CHAPTER 5

One Billion and Counting: The Hidden Momentum of Population Growth in India

INTRODUCTION

Sometime in late 2011, the number of people living on planet Earth reached 7 billion. After reaching the 1 billion mark somewhere around 1800, the world' s population reached 2 billion around 1930 (130 years later) and then, in each of the following years, added another billion: 1960 (30 years), 1974 (14 years), 1987 (13 years), and 1999 (12 years). Every second there are about 4.3 births and 1.8 deaths, and thus an additional 2.5 people on the planet.

Most of the world 's population lives in the less-developed countries of Asia, Africa, and Latin America. From 1950 to today, the combined populations of Asia, Africa, and Latin America have soared from 71 percent of the world' s total to 84 percent, and they are expected to comprise 87 percent of the world' s forecasted 10 billion by 2100 (Figure 5 .1) . In this chapter you will learn why the world 's population is growing so fast, why this growth is concentrated in less-developed countries, and what are some of the factors that go into population forecasting.

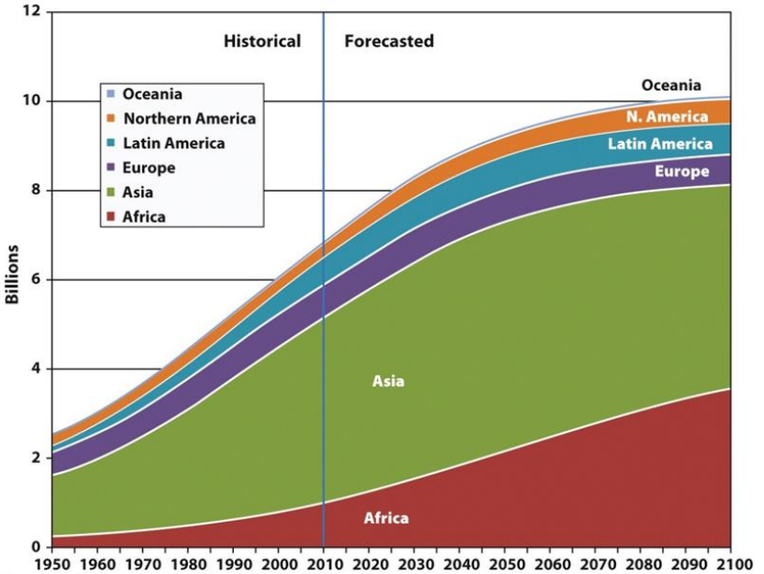

Figure 5.1 A s you look at these historical data and the forecast to 2100, keep in mind that population forecasting is an inexact science. This graph shows the medium variant of the United Nations forecast, with a population of 9.3 billion in 2050 and just over 10 billion by 2100. This medium variant is sandwiched between a high estimate of 15.8 billion and a low estimate of 6.2 billion. In the high variant, population would still be growing at almost 5 million per year in 2100; in the low variant, population would have peaked in 2045 and would undergo a substantial decline by 2100. Source: United Nations, Department of Economic and Social Affairs, Population Division, Population Estimates and Projections Section: esa.un.org/wpp/unpp/panel_population.htm.

The size, composition, and growth of populations affect the economic and environmental well-being of nations. Rapid population growth in regions such as Asia, sub-Saharan Africa, and the Middle East requires huge commitments of national resources for food, housing, education, and health care and

exacerbates problems of poor air and water quality, soil erosion, deforestation, and desertification. Not all countries today are growing too fast, however. Many European countries are experiencing negative growth or population decline. These countries devote considerable economic resources to support large elderly populations. About 16 percent of western Europe' s population currently is over 65 years of age, and this percentage is increasing steadily over time.

First, here are a few basics about the dynamics of population growth. Population change in any country results from four demographic forces: (1) births, (2) deaths, (3) immigration (people moving to a country), and (4) emigration (people leaving a country):

$$P_2 = P_1 + B - D + I - O$$

where: P_1 = population in time 1
P_2 = population in time 2
B = births
D = deaths
I = in - migrants
O = out - migrants

The formula shows that births (B) and in-migration (I) add to the base population (P_1) , while deaths (D) and out-migration (O) subtract from it. For many countries in the world (the United States is a notable exception), in-migration and out-migration do not contribute significantly to the overall balance sheet of population change. We therefore ignore them in discussions of current and future population change.

The **crude birth rate (CBR)**, the number of births per 1,000 persons, is a measure of the birth performance of a population. Similarly, the **crude death rate (CDR)**, the number of deaths per 1,000 persons, is an indicator of a population 's death experience. Both measures are called crude because they fail to account for the different age structures of populations. This explains why Germany has a crude death rate of 10 while Mexico has a crude death rate of 5. You would be incorrect in concluding that life expectancy, medical care, and the overall quality of life are higher in Mexico. Germany 's inflated crude death rate is a statistical artifact of its substantial elderly population. Some 21 percent of the German population is over 65 years of age, when the odds of dying are high. In Mexico a mere 6 percent of the population is older than 65 years. Relatively few Mexicans are in age classes where the likelihood of dying is high; thus, its crude death rate is low.

