel (more easily trained) together with simple but effective technology.[10] In addition to services of disease prevention and cure, this strategy includes educational programs, water and sanitation systemization, and the encouragement of appropriate agricultural

technology. It is a strategy aimed at the greater spread of effective, nonsophisticated techniques and the development of individual and community awareness, which is the basis of that behavior indispensable to the reduction of mortality. Unfortunately, the application of these strategies, while theoretically appropriate, is difficult, since they require changes in individual and family behavior and they must operate through various channels of social activity, including schools, public health programs, and so on.

In order to complete this discussion we should return to figure 5.5 for a moment. We can see that some countries lie considerably above the theoretical GDP – e_0 curve – that is to say, they enjoy a life expectancy considerably longer than we would expect given their level of well-being – while others lie below it and therefore have a lower than expected life expectancy. For instance, Nigeria, with the same GDP per capita of Bangladesh, has life expectancy 11 years lower, while better-off Indonesia has an e_0 5 years lower than poorer China. Amartya Sen has pointed out that the survival prospects of African Americans are much worse than those of the Indians of Kerala or of the Chinese, even though the former are many times richer, even counting for differences in the cost of living.[11]

These huge disparities (which manifest themselves if we use other development indices as well) are proof of the fact that the accumulation of material wealth does not by itself guarantee improved health conditions, and not only

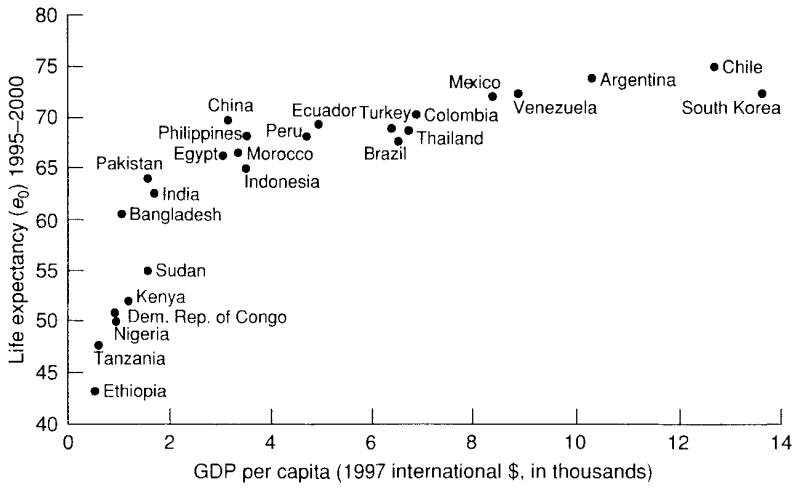


Figure 5.5 Per capita GDP (1997) and life expectancy (e_0) in 25 less-developed countries of Asia and Latin America (1995–2000)

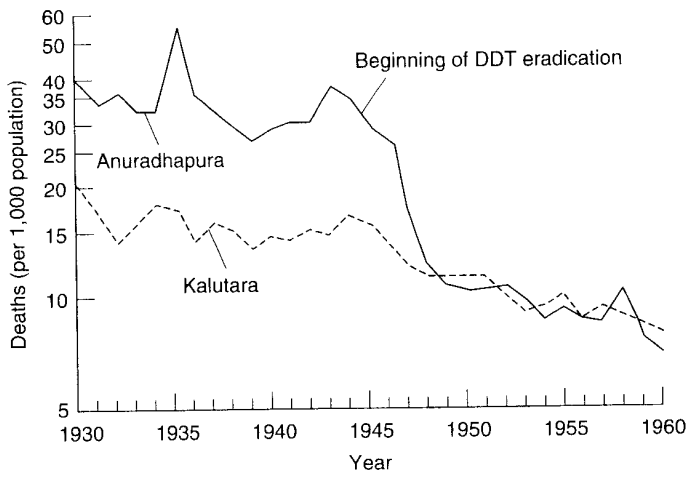


Figure 5.6 Mortality in the most malarial (Anuradhapura) and least malarial (Kalutara) zones of Sri Lanka (1930–60)

because of its unequal distribution among the population. Often the problem lies with the levels of individual, family, and community awareness, which do not necessarily increase with economic development. They are instead the product of deep-rooted cultural inheritance or of deliberate social and political action. Improved education, especially of women (because of their decisive role in child rearing, domestic hygiene, and food preparation), appears to be a necessary prerequisite to improved sanitary conditions. The fact that certain Islamic countries still have high levels of mortality in spite of considerable economic development has been explained by the subordinate status of women and the limited instruction they receive.[12]

Moreover, those countries which have had particular success in combating death are those in which government policy has allocated sufficient human and economic resources to the health sector. The examples of China, Sri Lanka, Cuba, and Costa Rica – politically diverse countries which have made considerable efforts in this area – show that low mortality is within reach of even the poorest populations.[13] The World Health Organization (WHO) estimates that 90 percent of deaths from infectious diseases are caused by pneumonia, diarrhea, tuberculosis, malaria, measles, and AIDS/HIV. For some of these diseases low-cost health interventions are now available (like oral rehydration therapy for diarrhea, already mentioned) that could easily prevent a large number of deaths. The incidence of malaria, for instance, could be drastically reduced by the use of bednets dipped in insecticide; inexpensive drugs are available for tuberculosis.

High mortality and high incidence of disease cost years of life and, for those who survive in poor health, years of healthy life. And healthy survival is a prerequisite for many, indeed most, of the ingredients of development: the acquisition of physical efficiency, the achievement of intellectual ability and skills, and the extension of individual time horizons to allow planning for the future. It is also a prerequisite for changing the demand for children and, therefore, for fertility control. In order to assess improvements and make comparisons in this regard, it is important to combine survival measures and measures of incidence of disease. Survival indicators alone may reveal only part of the picture: reliance on medicine may prolong a life made miserable by inadequate nutrition and the absence of elementary hygiene. An important improvement over survival measures, for the purpose of our argument, is the calculation, for a given population, of the years of healthy life lost owing to premature death or because of disabilities produced by disease and accident. In practice two quantities are calculated: (a) the number of years of life lost – obtained for each death as the difference between the age at death and the expectation of life at the same age in a low-mortality population; (b) the number of years of healthy life lost owing to disease or accident – estimated as the difference between the inception of the condition and its remission (or death). These years are not counted in full (as they are in the case of death), but each condition or disease is assigned a certain weight (between 0 and 1) according to the severity of the disability.

The combination of the future years lost in full owing to premature death and of the future years lost partially owing to disability give the total number of lost years (the World Bank has labeled these DALY, or disability-adjusted life years). Table 5.4 reports some of these: deaths, diseases, and accidents in 2002 will deprive the 6.2 billion inhabitants of the world of 1,490 billion DALY (or 1,490 billion healthy years), which amounts to 239 per 1,000 population. The maximum incidence is in sub-Saharan Africa (537 DALY per 1,000 population); the minimum incidence in high-income regions identified by WHO as Europe and Central Asia (essentially Europe and ex-USSR, 139 per 1,000). The inequalities between regions (a factor of 4) are large and mask still larger inequalities between individual countries, social groups, and so forth.

3 A Brief Geography of Fertility

During the past few decades the fertility of the poor world has been changing, and signs of the spread of voluntary control are ever more frequent. Areas which still conform to traditional procreational patterns now exist side by side

Table 5.4 Estimates of the burden of disease (2002)

Region	Population (millions)	DALYs (millions)	DALYs per 1,000 persons	DALYs by cause (%)			
				Communicable diseases	Noncommunicable diseases	Injuries and accidents	Total
World	6,225	1,490	239	41	47	12	100
Males	3,131	773	247	38	46	16	100
Females	3,094	717	232	44	48	9	100
Africa	672	361	537	73	18	9	100
America	852	146	171	18	68	14	100
South and Southeast Asia	1,591	427	268	43	44	13	100
East Asia and Pacific	828	150	181	9	77	14	100
Europe and Central Asia	503	139	276	47	41	12	100
Mediterranean and Middle East	1,718	265	154	20	66	14	100

Notes: DALYS = Disability-Adjusted Life Years. Africa is sub-Saharan Africa; South and Southeast Asia comprises (among others) India, Pakistan, and Bangladesh; East Asia and Pacific comprises (among others) China, Indonesia, the Philippines, and Oceania; Mediterranean is North Africa; Central Asia includes the former USSR.

Source: World Health Organization, *World Health Report 2004* (Geneva, 2004).

with others which resemble instead the more developed world. In order to obtain an initial impression of the changes which have taken place in the poor countries as a whole over the past 50 years, we should return for a moment to table 5.2. The average number of children per woman has declined by more than 3, from 6.2 to 2.9, though China, which has reduced fertility to replacement levels (from 6.2 to 1.7), is responsible for almost half of this decline. Fertility in the other large areas of the poor world differs widely: African fertility has undergone a modest decline from 6.6 to 5.0 children per woman, and birth control is still rare;[14] the change in southern central Asia has been larger still, with a reduction from 6.1 to 3.2, and this decline is due primarily to lower Indian fertility; southeastern Asia (6 to 2.5) and Latin America (5.9 to 2.5) have registered larger declines. Taking into account the different scale of the demography of the poor world today, the current situation resembles that of the western world at the beginning of the twentieth century when areas where fertility control was widely practiced (like France) coexisted with others where "natural" fertility still prevailed (like certain areas of Mediterranean Europe or the northern and eastern peripheries of the continent).[15]

Fertility decline seems to have accelerated in recent years, an observation supported by the comparison of the results of Demographic and Health Surveys (DHS) taken from the late 1980s to the present.[16] Even in sub-Saharan Africa fertility control seems to take hold fairly rapidly: the rate of annual decline of *TFR* has been 1.3 percent in Senegal, 3.3 in Ghana, 3.5 in Zimbabwe, and 5.2 in Kenya. Rates of decline of 3 percent per year (that, if sustained, determine a drop in *TFR* of one-quarter in a decade) are common in North Africa, Asia, and Latin America.[17] Indeed, experts are anticipating that Brazil – the largest country of Latin America – will reduce its fertility below replacement before the end of the current decade.