The **crude rate of natural increase** is the difference between the crude birth rate and the crude death rate. Take Burkina Faso in western Africa as an example. Burkina Faso 's crude birth rate of 43 and the crude death rate of 12 yield a crude rate of natural increase of 31. Keep in mind that these are rates per 1,000, so an increase of 31 per 1,000 translates into a growth rate of 3.1 per 100, or 3.1 percent. The U.S. crude birth rate of 13 and death rate of 8 result in a crude rate of natural increase of 5 per 1,000, or 0.5 percent. Ukraine 's rates are the reverse of those in the United States. The Ukrainian crude birth rate of 11 and crude death rate of 15 produce a crude rate of natural increase of –4 per 1,000, or –0.4 percent. If this rate were sustained, each year Ukraine 's population would be 0.4 percent smaller.

As these examples indicate, birth, death, and growth rates across the world 's countries vary markedly (Figure 5.2).

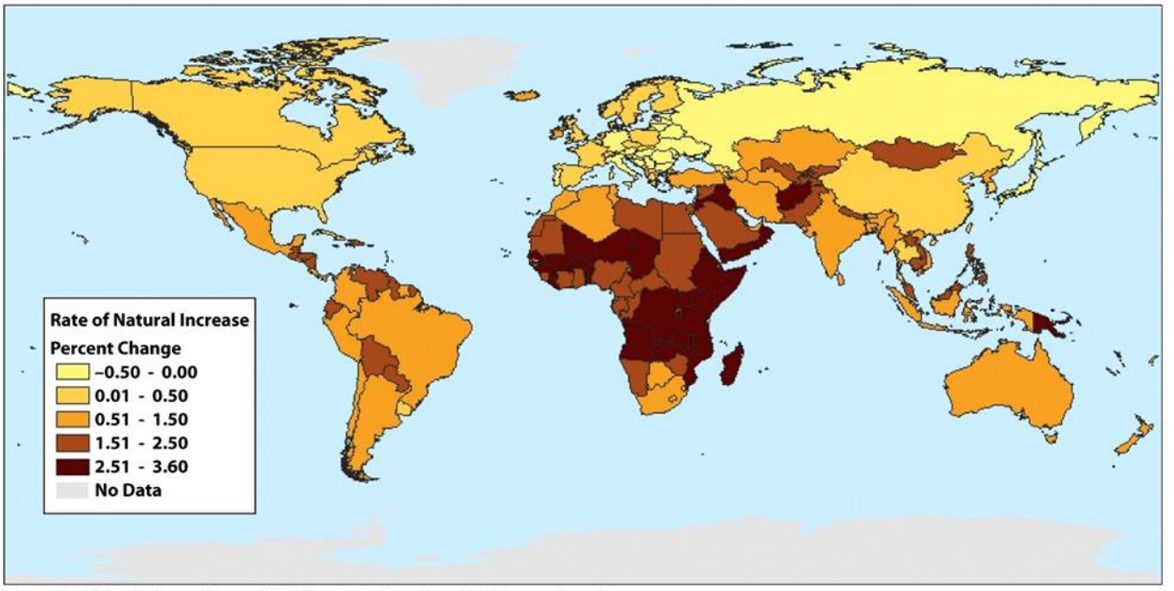

Figure 5.2 Annual rate of natural increase, 2011. Source: Population Reference Bureau, *World Population Data Sheet 2011* (www.prb.org).

Geographers and demographers use the **demographic transition model** as a framework for understanding the dramatic variations in birth, death, and growth rates worldwide. Based on the demographic history of European countries, the demographic transition model offers a generalized perspective of the way birth, death, and growth rates change through time.

The demographic transition model says that preindustrial populations begin with high crude birth and death rates, somewhere between 40 and 50 per 1,000 (Figure 5.3). These conditions hold in primitive societies where people die young from poor diets, inadequate housing, rampant contagious disease, and the absence of modern medicine. To keep from becoming extinct, societies have many children and high birth rates. High birth rates and high death rates maintain an **equilibrium**, a state in which the forces making for change are in balance. This balance is reflected in extremely low rates of population growth.

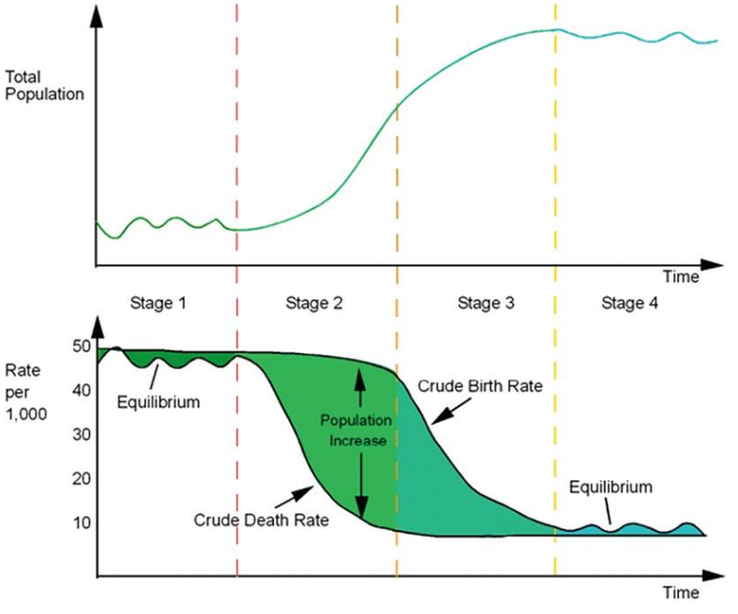

Figure 5.3 The demographic transition model.

Conditions of high birth and death rates and low growth prevailed for most of the time that humans occupied the Earth. From A.D. 1 to the time of the Industrial Revolution, the world' s population was nearly stable, trending slowly upward at a long-term rate of natural increase of only about 0.56 per 1,000 (Figure 5.4). High birth rates, high death rates, and low population growth characterize countries in the first stage of the demographic transition.

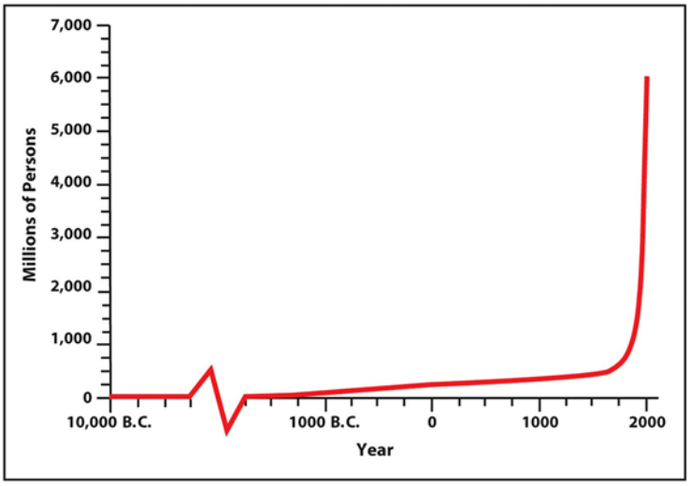

Figure 5.4 World population growth showing the rapid increase since the 1700s, which corresponds to the beginnings of the Industrial Revolution. Population growth before that time was very small. The zigzag you see shows a break in the data from 9250 BCE until 1750 BCE in order to extend the scale back to 10,000 BCE. (BCE = Before Current Era)

Modernization disrupts the balance between birth and death rates in the second stage of the demographic transition, which is characterized by declining death rates, continued high birth rates, and rapid rates of population growth. Death rates fall as food is transported from surplus to deficit regions, as housing improves, as knowledge about public health reduces contagious diseases, and as antibiotics, immunizations, and other innovations in science and medicine significantly prolong life. Birth rates, however, are slow to respond to the changing death situation because large family norms are deeply rooted in a society 's cultural traditions. In addition, in agrarian areas, children are economic assets to the family, fetching water, gathering firewood, working the fields, tending the animals, looking after smaller children, and caring for aged parents. Because the world' s population is still around half (49 percent) rural, it is not surprising that many less-developed countries today are still in the second stage (Table 5.1).

In the third stage of the demographic transition, birth rates begin to fall in response to lower death rates, urbanization, and other changes associated with modernization. Fertility falls in modern societies as women derive status from activities other than childbearing and motherhood and as the cost of raising children mushrooms. Children in modern societies become economically active at much later ages than those in agrarian societies do, and they marry later. Families learn that it is no longer necessary to have six children if they want three of them to survive to adulthood. In addition, as literacy increases and contraceptive technology improves, people are better able to achieve their desired family size.

Ultimately, birth rates decline, and the demographic transition is complete. In the fourth stage, population returns to equilibrium, this time under conditions of low birth rates and low death rates. All more-developed countries are in the fourth stage of the demographic transition. In addition, China, with a crude birth rate of 12, crude death rate of 7, and growth rate of 0.5 percent, is moving rapidly toward stage 4. Table 5.1 shows some of the range in birth, death, and natural increase rates. There are no countries in the world today still in stage 1 of the demographic transition, or even in early stage 2: Crude death rates everywhere are below 17 per 1,000. The early twenty-first century finds countries in stage 2 that still have very high CBRs, countries in stage 3 with declining CBRs and low CDRs, and the more demographically stable countries in stage 4. Note the positive correlation between stage of the demographic transition and the percent urban, and the negative association between transition stage and the percentage of the workforce in agriculture.

TABLE 5.1 Key Population Indicators for Select Countries

Country	Demographic Transition Stage	Crude Birth Rate (per 1,000)	Crude Death Rate (per 1,000)	Rate of Natural Increase (percent)	Percent Urban	Percent of Workforce in Agriculture
Afghanistan		44	16	2.8	20	79
Niger	2	48	12	3.6	17	90
Laos		31	8	2.2	27	75
Brazil		15	6	0.9	87	20
Mexico		19	5	1.4	78	14
Philippines	3	25	6	2.1	63	33
South Africa		21	14	0.6	62	9
Sri Lanka		18	6	1.3	15	33
Australia		14	6	0.7	87	4
Canada		11	7	0.4	80	2
Cuba	4	12	8	0.4	75	20
Germany		8	10	2 0.2	73	2
Italy		9	10	2 0.1	68	4
United States		13	8	0.5	79	1
Bulgaria	Severe Population	10	15	2 0.5	73	5
Ukraine	Decline	11	15	2 0.4	69	16

Sources: Population Reference Bureau, *World Population Data Sheet 2011*, http://www.prb.org; Central Intelligence Agency, *World Factbook* , www.cia.gov/library/publications/the-world-factbook/index.html. Natural increase does not always equal CBR-CDR/10 due to rounding.