Explanation of these trends requires analysis of the principal components of human fertility, discussed in chapter 1, section 4. Recall that the average number of children per woman (*TFR*) is determined by a combination of factors, predominantly biological, which determine natural fertility (birth intervals linked to the duration of breast-feeding, waiting time linked primarily to the frequency of sexual relations, fetal mortality); by marital patterns (age at marriage and percentage unmarried); and by the level of birth control.

I have already made reference to the fact that the "initial" fertility level of the poor countries – over six children per woman – was considerably higher than that of the West prior to the demographic transition (less than five). This is due primarily to higher levels of nuptiality: poor-country age at marriage (or the age at which a stable reproductive union is established) has traditionally been low,

with almost no one remaining unmarried, unlike the situation in the West. The World Fertility Survey (WFS)[18] revealed, for the late 1970s, an average age at first marriage of 19.8 years in 12 African countries (from a minimum of 17.5 in Cameroon to a maximum of 23.9 in Tunisia); of 21 in 13 Asian and Pacific countries (from 16.3 in Bangladesh to 24.5 in the Philippines); and of 21.5 in 13 Latin American and Caribbean countries (from 19.2 in Jamaica to 23.2 in Peru). (These levels, considerably below the western average of about 24, are already 1 to 1.5 years above the levels of 15 years earlier[19].)[20] In these same countries, and again according to the WFS, the percentage of unmarried women at the end of the reproductive period was barely 1 in Africa and Asia and 4 in Latin America (as compared to levels often over 10 percent in the West).[21] Data for the 1980s and 1990s confirm that the trend toward higher ages at marriage continues – although with irregular patterns – as a consequence of modernization and, in particular, of improved women's education and increasing labor participation.[22] Average age at marriage in the 1990s was 21 in Africa, 22 in Asia, and 23 in Latin America and the Caribbean.

However, although the Malthusian check does reduce fertility, its effectiveness is limited. For example, in the absence of voluntary fertility control, an increase in age at marriage from 18 to 23 (a radical change in nuptial behavior) will result in a reduction of the number of children per woman of 1.5 to 2. Clearly this reduction is too small to bring fertility down to levels compatible with moderate rates of population growth. Moreover, delayed marriage must translate into an effective delaying of women's entry into motherhood and implies that reproduction be confined within marriage. While this is true in Asia, where nonmarital fertility is practically negligible, it is not for Africa, Latin America, and the Caribbean, where reproduction outside marriage is common.

The decisive check to fertility, however, is its voluntary control. A simple measure of its "prevalence" is the percentage of women of reproductive age who, in a given period, use some methods of birth control. This percentage in turn can be broken down according to the method used ("traditional" and less efficient methods, like coitus interruptus or periodic abstinence – rhythm – or "modern," more efficient methods, like the pill, IUDs, and sterilization). Contraceptive prevalence of about 70 percent and above indicates low levels of fertility like those found in the rich countries.[23] The WFS (for 38 developing countries in the late 1970s) found levels of contraceptive prevalence of 10 percent in Africa, 23 percent in Asia, and 40 percent in Latin America and the Caribbean. About three out of four of the women practicing some form of birth control used the so-called "modern" methods.[24] The 45 countries investigated by the DHS between 1998 and 2004 show an increase of contraceptive

prevalence. The level for sub-Saharan Africa (average of 24 countries) stands at 23 percent, while it reaches about 50 percent in Asia (7 countries, among which is India) and 57 percent in Latin America/Caribbean (7 countries).[25]

Figure 5.7, borrowed from a World Bank survey, depicts a model of the factors responsible for reducing the average number of children per woman from traditional levels to replacement levels in a number of poor countries.[26] The model shows the contributions, positive or negative, to *TFR* reduction (from a maximum of 7 to a minimum of 2.1 children per woman) made by changes in age at marriage, duration of breast-feeding, contraceptive prevalence, the frequency of abortion, and a series of other residual factors. One of these factors – the declining duration of breast-feeding – has, in fact, contributed to fertility increase. The demographic transition in these countries has entailed a shorter period of breast-feeding which, all things being equal, would have led to shorter birth intervals and a 31 percent increase in *TFR* (equal to 1.5 children). All things, however, were not equal, and the other factors led to an overall reduction. First among these factors was increased contraception (–93 percent = –4.5 children), followed by a higher age at marriage (–28 percent = –1.4 children)[27] and higher frequency of abortions (–10 percent = –0.5 children).

We can conclude this discussion of poor-world fertility by considering figure 5.8, which compares per capita GDP and *TFR* in 25 large developing countries

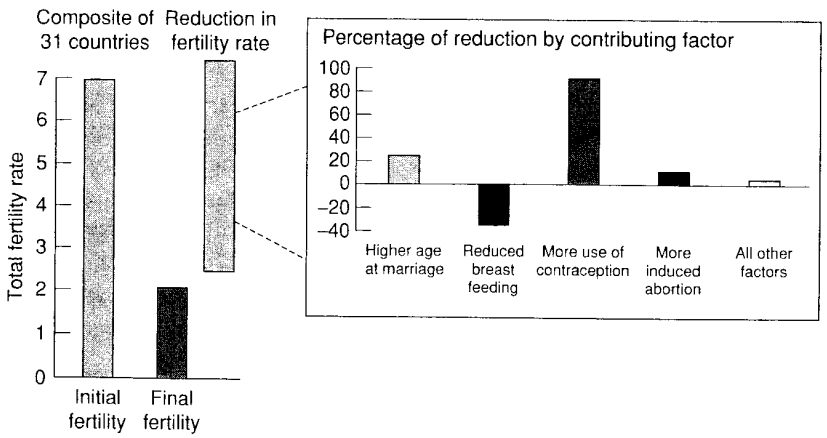


Figure 5.7 Model of the contributions of various factors in reducing fertility from natural to replacement levels

Source: The World Bank, *World Development Report 1984* (Oxford University Press, New York, 1984), p. 115.

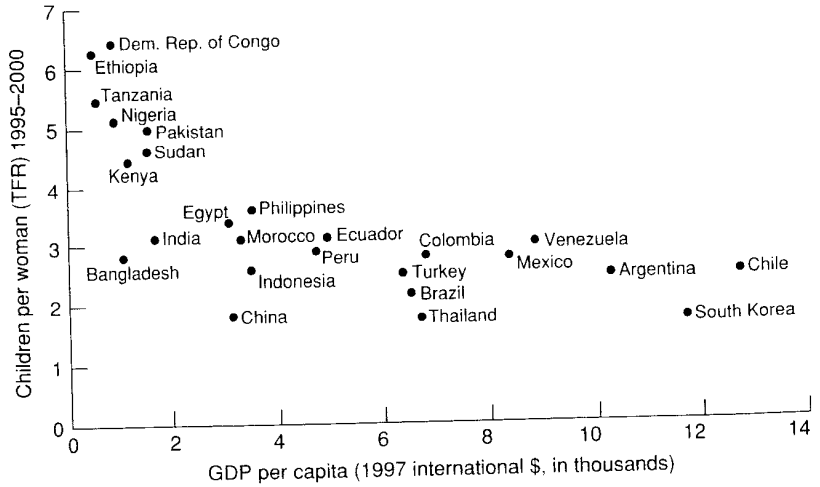


Figure 5.8 Per capita GDP (1997) and average number of children per woman (*TFR*) in 25 less-developed countries of Africa, Asia, and Latin America (1995–2000)

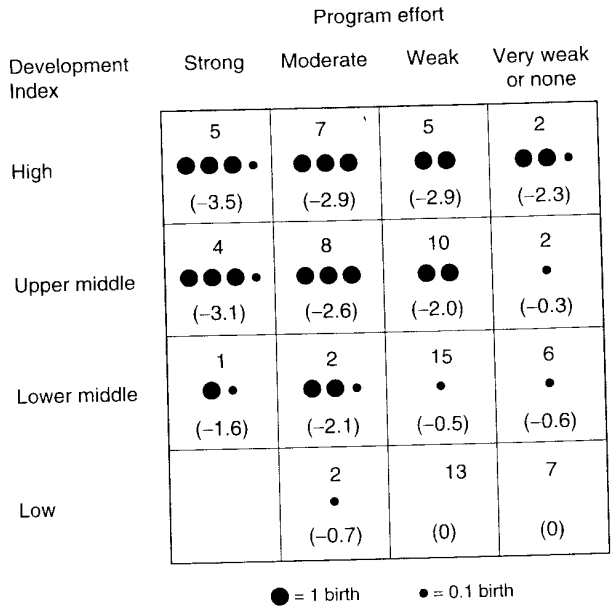


Figure 5.9 Absolute decline in total fertility rate (1960–5 to 1990), by level of development in 1985 and average program effort level in 1982–9

Note: in each square: top figure = number of countries; bottom figure (in brackets) = decline of *TFR* (or children per woman) between 1960–5 and 1990.

in the late 1990s. The relationship resembles that revealed by the analogous comparison for the rich countries (see figure 4.8): as income increases, fertility decreases, but the amount of decline is progressively less. Naturally, this relationship is obtained only by drastically simplifying a complicated and diverse reality. Deviation from the abstract income-fertility curve of figure 5.8 may be considerable. The fertility of some countries (like the Philippines and Venezuela) is higher than would be expected based on their income levels, while that of others (like China and Thailand) is a good deal lower. In other words, economic development as approximated by per capita GDP has been accompanied by very different fertility levels. In the pages that follow we shall seek to understand why.