Although the demographic transition is a compelling and extremely useful framework for viewing contemporary demographic change, it is not universally applicable. Some countries, such as Bulgaria and Ukraine (Table 5 .1), do not fit in any stages of the demographic transition model. With high CDR and low CBR, they are losing about half of 1 percent of their population annually. Demographers do *not* consider their strongly negative population growth as a next stage beyond stage 4, because Russia and Ukraine are *not* more advanced economically and socially than Europe, North America, or Japan. Rather, the high death rates and low birth rates in Russia and Ukraine are viewed as a temporary anomaly resulting from the poverty, unemployment, and instability associated with their rocky transition from Soviet-style communism toward democracy and capitalism.

We must also be careful in using the demographic transition model to predict the future of less-developed countries currently in the second or third stages. Their economies and populations are so profoundly different from those of European countries when they went through the second or third stages of the demographic transition that we cannot be sure the demographic transition will be resolved in the same way. During the nineteenth century, most European countries experienced a massive exodus of population to the United States, Canada, Australia, New Zealand, and Latin America. Few such "migration escape hatches" exist now for rapidly growing less-developed countries.

In addition, populations in less-developed countries are much larger, densities are higher, and rates of growth are much faster. The death rates of less-developed countries fell much faster during stage 2 of their demographic transitions than they did for the more-developed countries (Figure 5 .5) . For instance, the death rate of England declined gradually over a century or more with invention and diffusion of scientific improvements in agriculture, medicine, and modern sanitation. Comparable declines in less-developed countries such as India occur more quickly as countries acquire mortality-reducing technologies from

more-developed countries. The steeper drop in death rates translates into growth rates that are higher than any experienced in the history of more-developed countries.

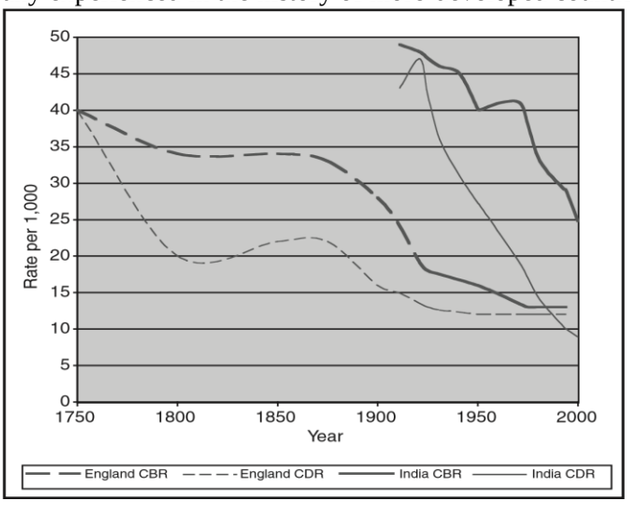

Figure 5.5 Contrasting demographic transitions of a more- and less-developed region: England and India. For both regions, the crude death rate (CDR) declined prior to the crude birth rate (CBR), but England started the demographic transition much earlier and the changes occurred over a much longer time span. India is still undergoing the transition, so its CBR remains higher than its CDR.

Also complicating completion of the demographic transition today is the nature of age structures in less-developed countries. There is momentum for continued population growth built into the extremely young age structures currently found in less-developed countries. Put simply, this means that future population growth cannot be avoided, even if countries are able to achieve small family sizes immediately. Take China as an example. Strict family-planning policies in China have reduced the average number of children to 1.5, lower than the 1.9 children per family average in North America. Still, the population of China continues to grow at a rate of 0.5 percent annually due to the large number of people in reproducing age groups.

The age structure of a population often is depicted in a **population pyramid** , a two-sided bar chart showing the distribution of population in various age categories, or **cohorts** as demographers call them (Figure 5.6).

The horizontal axis shows the percentage of the population in a particular age group. The vertical axis shows ages, typically represented in 5-year intervals. Males are represented on the left side of the pyramid and females on the right. The term *pyramid* comes from times past, when there were more young than old people in national populations. Thus, the younger bars near the bottom were longer than the older ones near the top, creating a pyramid-shaped diagram. Today, however, the population pyramids for many countries are no longer shaped like pyramids.

The shape of a population pyramid is determined by the history of fertility (birth) and mortality (death) circumstances of a population. Countries with high birth and low death rates characteristic of stages 2 and 3 of the demographic transition model have age-sex structures with steeply sloping concave sides, large bases, and tiny tops (e.g., Afghanistan and Gaza Strip in Figure 5.6). In stage 4 of the demographic transition model, under conditions of low birth and death rates, age-sex structures do not look like pyramids at all. They resemble beehives with relatively straight sides sloping inward at the top (e.g., United States and Canada in Figure 5.6). Women usually outnumber men, especially in older age categories, because of the longer life expectancies for females than males. The typical life expectancy of women in North America is 81 years compared to 76 years for men. In western Europe, 18 percent of the population is 65 and over, compared with just 4 percent in Africa and 7 percent in Asia. Already, wealthier countries with aging populations, such as Italy, are developing upside-down or tornado-like pyramids (Figure 5 .6) and are starting to face the relatively new societal problem of a shrinking labor force having to provide for the needs of a burgeoning elderly population (Figure 5.7).