4 The Conditions and Prospects for Fertility Decline and Demographic Policy

Confronted with the rapid growth rates of poor populations in recent decades, scholars and social workers have debated at length the causes of high fertility and the factors that might bring about its decline, the prerequisite to moderate growth. In the previous section we discussed the mechanics of fertility, analyzing its various biological and social components. We have seen that increased age at marriage and, above all, the spread of birth control are the instruments of fertility decline. However, in order for decline to occur, a change in the reproductive plans of couples is necessary. We must therefore understand what determines these plans and what can be done to change them. To borrow the economist's terminology, we must understand what determines the "demand" for children on the part of parents – still high in the poor countries – and what the factors are that might change it.[28]

In the first place, we may take for granted that preservation and survival (of the individual, the family group, or the collectivity to which they belong) are innate values of the human species, just as they are for other animal species. Fertility therefore must compensate for mortality; when the latter is high, the former must be so as well. From this point of view, five or six children per woman are compatible with normal pretransition mortality levels. Often the risk of having no surviving heir induces couples to have many children as a sort of insurance, with the result that aggregate fertility is higher than general mortality. As stated above, mortality decline is a necessary prerequisite to fertility decline.

In almost all poor countries mortality, but not fertility, has declined considerably. Why does fertility remain high? Why has the "demand" for children by parents not slacked off? First, the cost of raising children remains low. In rural areas and under certain conditions, children may constitute a net gain for their parents. The work performed by children and adolescents may offset the costs sustained by the family, which in any case are low in a poor economy.[29] Second, in many social contexts parents consider children a guarantee of economic and material assistance, not to mention affection, in old age. Studies in Indonesia, Korea, Thailand, Turkey, and the Philippines reveal that 80 to 90 percent of parents interviewed count on receiving economic assistance from their children in old age.[30] And in any case, it is natural to depend upon help from one's children in the event of great misfortune.[31] Third, cultural context often demands a large number of children: as an affirmation of the family, as a guarantee of generational continuation, or as the expression of deep-rooted religious principles. Finally, ignorance of birth control methods, unavailability of contraceptives, and inadequate medical and health services contribute to inadequate fertility control or increased recourse to abortion. Legislation controlling the spread of contraceptives can reinforce these barriers to fertility decline.

If these are the causes of high fertility, then it is necessarily by means of their modification that the birth rate might decline. Above all, mortality must decline. Figure 5.3 (in which fertility and mortality are compared) indicates that countries with a life expectancy over 60 have a relatively low *TFR*, the result of a certain degree of fertility control independent of socioeconomic conditions.

The increasing "relative cost" of child rearing also appears to be a factor in fertility decline. This increase may, for example, come about as the result of expanded female education, so that women are less willing to give up the possibility of wage-earning employment in favor of housework and raising children. Other factors might include compulsory childhood schooling, which delays the beginning of a child's work life, or a general increase in well-being and the attendant requirements for greater investments in children. The creation of institutional mechanisms of social protection reduces the need of aging parents for support from their children, and so another incentive to high fertility is undermined. Other elements that tend to hasten fertility decline include the elimination of legislative obstacles to birth control, a policy actively supporting family planning, the spread of contraceptive knowledge and techniques, and the fact of their being both affordable and psychologically acceptable.

None of the above factors can on its own bring about the transition from high to low fertility levels, and the proper combination of factors is difficult to determine, since it depends upon many characteristics of the society in question. The elements discussed entail improvements in medical and health services, economic development, and social change (changes in values, freedom for women, secularization of behavior) – essentially all the aspects of

societal development. No one aspect will effect change, and each country will have to find the appropriate mix.

Nonetheless, certain forms of intervention are simpler or more contained than others and so are more likely instruments of policy. Since the 1950s, for example, family planning has been a preferred approach and, generally speaking, it is unlikely that fertility decline will occur without an adequate network of these services.[32] Today, the political acceptability of this sort of intervention is taken for granted, but this was not always the case. In the 1950s and 1960s, family planning programs – often naively and even clumsily introduced – were opposed in much of the poor world. In those countries embracing a socialist political system or ideology, for example, it was claimed that economic development would spontaneously regulate fertility. In others, ruling nationalists viewed birth control policies as an attack on the numerical strengthening of the nation, while these policies were opposed on moral grounds in countries where religious fundamentalism played an important role. The support given by rich countries – especially the United States – to these programs, often of dubious motivation, was considered a subtle form of capitalist imperialism. However, in 1974, at the United Nations World Population Conference in Bucharest[33] (a conference restricted to official national delegations), China, Algeria, Brazil, and Argentina headed a large group of nations opposed to policies aimed at lowering population growth rates. On the other hand, many Asian countries, especially those of the Indian subcontinent, were in favor of such policies. A memorable slogan from that conference claimed that "development is the best contraceptive." Ten years later, in Mexico City, again at a UN conference,[34] opposition had disappeared; all nations agreed that demographic growth should be curbed by the application of specific policies not necessarily linked to other development policies. In 1994, at the Cairo United Nations Conference on Population and Development, this point was reaffirmed and unanimously endorsed.[35]

What have the results of demographic policy (understood in the restricted sense of family planning programs) been? (We shall for the moment leave aside the special case of China, whose coercive policy is unique.) The answer to this question contains important implications for future policies aimed at reducing fertility and slowing down the speed of population growth. According to one conventional view, a large part of the variation of fertility in poor countries derives from the fact that a large proportion of women who would like to limit their fertility are unable to do so because they are unaware of the existence of contraception or because contraception is either not available or access to it (in some cases because of cost) is restricted. Making contraception easily available, then – or as is often said, satisfying the "unmet need" for contraception – will

accelerate fertility decline. Satisfying that need is the goal of population policies, one they have gone some way to achieving in the past decades.[36] The existence of an "unmet need" is attested to by the fact that a percentage of pregnancies are unwanted, or poorly timed (therefore not wanted at that particular moment), and that a share of women who do not use contraception want either to avoid or postpone pregnancies.[37] The role of family planning programs can be assessed from figure 5.9. This is a classification of 88 poor countries according to the average fertility (*TFR*) decline between 1960–5 and 1990 as a function of two variables: (1) a development index (a synthesis, for 1985, of various indicators of education, mortality, income, occupation, and urbanization); and (2) an index of family planning program effort for 1982–9 (based on a variety of factors including measures of policies, resources, "stage setting," services, record keeping, and availability of fertility regulation supplies and services).[38] The results are as expected: the greatest fertility decline occurred in countries where both these indices were in the upper to middle range. Conversely, fertility remained high in countries where development was low and programs weak or nonexistent. Less easily predicted, decline was minimal in those countries enjoying relatively high levels of development but lacking much in the way of family planning programs. Development without appropriate programs slows down the process of fertility decline, while the combined action of these two factors speeds it up. Efforts to measure the "net" ("net" of the effects of development) contribution to fertility decline of the family planning programs are plagued with difficulties, and results vary from next to nothing to almost one-half.[39]

Less sophisticated supporters of the conventional view observe that contraceptive prevalence (the proportion of reproductive-age women currently employing contraception) is low where fertility is high and vice versa, and a close correlation of these variables is revealed in figure 5.10c (based on the findings of DHS surveys in the late 1980s and early 1990s in 44 developing countries).[40] It follows that policies that increase contraceptive supply will increase contraceptive prevalence and bring about a proportional decline in fertility. This sort of argument, however, is like saying that building new schools will bring about an increase in primary education, irrespective of the fact that parents might not be willing to send their children to school or that teachers might be missing, and so on. In the case of fertility, contraception is only an instrument through which desires and aspirations may be realized.

A mirror-image approach as compared to the conventional "supply-side" view focuses instead on "demand," where demand refers to the children effectively wanted by parents.[41] Simply put, the theory states that fertility is driven by the desires of women or couples. Populations with high fertility,

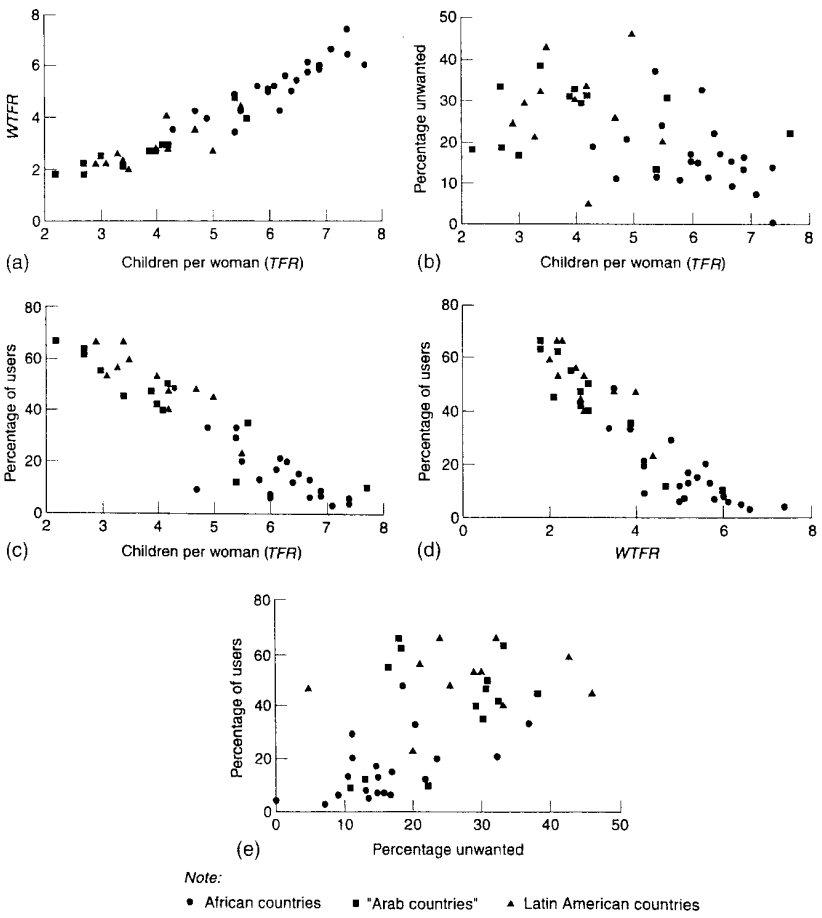


Figure 5.10 Relationship between the average number of children per woman (*TFR*) and the percentage of undesired fertility for 44 populations (late 1980s)

Notes: African countries: Botswana, Burkina Faso, Burundi, Cameroon, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Namibia, Nigeria, Rwanda, Senegal, Sudan, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Arab countries: Bangladesh, Egypt, Indonesia, Jordan, Morocco, Pakistan, Philippines, Sri Lanka, Thailand, Tunisia, Turkey, Yemen.

Latin American countries: Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Peru, Trinidad.

TFR = Total Fertility Rate.

WTFR = Total Wanted Fertility Rate.

Percentage users = Population of women 15 to 49 practicing some method of contraception.

Percentage unwanted = Difference TFR and WTFR as percentage of TFR.

then, also have a high demand for children. Even if the supply of family planning services is high and they are efficiently run, they will be little used and fertility will remain high. This situation is particularly frequent in sub-Saharan countries and among many Islamic populations. Conversely, low demand for children coincides with low fertility even in the absence of family planning programs. Indeed, in western countries fertility declined in the first two-thirds of the twentieth century in spite of legislation hostile to family planning and a limited supply of contraceptives (advertising contraceptives was illegal in many countries until the 1950s and 1960s). The level of fertility, then, is dictated by motivations, expectations, and desires. If these change, so will fertility. Figure 5.10 lends some support to this view. Indeed figure 5.10c – as we have seen – shows the close inverse relation between fertility and contraceptive prevalence, but the same association can also be seen between wanted fertility and contraceptive prevalence (figure 5.10d).[42] The close similarity of the two figures implies a very close association between actual and wanted fertility, as is indeed shown by figure 5.10a. In other words, variation in actual fertility is almost completely explained by variation in wanted fertility. When fertility is high, wanted fertility is also high. Figures 5.10b and 5.10e are even more interesting. In figure 5.10b, actual fertility is compared to the proportion of fertility that is unwanted.[43] As we can see, there is no correlation between the two variables: indeed, with the decline of fertility toward small family norms there is no attendant decline of unwanted fertility. On the contrary, unwanted fertility seems to increase in the intermediate stages of the fertility transition. A similar observation can be made regarding figure 5.10e, where the proportion of unwanted fertility is compared to the prevalence of contraception. One would think that increased prevalence of contraception should reduce unwanted fertility, but such is not the case. A study suggests instead that the variation of fertility across countries (holding desires constant) is explained only in minimal part (1 or 2 percent) by variation in contraceptive prevalence.[44]

To sum up: (1) fertility is driven by motivations and desires; (2) contraception is a necessary technical instrument for controlling fertility, but its availability – other factors being equal – has little impact on fertility and does not reduce unwanted fertility; (3) policies directed to lower fertility must be "demand"-oriented, trying to influence the factors that determine the propensities, desires, and motivations of couples.

This debate has been useful in providing better guidelines for policies. It is clear that small family norms, well-rooted in society, cannot be brought about by family planning programs alone, no matter how well conceived and aggressive they might be. Paul Demeny has identified four factors as particularly important in determining the fertility transition: (a) the direct cost parents must

incur in raising and educating their children; (b) the opportunity costs of children to parents (or the earnings that a couple – in general the woman – forgoes because of children); (c) the contribution that children's labor makes to the income of the family; (d) the contribution of children to parents' economic security in old age relative to other forms of security.[45] Therefore, those policies that tend to favor the responsibility of parents in raising children, including bearing part of the cost of education and health; that encourage women to enter the labor force; that enforce compulsory education of children; that make child labor illegal; and that develop old-age private or public insurance schemes are conducive to fertility decline. The combination of these policies with well-balanced programs for family planning and reproductive health – which increase access to contraception, reduce its cost, and compress recourse to abortion – may accelerate a smooth transition to low fertility.

5 India and China

By the mid-1980s almost all the governments of the world officially supported family planning to some degree; the United Nations announced that this was the case for 127 countries comprising 94 percent of the world's population.[46] However, behind these encouraging figures are both successes and failures, as well as combinations of the two. The cases of India and China are representative and merit attention if only by virtue of the demographic dimensions of both countries: together they account for about half the total population of developing countries.

Demographic data for the two countries are listed in table 5.5 and require little commentary. Between the early 1950s and the beginning of the twenty-first century Chinese fertility was reduced by three-quarters, while that of India has declined by about half; Chinese life expectancy at birth, at the same level as India's at the middle of the twentieth century, is now 8 years longer. Today, Chinese fertility is below replacement level, and if it remains there the population will eventually decline. By contrast, Indian fertility – 1.4 children per woman more than China – ensures continued rapid population growth.

In order to understand these great differences we must consider the demographic policies adopted by these two countries and their results. The Indian government has pursued slower demographic growth since 1952. The first two five-year plans (1951–6 and 1956–61) called for the creation of family planning centers; the fifth plan (1971–6) called for a crude birth rate of 25 per thousand by 1984 (clearly a goal which was not met, as the 1980–5 birth rate was 10 points higher).[47] Accomplishments have been few and fertility decline min-

Table 5.5 Demographic indices for India and China (1950–2005)

Year	Population (millions)		% population age 15 or less		Period	Annual rate of growth (%)		Children per woman (TFR)		Life expectancy at birth (e_0)	
	India	China	India	China		India	China	India	China	India	China
1950	358	555	38.9	33.6							
1955	395	609	39.0	37.1	1950–55	2.00	1.87	5.97	6.22	38.7	40.8
1960	442	657	39.8	38.9	1955–60	2.26	1.53	5.92	5.59	42.6	44.6
1965	495	729	40.4	40.2	1960–65	2.26	2.07	5.81	5.72	45.5	49.5
1970	555	831	40.4	39.7	1965–70	2.28	2.61	5.69	6.06	48.0	59.6
1975	621	928	39.8	39.5	1970–75	2.24	2.21	5.43	4.86	50.3	63.2
1980	689	999	38.5	36.5	1975–80	2.08	1.48	4.83	3.32	52.9	65.3
1985	768	1,070	37.5	30.3	1980–85	2.17	1.38	4.47	2.55	54.9	66.6
1990	849	1,155	37.4	27.7	1985–90	2.01	1.53	4.07	2.46	57.6	67.1
1995	936	1,219	35.4	26.5	1990–95	1.95	1.08	3.56	1.92	60.3	68.4
2000	1,021	1,274	33.3	24.9	1995–2000	1.74	0.88	3.32	1.8	61.5	69.7
2005	1,103	1,316	32.1	21.4	2000–05	1.55	0.65	3.07	1.7	63.1	71.5
2005 (1950 = 100)	308	237	83	64	2000–05 (1950–55 = 100)	77	35	51	27	163	175

Source: United Nations, *World Population Prospects. The 2004 Revision* (New York, 2005).

imal: in 1970 the percentage of couples (woman of reproductive age) using birth control was very low (14 percent). For both males and females the most frequent method was sterilization.[48] Success has been limited to a few states, the upper classes, and the urban population. Confronted with these poor results – caused by insufficient investment but also discontinuities in and the difficulty of administering the program in a country characterized by a variety of languages, religions, and customs – Indira Gandhi's government decided in 1976 to speed up the program. With the declaration of April 16, 1976, the government implemented a series of measures (including strengthening of the existing program and increased financial incentives for the participants) and encouraged the state legislatures to pass laws making sterilization obligatory after the birth of the third child (only the state of Maharastra passed such a law, and it was not enforced).[49] This coercive line inspired violent protests that were among the causes of the defeat of Gandhi's Congress Party in the March, 1977 elections.[50] As a result, the Indian program suffered a notable setback. Indira Gandhi's return to power in 1980 and the unexpected results of the 1981 census (which revealed a population considerably larger than expected) led to renewal of the demographic policy. The seventh five-year plan of 1986–90 called for the achievement of replacement fertility by the year 2000. This was an unrealistic goal because it would have required a fertility decline similar to that experienced in China during the 1970s under exceptional and perhaps nonrepeatable conditions; indeed, by 2000, fertility was still 50 percent above replacement. The Indian plan called for greater investment in the family planning program; increased financial incentives for its participants; a big increase in sterilization and more widespread use of the IUD, not to mention other forms of birth control; and combining family planning services with maternal and infant services.[51]

"Despite official support (for 30 years) of family planning, the government of India has not been able to organize a birth control program that regularly provides adequately staffed services to most of the population. At different times the responsible central agency ... has promoted different methods of contraception and tried different organizational approaches. At first, when modern contraceptives were not widely used anywhere in the world, there was a hope, soon disappointed, that periodic continence (the rhythm method) would reduce the birth rate in India, where it seemed to conform so well with Gandhian principles. Later there was primary reliance on the intrauterine device, but the health and family planning network never developed the capacity for skillful insertion, proper monitoring, and adequate counseling to counter exaggerated reports about the dangers of the device, to reassure patients about the side effects, or overall to obtain sustained high rates of

insertion and retention. For various reasons, oral contraceptives have never been authorized for use in India." This was the harsh judgment of Ansley Coale, an expert on the Indian demographic situation.[52] The only aspect of the program which enjoyed a degree of success was sterilization, the frequency of which increased dramatically in 1976–7 (8 million sterilizations in two years as compared to an average of 2 million per year in the period just before). After Gandhi's defeat, however, the sterilization program came to a sudden halt and has only shown signs of recovery in recent years.

The 1980s should have signaled a new strategy, concentrating not only on family planning but also on those aspects of social and economic development which favor fertility decline: increasing age at marriage, raising the status of women, improving female literacy, enhancing child survival, alleviating poverty, and providing security for old age.[53] These good intentions, however, have had little effect. In spite of increased resources, the 1980s witnessed "a steep decline in the quality of family planning and public health practice" due to the increasing role played by bureaucrats as opposed to specialists.[54] At the end of his term as prime minister, Rajiv Gandhi issued sharp criticism of population policy failure in India, citing excessive bureaucratic centralization of the program which allows little flexibility in a country characterized by vastly differing needs.[55] In recent years, the government seems to have adopted a more diversified approach: couples are provided with information on a broad range of family planning methods, and the family planning targets set in various districts have been eliminated in order to dispel fears of coercion. A survey of 1998–9 (National Health Family Survey) estimated a total fertility rate of 2.9 (against 3.4 as measured by a similar survey of 1992–3); 5 women out of 10 use contraception, mainly sterilization; about four-fifths of all contraceptives were obtained from public sources. New steps, then, have been made in spite of the uncertain role of government actions. In Andhra Pradesh – a populous state, approximately the size of Germany – *TFR* for the three years preceding the survey was estimated at 2.25, down from 4.1 in 1971, notwithstanding an educational level below the Indian average and a median marriage age of 15 years, well below the legal age of marriage. About 60 percent of fertile women were users of contraception, up from 47 percent six years before.