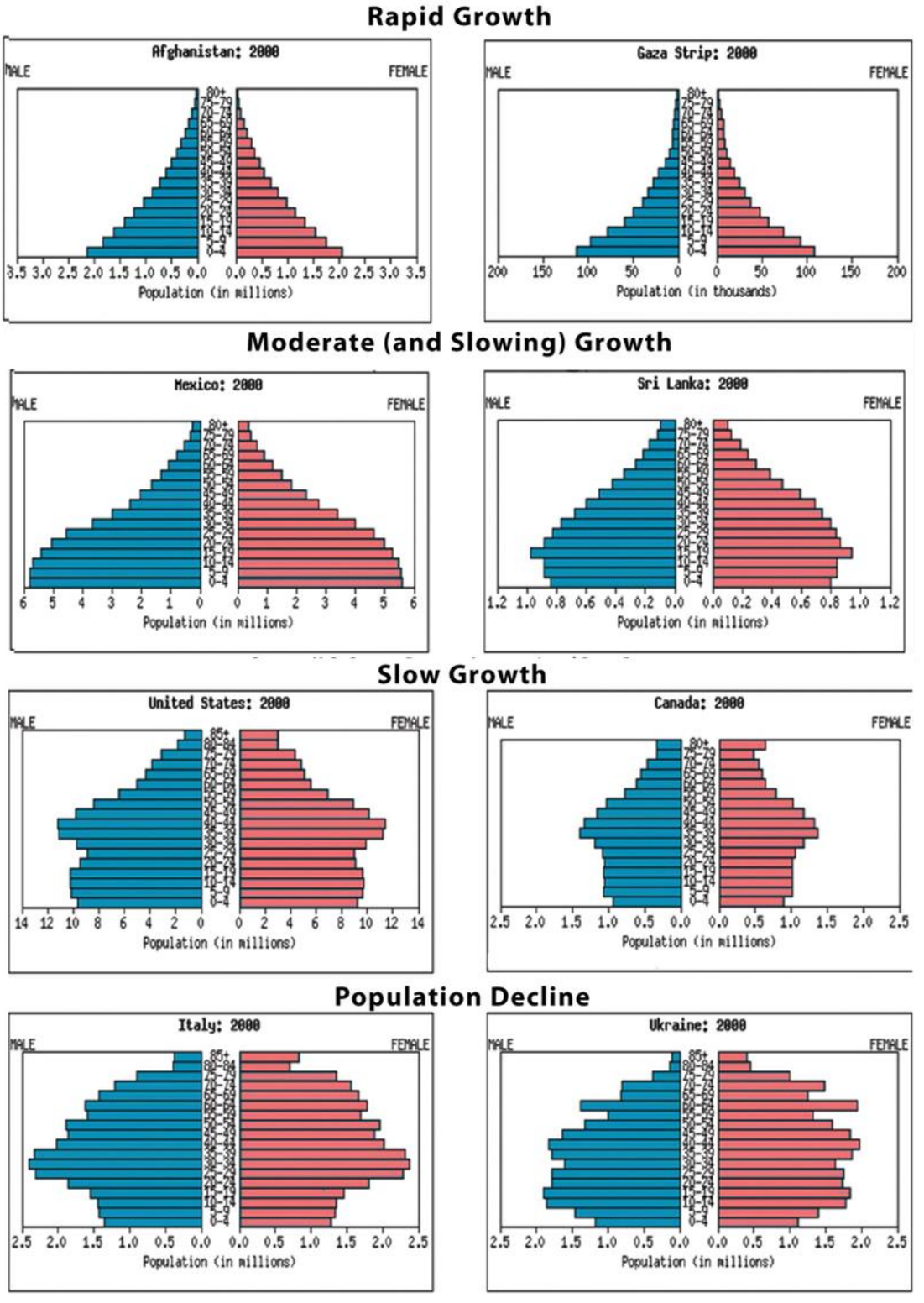

Figure 5.6 Examples of different countries' population pyramids.

Figure 5.7 Elderly populations in a few countries, such as Italy, are now 20 percent of the total population and rising fast. How will these societies meet their growing needs for food, housing, transportation, and medical care?

Of particular interest in an age-sex structure is the relationship between the generation that is currently bearing children—the so-called reproducing generation between the ages of 20 and 40—and their children at the base of the structure. In less-developed countries with triangular age-sex structures, the reproducing generation gives birth to a generation of children that is much larger than itself, often by a factor of 2 or even 3. This is symptomatic of high fertility and rapid growth.

Now contrast this situation with a beehive-shaped structure characteristic of more-developed countries. The reproducing generation is giving birth to a new generation that is about the same size as itself. These roughly equal-sized cohorts indicate that fertility is at or near the level needed for each generation merely to replace itself. The fact that older people eventually die leads to a tapering off at the top of the beehive.

The shapes of age-sex structures are strongly affected by **age-specific birth rates** . An age-specific birth rate is a precise indicator of the number of births occurring in each age cohort. More specifically, it is the number of births to women in a certain age cohort, say 25 to 29 years of age, divided by the number of women in that age cohort. Age-specific birth rates can be computed for all age categories in which women bear children, typically between 15 and 49 years. An age-specific birth rate tells us the likelihood that a woman of a certain age will bear a child in any given year.

If we add the current age-specific birth rates for all years from 15 to 49, we have a measure called the *total fertility rate*. Another way to think about the total fertility rate is that it is the number of children that an average woman would bear as she passes through her reproductive years. The **total fertility rate (TFR)** , often called the *average family size* , is a cross-sectional look at current fertility conditions. TFR ranges from a high of 7.0 children per woman in Niger to a low of 0.9 in Taiwan. The TFR for the entire human race is 2.5 children per woman, which masks the differences between the more-developed countries (1.7) and the less-developed world (2.6, or 3.0 excluding China). China is a special case, with a one-child policy designed to dramatically slow (and eventually reverse) growth in its massive population of 1.3 billion people. The policy uses a variety of financial, medical, educational, and housing penalties and incentives; laws setting a minimum marriage age; and "birth-planning" programs to convince people to have only one child. Originally designed in 1979 to cap the population at 1.2 billion by 2000, it has succeeded in lowering

TFR only to 1.5, because of exceptions granted to farmers and ethnic minorities. Nevertheless, without the highly controversial one-child policy, China would have hundreds of millions more people today.

When the total fertility rate is about 2.0, the average woman and her spouse or partner are having just enough children to replace themselves. The population is said to be near replacement fertility. In developed societies such as North America or Europe, a total fertility rate of slightly more than 2.0 is needed to achieve **replacement fertility** because a small number of females will die before they reach an age at which they will reproduce. In high-mortality countries, a larger surplus of births is needed to account for the fact that many females born today will not live to an age when they will bear children. In such countries, a total fertility rate of 2.5 or 2.6 translates into replacement fertility. Replacement fertility can be expressed in terms of replacing both parents, or defined in terms of replacing each female, since males do not give birth.

The growth trajectory of a country is not determined by fertility conditions alone. The difference between the crude birth rate and the crude death rate determines the level of growth. When the number of births is equal to the number of deaths, the CBR minus the CDR equals 0, and the country is said to be at **zero population growth (ZPG)**. ZPG refers to the *current* relationship between births and deaths.

One of the more perplexing concepts for students to understand is how a population can have a total fertility rate at or below the replacement level and continue to expand through natural increase. Yet this is exactly what is happening in China, France, Thailand, Ireland, South Korea, and some other countries, including Canada, with a TFR of 1.7 children per woman and a natural increase rate of 0.4 percent per year. **Demographic momentum** (or hidden momentum) is what population geographers call this tendency for a population to continue to grow long after replacement fertility has been achieved. This phenomenon originates with young, triangular age structures similar to those found in less-developed countries today. When the base of the age-sex structure is wide, many people are at or will soon be in age groups that will bear children, that is, typically between ages 20 and 40. Very few people are at the top of the pyramid in age groups where the likelihood of death is high. Thus, even if the population were to achieve replacement fertility today, the sheer number of people in or near the base results in large numbers of births. The small number of old people at the top results in a small number of deaths. Remember that growth is the numerical difference between births and deaths, not between births and parents. ZPG is almost impossible to achieve in pyramids with large bases. It takes many years for the large base to work itself upward into older age groups where deaths typically occur. In Activity 2 of this chapter, you will see several scenarios that illustrate the hidden momentum of population growth.

The hidden momentum issue is the subject of this chapter. You will be asked to simulate demographic conditions in India based on its total fertility rate. Understanding this process will enable you to interpret the geographic distribution of current and future population growth.

(Note: Students interested in the population structure of Canada can view animations of population pyramids through time for the entire country or its provinces at www .statcan.gc.ca/kits-trousses/animat/edu06a_0000-eng.htm. This site demonstrates demographic momentum, as well as examples for rapid, moderate, slow, and declining growth.)

CASE STUDY: INDIA

GOAL

To learn how to interpret **population pyramids** and to apply that knowledge to understand population projections. You will simulate the effects of future fertility rate assumptions on the shape of pyramids and interactively examine the **hidden momentum** of population growth (i.e., why a long lag occurs between declining fertility and the end of population growth).

LEARNING OUTCOMES

After completing the chapter, you will be able to:

- Relate the shape of population pyramids to a country's birth, death, and growth rates.
- Differentiate population pyramids of countries with rapid, slow, and negative population growth.
- Understand the hidden momentum built into current population pyramids.
- Recognize the hypothetical nature of population projections.

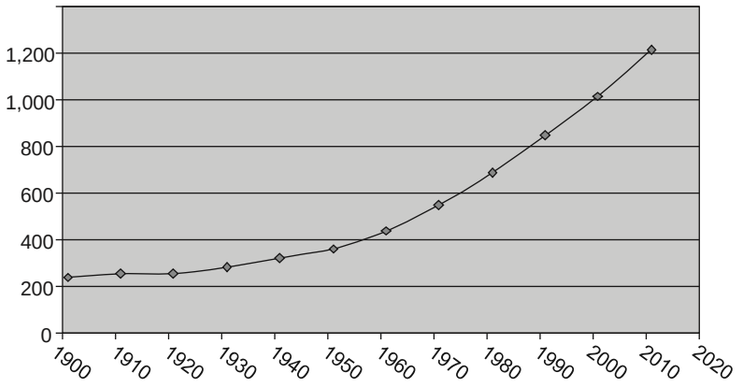

Figure 5.8 India's population, 1901 to 2011. Source: Census India: www.censusindia.gov.in. Total Population (millions) 1,400 (1.4 billion) (estimated, 2021).