With a population that at the 2001 Census amounted to 1.027 billion, and with a 1.5 percent growth rate, the Indian government is wary of the nation's demographic future, even if in the south of the country (Tamil Nadu, Kerala, Andhra Pradesh) reproduction is under control (*TFR* about or below replacement). Recently the government has offered incentives to couples having no more than two children. More precisely, incentives are aimed at couples living in poverty who postpone marriage after the legal age of 21 and have no more than

two children, or spouses who undergo sterilization after the birth of the second child. The Indian government, aware of the fierce popular opposition to coercive policies, affirms that the new population policy will refuse coercion and force and will be based on "informed consent and democratic principles."[56]

The history of government family planning programs in China differs considerably from that of India.[57] In 1949 Mao declared: "China's vast population should be viewed as a positive asset. Even if it should multiply many times, it will be fully able to resolve the problems created by this growth. The solution lies in production ... Revolution and production can resolve the problem of feeding the population."[58] However, as the revolution was consolidated and the results of the 1953 census became known, concern over the population problem began to emerge. At the Eighth Party Congress in 1956 Zhou En-lai's speech included these remarks: "We all agree on the desirability of adopting measures favoring birth control, both for the protection of women and children and to ensure that the younger generations are brought up and educated in such a way as to guarantee national health and prosperity."[59] This first birth control program required the creation of an assistance network, the production of contraceptives, and a plan to encourage the population to use these birth control services and devices. However, demographic prudence was not in keeping with the ambitious socioeconomic program of 1958/9 – the Great Leap Forward – and the attendant blind faith in gigantic productivity goals. As a result the program came to a sudden halt; but after the failure of the Great Leap Forward, poor harvests, famine, and the high mortality of 1959–61, a second campaign was launched with the creation of a Department of Family Planning. This second campaign, which among other things introduced the IUD and advocated later marriage, was essentially suspended during the Cultural Revolution. It was only with the return to normality in 1971 that the third campaign began, based on the three principles of later marriage, longer birth intervals, and fewer children. Later marriage meant, for women, 23 years of age in rural areas and 25 in the city; longer intervals meant 4 years between the first and second child; and fewer children meant no more than two children in the city or three in the country. In 1977 the latter limit was lowered to two for both city and country. The unquestioned success of this program in the 1970s was due to a system of birth quotas: "According to this system, the Chinese government began to establish annual numerical objectives for the natural rate of population increase in each province ... Provincial authorities and prefects, in turn, translated their assigned rate into a birth quota, distributing this quota among the prefectures and counties under their jurisdiction. This process continued on down until it reached the work team or its urban equivalent."[60] Within these groups, couples planning to have children met

with group leaders to determine which were entitled to have a child the following year. About half of the couples practicing birth control used an IUD, about a third used sterilization, and the remainder chose a variety of other methods, including a considerable proportion using steroids.[61] Abortion also became widespread and easily obtainable, free of charge, and did not require the husband's consent.

After Mao's death and the defeat of the Gang of Four, demographic objectives became both more explicit and more ambitious. During the second session of the Fifth National People's Assembly in 1979, Hua Guofeng affirmed that a large reduction in demographic growth was one of the essential conditions for the success of the "four modernizations" (of agriculture, defense, industry, and science and technology). Initially, the aim was to reduce the rate of natural increase to 0.5 percent in 1985 and zero in the year 2000. In September, 1980, Hua updated these objectives, the new goal being to not exceed 1.2 billion in 2000. In order to accomplish this a birth limit of one child per couple was established in 1979, with exceptions for ethnic minorities, border areas, and couples in special situations. A series of incentives and disincentives has been introduced in order to meet this difficult goal. The primary tool has been the one-child certificate, issued by local authorities, which guarantees a series of benefits for couples and their children in exchange for the commitment not to have more than one child. The benefits include wage and pension increases, larger dwellings, free medical care, and priority for the child in school. Couples who refuse to cooperate and give birth to a second, or worse a third, child are penalized in the form of wage cuts, revocation of privileges, and other disincentives.[62]

The Chinese one-child policy has been pursued with varying intensity. Until 1983, pressure increased as coercive methods were implemented on a vast scale. The resulting protests and discontent, however, led to a period of uncertainty. On the one hand, recognition of the growing number of women of reproductive age born during the period of fertility increase which followed the catastrophic Great Leap Forward (between 1983 and 1993 the number of women aged 21 to 30 increased from 80 to 125 million) argues for maintaining the policy;[63] on the other hand, the protest and resistance of a population denied one of the most basic of human rights urges its relaxation. The 1990 census counted 1.134 billion Chinese and reveals that the official goals will not be easily realized. Until 1985, government policy continued to target a population not over 1.2 billion by the year 2000, but this formula has since been made more elastic, calling for "about 1.2 billion," which in practice means that the ceiling has been lifted to 1.25 billion. This limit was also officially revised to 1.3 billion (the United Nations has estimated at 1.275 billion the population at

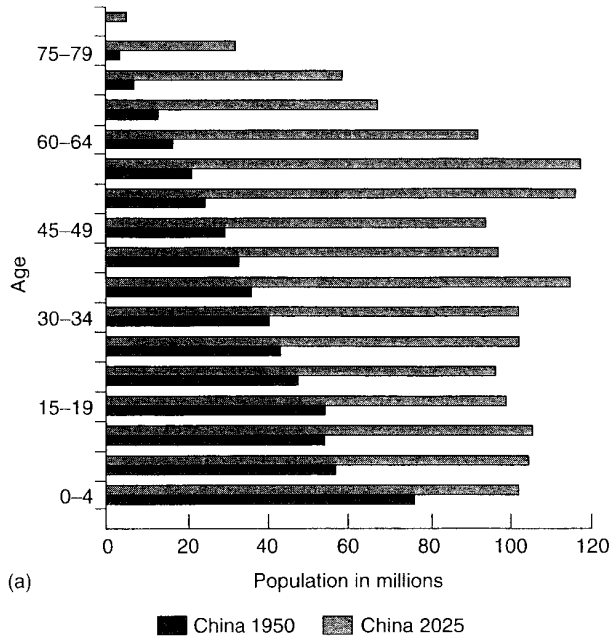
mid-2000, very close to the 1.265 counted by the Census in the same year).[64] The 1980s were indeed characterized by several examples of the relaxation of the policy: the progressive extension of the right of rural couples to have a second child when the firstborn is a girl, or permission granted on special, probably discretionary, grounds, or because the family lived in a remote area or had special characteristics.[65] Fertility decline stopped in the first part of the 1980s and fertility even increased between 1985 and 1987 (*TFR* grew from 2.3 to 2.5). The dismantling of the socialist collectives, which were an essential tool of family planning policies, "led to an erosion of cadre power and a breakdown of the system of economic incentives and disincentives on which policy enforcement had been largely based."[66] Moreover, the process of economic liberalization and the general attenuation of public control over individual behavior increased the obstacles to full implementation of the policy. Nonetheless, at the beginning of the 1990s the Chinese leadership renewed its commitment to the one-child policy, leaving the regulations intact and strengthening their implementation: a nationwide fertility survey put total fertility at 1.9 for 1992, well below the average level of the 1980s. Apparently this new party-led drive enjoyed success, reinforcing commitment to family planning at all levels and responsibility systems, strengthening economic incentives and penalties, introducing old-age insurance schemes, and so on.[67] Continuing rapid economic growth and associated social change have also influenced reproductive norms and values, thus facilitating the task of policy-makers. Now that low fertility has been achieved it is the opinion of many that the old coercive policy must be phased out. Many provinces now offer exemptions to the one-child commitment to young people who have no siblings. When two of these young people marry, they will be allowed to have two children. According to the current (2005) legislation, the one-child policy is strictly enforced in six provinces and regions under the direct jurisdiction of the central government (among which are Beijing, Shanghai, and Tianjin), representing 35 percent of the total population. The policy allowing couples whose first child is a girl to have a second child applies to 54 percent of the population. The residual 11 percent is made up of peripheral populations composed of ethnic minorities that are allowed to have two and even three children. If these rules were severely enforced, the *TFR* of the Chinese population would be 1.5. At the basis of the phasing out of the policy there are three considerations: the first is that low-fertility preferences are now well rooted in the couples' behaviors and that, at the same time, coercive policies may enter into a collision course with the aspirations and the modes of life of the young generations. The second consideration is that the combination of the one-child policy and of the deeply rooted aspiration to have a male heir has

strongly altered the sex ratio at birth, now close to 120 (against a natural level of 105–6; it was 108 in 1982). This is the consequence of sex-selective abortion and of the higher infant and child mortality of baby girls in comparison with the boys of the same age, because of various forms of child neglect and discrimination. The third element is that very low fertility is altering the age structure, accelerates the aging process, and weakens the support system of the older population. There will be an acceleration of the aging process in the second and third decades of the twenty-first century, when the numerous cohorts born in the 1950s and 1960s will enter old age (population over 65 was 7 percent of the total population in 2000 and will grow, according to projections, to 23 percent in 2050). The lack of an extended pension system and the fact that the traditional support – a male child – may either not exist or may have migrated far from his aged parents, will erode the societal support of the older generations and cause an explosive problem in the coming decades.[68]

In spite of great difficulties, Chinese demographic policy has clearly realized goals not even approached by the other Asian population giant. The reasons for this success are many, but may be summarized by the following four points:

1. Chinese social transformation has proceeded more quickly and efficiently in the area of public health care. Mortality as a result has declined more rapidly than in India, favoring fertility decline.
2. In the Chinese political system, the authority of the Communist Party ruling group extends through all levels of the administrative hierarchy down to the production squads. This system has allowed for the quick execution of demographic policy directives, a task facilitated by effective propaganda and indoctrination.[69]
3. An efficient distribution and assistance network has been established, employing a variety of birth control methods, including abortion.
4. Chinese society may be more receptive to fertility limitation. Other East Asian societies, linked to some degree to the Chinese, have experienced rapid fertility decline in a variety of socioeconomic contexts; these include Japan, Taiwan, South Korea, Singapore, and Hong Kong.[70]

The age structures for China and India in 1950 and 2025 (the latter according to the United Nations projections which, incidentally, do not predict full realization of Chinese goals) are compared in figures 5.11a and 5.11b. In 1950 the shape of these structures is similar and China has a larger population in each age group: 555 million total in China as opposed to 358 million in India, a difference of almost 200 million (+55 percent). In 2025 the population of China will be smaller than that of India in each age group up to age 35 as a result of more rapid fertility decline since 1970 (a total population of 1.441 billion in China and



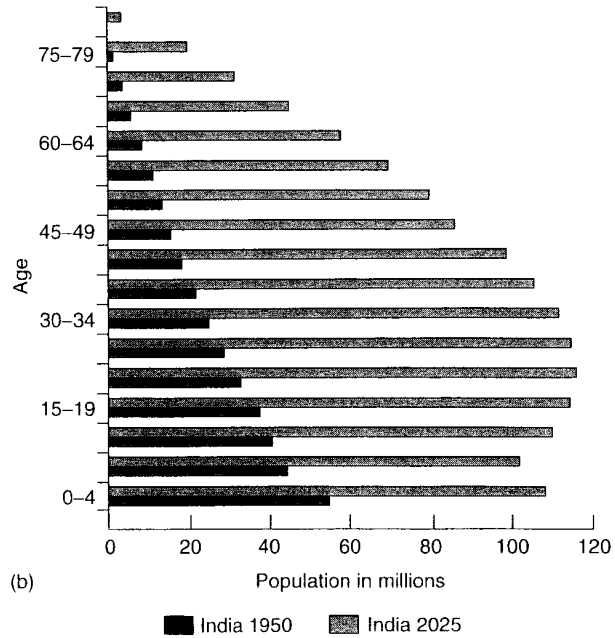


Figure 5.11 Age structure in: (a) China (1950 and 2025); (b) India (1950 and 2025)

of 1.352 in India). Only at the older ages will the Chinese population be much greater than that of India. Between 1950 and 2025 the population of India will almost quadruple, while that of China will increase by a factor of less than three, and in 2030 India will have surpassed China in demographic dimensions.

It is too soon to make an historical evaluation of the demographic paths undertaken by the two Asiatic giants. The rapid deceleration of demographic growth in China has probably made a relevant contribution to the spectacular economic development since the 1970s, but the country will have to be ready to absorb the shock of rapid aging in the coming decades as well as the political heritage of a coercive regime. On the other hand, India's sustained population growth has probably been an obstacle to the modernization of the country and worsened many social problems, although it has not impeded the acceleration of economic growth and may spare the country the shock of violent changes in the age structure.

6 Fertilia and Sterilia

"In the tropical region of a large continent lie the two bordering lands of Fertilia and Sterilia, which have in common a primarily agricultural economy pursued in the more temperate highlands. Sterilia has an outlet on the sea where its principal city is found. It has for centuries been a center of maritime commerce and trades with countries near and far, including a former colonial power. Sterilia's population is, especially in the coastal region, ethnically mixed as a result of the several currents of immigration which have peopled its shores. Fertilia, on the other hand, landlocked and extending to the interior of the continent, is characterized by ethnic homogeneity and a traditional culture. Politically it is dominated by an upper class of large landowners, and contact with the outside world is minimal. At the time of decolonization, which occurred contemporaneously in the two countries, the two populations were about the same size and had similar demographic characteristics: fertility was high and uncontrolled and mortality, though high by western standards, had nonetheless declined considerably thanks to the introduction of penicillin and the elimination of malaria by DDT spraying in the colonial era. As a result, both of the countries had high rates of growth, between 2 and 3 percent. Independence brought a coalition backed by the large landowners to power in Fertilia, while the merchant class gained hegemony in Sterilia. In addition to trade liberalization, one of the first political acts in Sterilia was the initiation of a vigorous family planning program, spread throughout the country by a system of internal communi-

cations and supported by foreign investment. A trained corps of personnel and a mobile network of consultants were quickly established. Other measures included liberalized abortion and sterilization, subsidies for contraceptives, and incentives for participation in the program. We shall probably never be able to determine whether this program was actually the cause of the profound changes in reproductive behavior which followed or else simply accelerated a transition already on the verge of initiation. In either case, fertility declined quickly, soon reaching replacement levels. By comparison, the more traditional government of Fertilia, influenced by fundamentalist religious groups and ruling a population little exposed to foreign contact and trade, only formally recognized the UN directive to respect the right of every couple to decide how many children it wanted. In spite of pressure from the ex-colonial power, which provided considerable economic aid, no active family planning policy was initiated and, if anything, the government blocked similar programs advanced by private concerns. Birth control spread slowly and, 30 years after independence, the women of Fertilia bore on average two children more than those of Sterilia.

"These two policies have affected the demographic growth and economic development of these countries very differently. The demographic consequences include divergent rates of growth and age structures. Equally populous at the time of independence (which, however, was referred to as the Revolution in Sterilia), the ratio was 1.4-to-1 after 30 years (in favor of Fertilia naturally) and 2-to-1 after 60. In Sterilia, population under the age of 15 accounted for 42 percent of the total at the time of the Revolution; after 30 years this figure had dropped to 27 and after 60 to 21 (at which time the growth rate was about zero). In Fertilia, on the other hand, the under 15 proportion, equal to that of Sterilia at the time of independence (42 percent), declined more slowly, representing 38 percent of the total after 30 years and 30 percent after 60. At the latter date population growth was still running about 1.5 percent per year. By contrast, 60 years after the Revolution the proportion of the population over 65 in Sterilia (12 percent) was double that in Fertilia.

"Differences in economic development have been equally significant. The high rate of growth in Fertilia has led to the quadrupling of the working-age population with an attendant high level of agricultural underemployment. Strong currents of migration flow primarily toward the capital city, which has become a sprawling megalopolis crowded with impoverished masses. Given the still large average family size, the average Fertilian's small income goes almost entirely to obtaining the necessities of survival, leaving little for savings; this is to the detriment of investments, which only barely keep pace

with population growth. The meager financial resources commanded by the government have been insufficient to expand infrastructure and services. In particular, the spread of education has been slow: in spite of the (slow) fertility decline, the school-age population, between the ages of 5 and 15, has tripled in the 60 years considered. The combination of a slow rate of agricultural development and a high rate of urbanization has transformed the country from an exporter of tropical products to a net importer of foodstuffs. Lack of investment has inhibited the development of its fragile manufacturing industry, and the country has accumulated an enormous foreign debt. The growth of per capita income has been small, and the absolute number (if not the percentage) of the marginally poor and illiterate has increased dramatically.

"Sterilia's recent history differs substantially from that of Fertilia. Fertility limitation has ensured that, during the 60 years since the Revolution, the size of Sterilia's school-age population has remained constant (as opposed to its tripling in Fertilia), which has enabled public monies to be used for considerable expansion and improvement of the education system. As a result, succeeding generations entering the labor market have been both smaller in number and better trained than in Fertilia. Labor force efficiency has increased rapidly, fueling development in both the traditional and modern sectors of the economy. Birth control has also meant smaller families and so more rapid emancipation of women and the possibility for personal savings of those resources no longer completely absorbed by basic needs. Greater savings have allowed investments to outpace demographic growth, making infrastructure modernization, greater agricultural production, and economic diversification possible. Moreover, changes in age structure have notably reduced the dependency ratio (the number of nonproductive members of society – the old and the very young – per 100 productive members), and this too has favored economic development. This same process has proceeded much more slowly in Fertilia. Lower levels of population increase and urbanization and above all improved agricultural productivity have ensured that Sterilia remains a net exporter of foodstuffs, which has helped to finance the purchase of machinery for the development of the manufacturing industries. Per capita income has grown rapidly and, 60 years after the Revolution, Sterilia has half the population of Fertilia, a larger gross national product, and a standard of living envied by its neighbor."

The preceding passage is an invention on the part of the author, but might be taken from the work of an historian attempting to describe and interpret the recent past of these two countries, also purely imaginary.[71] Analyses of this sort have been frequent over the decades since World War II, during which the population growth rate of the developing countries has risen dramatically, making demographic increase a major contemporary concern. The contrast

between Fertilia and Sterilia serves to illustrate the paths which the poorer nations have followed in recent decades or might follow in the near future. However, the above analysis, while fairly convincing in its general line of reasoning, is less so for the basic assumptions that it takes for granted.

The first of these assumptions is that rapidly growing population inevitably leads to diminishing returns from labor and other factors of production and so to that capital dilution which, all things being equal, increases poverty; according to this formula, the slower population growth of Sterilia is clearly an advantage. The second assumption is that smaller families lead to the creation of savings and so greater investments, another point in Sterilia's favor. The third is that slower population growth means greater workforce efficiency and therefore greater productivity. And according to the fourth, factors of scale related to demographic size are of little relevance and so do not benefit the more rapidly growing population. Similarly, population increase is assumed to have no positive effect on technological progress. In short, success at limiting demographic growth must be a determining factor of economic development. It should follow, then, that demographic growth and economic development since the 1960s or 1970s relate inversely to one another.

This final point, which sums up the previous ones, can be put to a first-order test. It is a fairly crude test, analogous to that made in chapter 4, section 7 for the western countries, comparing population growth rates and per capita income for 28 poor countries.[72] I need not repeat here the cautions I have already expressed at some length regarding this exercise.