TABLE 5.2 Ten Most Populous Countries, 2011

Rank	Country	Population (millions)
1	China	1,337
2	India	1,189
3	United States	313
4	Indonesia	246
5	Brazil	203
6	Pakistan	187
7	Bangladesh	159
8	Nigeria	155
9	Russia	139
10	Japan	126

Source: 2011 World Population Data Sheet of the Population Reference Bureau.

BACKGROUND

Sometime in 2000, India joined China in the One-Billion Club of demographic giants (Table 5.2). Because of its higher fertility, India is expected to surpass China sometime between 2020 and 2025 as the world' s largest population. To understand India 's current and future population prospects, it is important to know about its demographic history, the status of Indian women, efforts at family planning, connections with the rest of the world through international migration, and the environmental and societal effects of rapid population growth.

As with other developing nations, India 's population growth before World War II was slow, owing to high death rates and low life expectancies (Figure 5.8). Epidemics of plague and cholera and famines kept the death rate high and population growth low. Fertility was high to compensate for the loss of children and to ensure that families would have enough sons to work the land and to take care of them in old age. India was in Stage 1 of the **demographic transition** with high fertility, high mortality, and slow population growth.

The beginnings of modernization after World War II improved health and diet. Life expectancy, which was only 32 years at the time of Indian independence in 1947, rose to 58 years in the 1980s and to 64 years today. The **infant mortality rate**, the number of babies who die before their first birthday (per 1,000 live births), fell from between 200 and 225 in 1947 to 90 during the 1980s and to 50 today. Initiated during the 1970s, the national government 's program to provide free immunization to all children reduced the risk of contagious diseases such as tuberculosis, diphtheria, pertussis, tetanus, polio, and measles and was a major factor in reducing childhood death. Still, India 's childhood immunization program misses a considerable percentage of children, especially in rural areas. Studies also show that children of illiterate mothers are less likely to be immunized than children of literate mothers, and girls are less likely to be immunized than boys.

A s the demographic transition model predicts, the decline in birth rates in India lagged the decline of death rates (See Figure 5 .5). Norms of high fertility were, and still are, deeply ingrained in traditional Indian culture. Although India is the home of three of the world's 15 largest cities—Mumbai (formerly Bombay), Kolkata (Calcutta), and Delhi—71 percent of the population lives in the rural countryside where incomes depend on agriculture, illiteracy is

high, and the status of women is low (Figure 5.9). Despite rapid economic growth, there are still not enough jobs for the recent flood of young people entering the workforce, and a rigid class structure inhibits upward mobility. India is home to almost 950 million people who live on less than $2 per day—76 percent of India 's total population, and 28 percent of the world 's poor. Among these lower classes, illiteracy, hopelessness, and dependence on traditional value systems keep birth rates high. India today falls squarely in the third stage of the demographic transition with high but falling birth rates, low death rates, and rapid population growth.

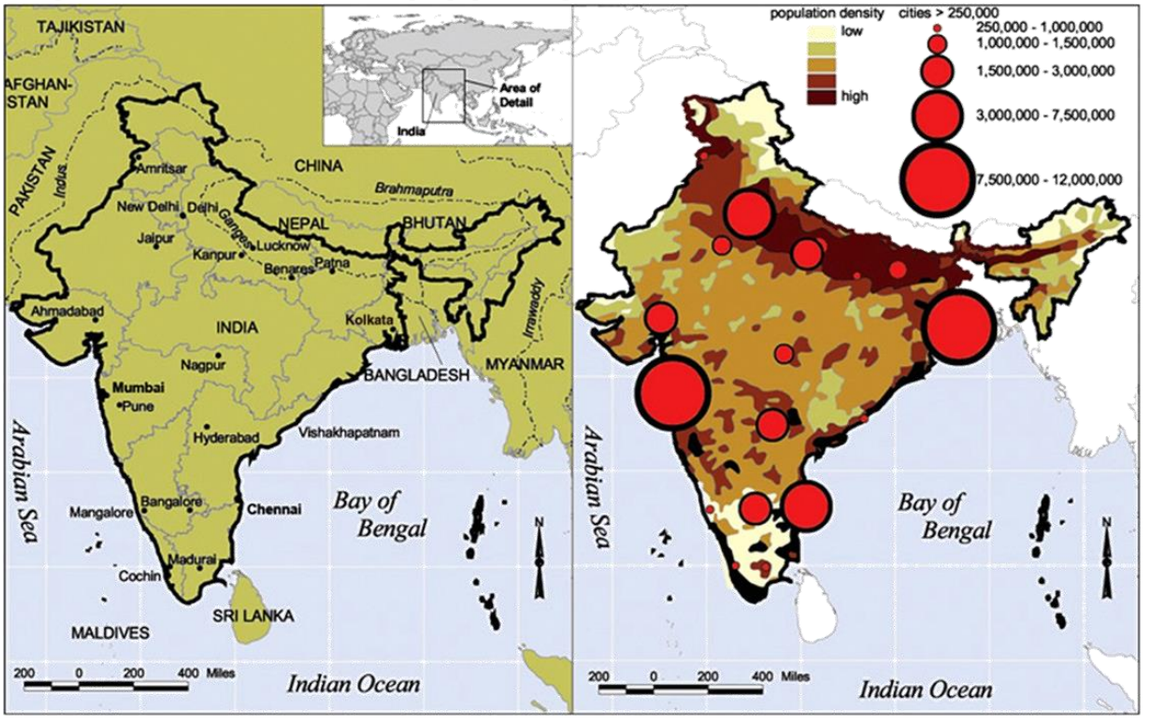

Figure 5.9a (left): India reference map, with major cities shown.
Figure 5.9b (right): India population density and major city population.