Figure 5.12 plots the population growth rate against the per capita GNP growth rate for the period 1975–2000. Contrary to other exercises covering previous periods, there is a relatively close inverse association between the two variables. In figure 5.13, the population rate for the period 1950–75 is plotted against the GNP growth rate for 1975–2000, in keeping with the hypothesis that the intensity of population growth influences GNP growth with a certain delay (about two decades, corresponding to the approximate interval between birth and entry into the labor force). Now the inverse association is much less evident, almost lost in the cloudlike dispersion of points. Finally, figure 5.14 compares demographic and economic performances during the entire period 1950–92, and a weak inverse association seems to emerge. These tests indicate that this connection between population growth and development is blurred by a series of factors which probably cancel one another out. It also indicates that demographic growth has probably not been an insurmountable obstacle to increasing well-being and that, for diverse and complicated reasons, those factors which seemed so clearly at work in Fertilia and Sterilia have in fact operated in a much less clear fashion in recent decades.[73] I shall turn to this problem in the pages that follow.

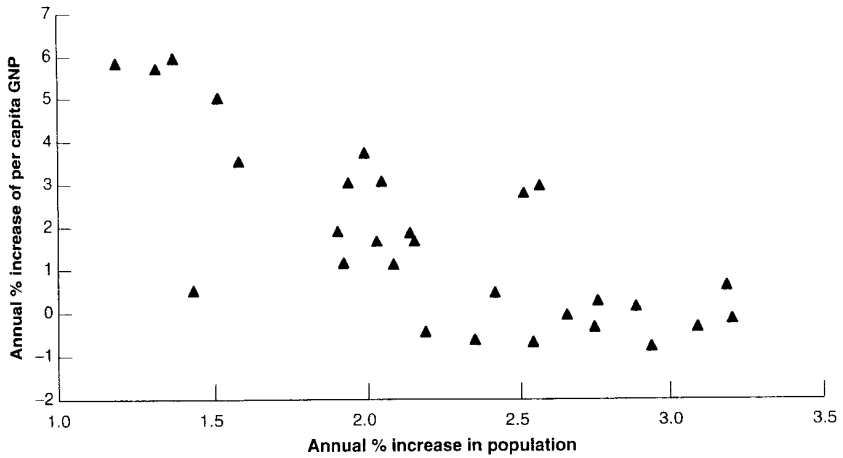


Figure 5.12 Annual percentage increase in population and per capita GNP in 28 major less-developed countries (1975–2000)

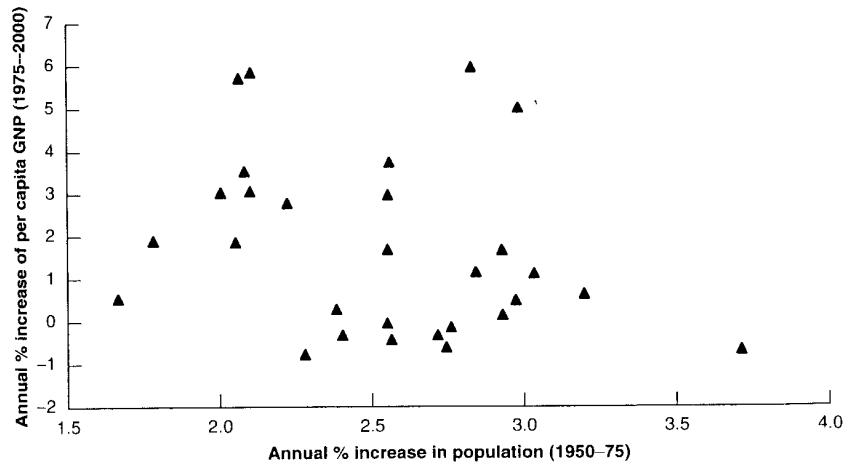


Figure 5.13 Annual percentage increase in population (1950–75) and percentage change of per capita GNP (1975–2000) in 28 major less-developed countries

7 Explaining a Paradox

Considerable debate has arisen over the fact that the model relationship between demographic growth and economic development underlying the

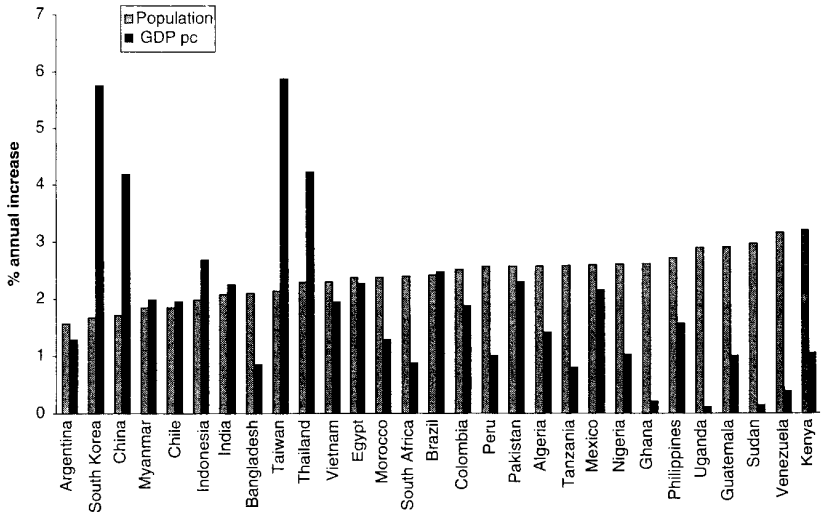


Figure 5.14 Annual percentage increase in per capita GDP and population in 28 major less-developed countries (1950–2000)

examples of Fertilia and Sterilia is difficult to verify (as crudely demonstrated by figures 5.12–5.14). As a result, scholars have sought both empirical verification for the theoretical premises on which the model is based and explanations for the lack of confirmation.[74] It was in the 1980s, when it became universally accepted that population growth must be controlled – at the 1984 United Nations Conference in Mexico – and that fertility control was considered a goal in and of itself and not subordinate to others, that the existence of an unambiguous relationship between the phenomena of demographic and economic growth also began to be questioned. This is not surprising, however, since the idea of limiting growth has been accepted as a worthy goal in and of itself, independent of empirical verification.

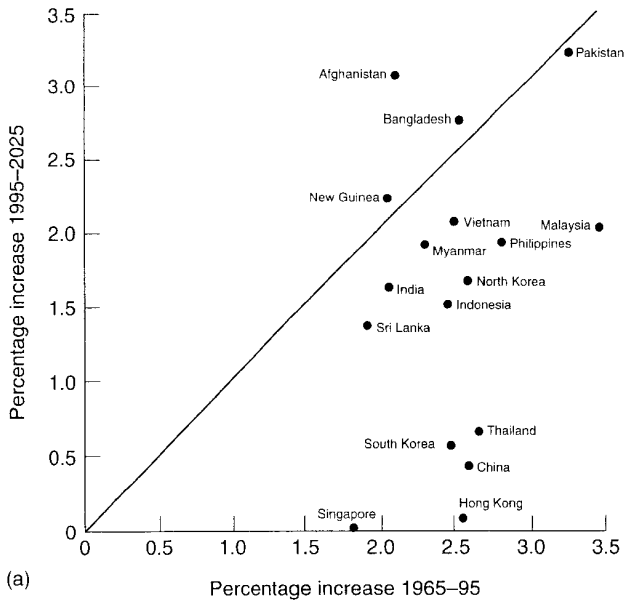
Returning to the heart of the problem, faster demographic growth – that of Fertilia as compared to Sterilia – is considered harmful to economic growth for a series of reasons. In simplified form they are:

1 The stock of physical capital (that is, capital goods such as tools, machinery, infrastructure, and buildings) per worker declines, or is "diluted," by the addition of new units of population. As a result, per capita production also declines.[75] Fertilia, growing more quickly than Sterilia, suffers from this handicap, which could be overcome if its rate of investment (the proportion of GDP dedicated to investment) were to increase. This increase, however, can only come about if a smaller proportion of income is devoted to consumption, which in turn is linked to the standard of living. Table 5.6 reports absolute values of gross investment for a number of countries as well as investment as a percentage of GDP and per capita investment per each potential additional worker between 1995 and 2000. Investment available per each additional worker in poor countries varies from a minimum of $2,000 in Bangladesh to $485,000 in South Korea, but even the latter is much lower than investment per worker available in the United States. The problem for the poor countries (especially those with high rates of natural increase) is made worse by the fact that over the next decades their work forces will expand at rates far above those of the rich countries and so, in order to reduce the gap between them, they must not only match but exceed the rich country rate of investment increase. However, as far as variation of the labor force is concerned, prospects in less-developed countries vary considerably. Figure 5.15 compares the annual rate of increase of the labor force in Asia and sub-Saharan Africa in 1965–95 with the same rate estimated for 1995–2025. For the majority of Asian countries (a) future rates are well below past rates, while the reverse is true for sub-Saharan

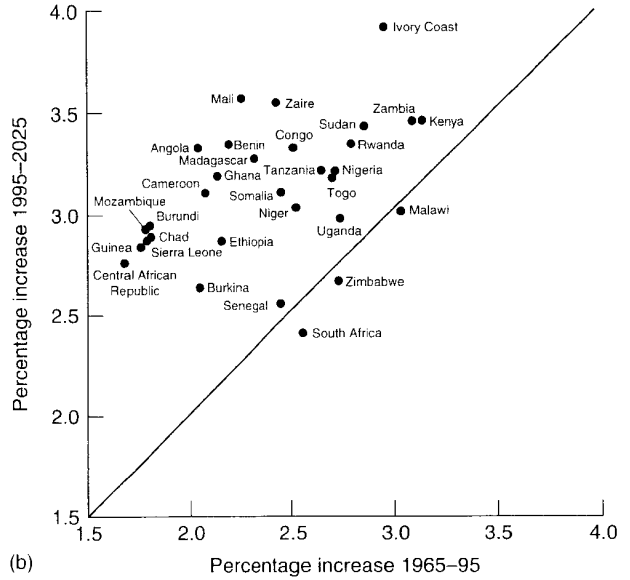
Table 5.6 Gross investment and working-age population, selected less developed countries and the USA

	Gross domestic investment, 1997		Annual increase of working age population (millions, 1995–2000)	Gross investment per potential additional worker ($ thousand)	% increase of working age population, 2000–10
Country	**% of GDP**	**$ billion**			
China	35	369	9.9	37	12.6
India	25	93.6	13.1	7	21.7
Bangladesh	17	5.6	2.41	2	24.0
South Korea	35	169.8	0.35	485	11.2
Thailand	41	69.5	0.61	114	11.5
Nigeria	21	6.4	1.63	4	29.6
Ethiopia	20	1.3	0.7	2	31.4
Egypt	28	19.9	1.09	18	27.5
Brazil	20	154.7	2.24	69	16.3
Mexico	21	73.2	1.31	56	20.6
Bolivia	18	1.3	0.14	9	29.8
USA	18	1,384.2	1.87	740	9.8

Sources: World Bank, United Nations.



(a)



(b)

Figure 5.15 Past and future labor-force growth in: (a) Asia; (b) sub-Saharan Africa

Africa. In this latter group of countries available investment will encounter an accelerating supply of labor (in many cases with rates of increase exceeding 3 percent a year), while in Asian countries the labor force supply will decelerate (many countries with rates below 1 percent).

2 When natural resources – especially land and the water necessary to make it productive – are scarce or expensive, they too are affected by excessive population growth, suffering the progressively diminishing returns which we have already discussed at length (see chapter 3, section 1). During the decade 2000–10 the agricultural population of working age will continue to increase rapidly in many Asian countries already characterized by very high densities of agricultural population, a high level of landlessness, and small average holdings among the landed. As rural population increases, "the implications will be grim. Arable land per farmer will decline even further, lowering labor productivity and income, increasing the incidence of rural poverty and exacerbating inequality."[76]

3 Human capital, as expressed by the physical and technical efficiency of the population, is subject to rules similar to those applying to physical capital. If, for example, Fertilia and Sterilia invest the same percentage of GDP in social programs (education, but also public health) at the beginning of their demographic transitions, then the subsequent and growing difference in the size of the school-age populations will be such that while in Sterilia education can expand and improve without increasing this percentage, the same can only occur in Fertilia if the percentage increases (at the expense naturally of other investments or consumption).[77] Increased education has beneficial effects on development, and this effect is particularly strong with the transition from illiteracy to primary education.[78]

4 Rapid growth may create a general distortion of public spending. As literacy and public health are generally given priority, a rapidly growing population may require that a larger portion of the overall budget be set aside for these needs than is the case for a population growing more slowly.[79] Fewer resources remain for investment in fixed capital, generally considered more profitable in the short or medium run, and so growth is less than it would otherwise be.

5 Rapid demographic growth also inhibits the creation of family savings. These in turn represent a significant portion of the private savings which determine the resources available for investment.[80] Rapid growth implies high fertility and large families. As a result family income is devoted primarily to satisfying basic needs, leaving only a few cents for savings. As the number of children per family declines, a larger percentage of family resources becomes available for savings, and so for investments. The link to economic growth is clear.

6 Several of the previous points suggest that population increase (or increase of the absolute dimensions of the economy) does not generate positive factors of scale. In other words, a larger population would not create better conditions for the use of the factors of production (natural resources, capital, labor).[81]

In order to verify the above points (which are simplifications of much more complex theories), we should be able to detect a negative relationship between demographic growth and economic development over the past decades. If we have been unable to do so, it is because the diverse situations of the poor countries and their often stormy political, economic, and social histories have altered, often in unexpected ways, the above mechanisms.

Consider the investments in fixed capital that make an important contribution to development in poor countries: for the period 1960–87 it has been estimated that about two-thirds of output growth was the result of increased input of capital as compared to one-quarter due to labor and one-seventh to total factor productivity or technical progress. In industrial countries, the contribution of fixed capital in the same period was much lower and estimated at between one-quarter and one-third of total growth.[82] All things being equal, there should in principle exist a thinning effect on capital per worker in more rapidly growing populations.[83] Many countries, particularly the poorest ones, have managed just the same to increase the percentage of their GNP devoted to investment: According to the World Bank, low-income economies increased this share from 20 to 30 percent between 1970 and 1993.[84] In this way the "thinning effect" on capital exerted by rapid population growth has been at least partially neutralized.

With regard to fixed natural resources, especially land, the agricultural expansion that has enabled the developing countries as a whole to increase agricultural production at a greater rate than population is primarily due to increasing yields (the "green revolution"), rather than the cultivation of new lands.[85] In fact, the introduction of green revolution technology in many areas has been aided by high population density, which favors infrastructure development and technology transfer.[86] In other areas, however, the scarcity of land and its high cost have created serious obstacles.[87]

Recent studies have also cast doubt on the theory that rapid demographic growth alters the proportions of public spending, favoring "social investments," especially education, at the expense of investments in fixed capital. According to some, poor country rates of demographic growth have not affected the progress of literacy and education, nor have they distorted public spending to the detriment of investments in fixed capital. More economical use of available resources (for example, limiting teachers' salaries) has allowed for the realization of goals in spite of high demographic pressure.[88] In the period since 1980, an increased proportion of resources in many countries has been channeled to education.[89]

With regard to the creation of savings, both theoretical and empirical considerations challenge the assumption that rapidly growing population necessarily implies a lower rate of saving due to larger family size. Several possible mechanisms seem to neutralize this effect. The first is that adult labor intensity within the family does not remain fixed, but changes in response to changes in family size. A larger number of dependent children leads to intensification of productive activity (particularly in rural areas), an increase in resources, and so perhaps also of savings.[90] In his classic study of peasant economies, Chayanov noted a clear relationship between the number of dependants per worker and labor intensity in peasant families of Tsarist Russia. Intensity increased as families grew and declined as they shrank.[91] In the second place, there is a higher ratio of young workers (who save) to old or retired workers (who have negative savings) in a rapidly growing population, and this effect tends to balance out the negative impact on savings of a large number of dependent children.[92] Finally, family savings in poor countries come primarily from a few very rich families and so are little influenced by family size. As things stand, the numerous tests of the relationship between demographic growth (not to mention age structure, dependency ratio, and so forth) and the rate of savings have not yielded significant results. Opposing forces seem to neutralize one another, and it may also be the case that insufficient data play an important role in the inconclusiveness of results.[93]

The final point concerns possible economies of scale, which I have already discussed (see chapter 3, section 5). Those who support the hypothesis of a negative correlation between demographic growth and economic development believe these to be nonexistent or at least irrelevant. Others, however, hold that population growth and increasing density have fueled the development of infrastructure (especially communications and transportation) necessary to economic development.[94] As mentioned above, in many countries agricultural development and the green revolution seem to be helped rather than hindered by higher demographic density, and so factors of scale, in a broad sense, seem to exercise a significant positive influence. One should also add the fact that the geographic situation of a country, its climatic and biopathological environment, its accessibility and natural conformation, and its endowment of primary resources, closely interact with the demographic and economic characteristics.[95]

The problems raised by consideration of the relationship between population and economy are intricate and involve variables whose interaction and causal relationship with other factors are neither stable nor well understood. The above discussion may help to explain why the evolution of the relationship between population and economy in recent decades escapes simple theoretical schemes. The extreme adaptability of human behavior, both

demographic and economic, in the face of external limitations confounds the simplifications of those who would like to translate this behavior into simple formulas for the sake of easy analysis. In addition, the helter-skelter progress of technology blunts, expands, and distorts relationships often taken for granted.

Nonetheless, the fact that a clear and direct relationship between demographic growth and economic development is not readily discerned does not mean that it does not exist nor that it is ultimately unmeasurable. The conclusions reached by A. C. Kelley in his in-depth study of this problem are relevant: "Economic growth (as measured by per capita output) in many developing countries would have been more rapid in an environment of slower population growth, although in a number of countries the impact of population was probably negligible, and in some it may have been positive. Population's adverse impact has most likely occurred where arable land and water are particularly scarce or costly to acquire, where property rights to land and natural resources are poorly defined and where government policies are biased against the most abundant factor of production – labor. Population's positive impact most likely occurred where natural resources are abundant, where the possibilities for scale economies are substantial, and where markets and other institutions (especially government) allocate resources in a reasonably efficient way over time and space."[96]

Therefore, between the demographic paths taken by Fertilia and Sterilia, the choice will generally be for that of Sterilia, though we should keep in mind that this choice may not always be a successful one.

6

The Future

1 Population and Self-Regulation

Two centuries ago, in the process of achieving greater demographic order and efficiency, the human population embarked upon an unprecedented cycle of growth. And while this cycle is now coming to an end in the rich countries, it is still in full swing in the poor ones. World population hit the one billion mark as steam engines began to revolutionize transportation; the second billion was reached after World War I, as airplanes became an ever more common means of transportation; the third billion was achieved at the beginning of the aerospace era. The fourth and fifth billion marks did not wait for similar revolutionary epochs and were reached in 1974 and 1987; and the sixth was achieved in 1999. Many demographers, sure of winning, would be willing to bet that the seventh billion will not be reached before 2013, and that the eighth will come before 2030. The combination of current young age structures and high fertility ensures that these levels will be easily reached within this time frame. Longer-term prediction rapidly loses certainty, becoming eventually a purely mathematical exercise. This uncertainty, however, will not deter us from considering potential population growth well into the twenty-first century.

Many view this growth process like a spring that is ever more tightly compressed, ready at the first jolt to unload an accumulation of devastating force. From an economic point of view diminishing returns must sooner or later lower living standards, since land, water, air, and minerals are all fixed and limited resources, allowing only partial substitution and therefore bound to place a limit on growth. The link between demographic growth and environmental deterioration also seems clear, judging from the pollution caused by