Although fertility in India is still slightly above the world average, it has fallen rapidly since the early 1970s. The **total fertility rate** —the average number of children a woman would have under current age-specific fertility rates—provides the best indication of fertility change over time. From a six-child average in the 1960s, the TFR fell to 3.1 by 2005. (Figure 5 .9), and to 2.5 by 2011 (Figure 5 .10). This decline is substantial and significant in the context of the country' s rural roots and traditional culture, but fertility remains above the replacement standard of roughly two children per woman that prevails in societies that have completed the demographic transition. Pivotal factors in fertility decline have been an increase in the average age at marriage for women, from 16 in 1961 to about 22 today, and higher rates of contraceptive use, from 13 percent in 1970 to 54 percent today.

One of the biggest barriers to further fertility decline is the low status of Indian women. Evidence from the rest of the world shows the strong link between women 's status and fertility. Literate, working women define their worth beyond the number of children they produce for the family. In most Indian families, males continue to make decisions about finances, work, social relationships, and selection of spouses. Marriage customs rely on arranged marriages,

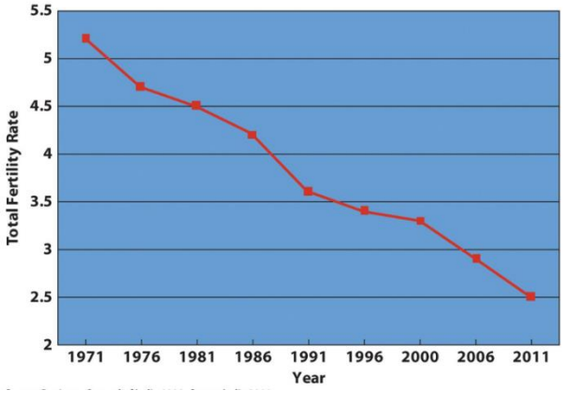

Figure 5.10 Total fertility rates in India, 1971 to 2011. Source: Registrar General of India 1998, Census India 2011.

patrilineal inheritance systems, and wives who move in with their husband 's family and then have little contact with their family of birth.

Related to the status and position of women in Indian society, a strong cultural preference for sons over daughters has been getting worse over time. Biologically, baby boys outnumber baby girls by a ratio of 105:100 because of higher across the-board mortality among males. The India Census revealed an increase in this rate from 108 males per 100 females in 2001 to 109 per 100 in 2011—a trend in the wrong direction. Sons are seen as a better source of financial support for parents in their old age. Although payment of dowries from the bride' s family to the groom 's has been illegal since 1961 in India, the practice continues. Having a daughter, it is said in India, is like "watering your neighbor 's garden." The preference for sons promotes neglect of female children, especially in poor families. Neglect can be extreme, as in the case of outright infanticide among girl babies, or more subtle, as in failing to inoculate girls against childhood diseases or not sending them to school. Neglect of females has led to a deficit of women in the Indian population. Despite the higher mortality rates of men and the longer life expectancy of women, India 's population has 7 percent more males than females.

Faced with high fertility and unprecedented population growth, India initiated a family-planning program during the 1950s. The program evolved from one focused on increasing the availability of family planning methods to a more all-encompassing view of family planning as integrated with efforts to improve overall health, reduce poverty, protect women 's rights, and maintain the environment. Early efforts at family planning stressed methods over motivation and failed because Indian couples were not ready to accept family planning or were concerned about the risks of contraceptive use. In one ill-fated instance, 800,000 to 900,000 Indian women were fitted with intrauterine devices (IUDs) in the mid-1960s. Real and perceived IUD-related health risks caused IUD use to plunge, and the method has never again gained widespread popular acceptance.

Frustrated by slow progress toward fertility reduction, many government officials rejected family planning as a means to slow population growth in the mid-1970s. At the 1974 World Population Conference in Bucharest, the Indian delegation articulated the now-familiar slogan that "development is the best contraceptive." In their minds, contraceptives are only a means to an end—a vehicle to help people achieve the family size they desire, however large that size may be (Figure 5.11).

Nora Kuby

Figure 5.11 Women in most parts of India have access to family planning. The larger question is, how many children do they want to have—and how many do their husbands want, and of what gender?

Without development and all that it includes—education, rising income, upward mobility, and urbanization—the view was that family planning would be unable to reduce fertility. This view has been moderated subsequently with growing evidence from India and elsewhere that family-planning programs can reduce fertility even without the obvious benefits of development. For instance, in neighboring Bangladesh, a small, mostly rural, country the size of Wisconsin with almost half as many people as the United States, the TFR has fallen to 2.4 children per woman as a result of a strong government program of community-based family planning. This is true despite the fact that the average per capita income in Bangladesh is not even half as high as India's.

In the late 1970s, the Indian government established sterilization clinics around the country and offered financial and material incentives (e.g., money, bags of rice, radios) to those agreeing to the procedure (Figure 5.12). The national government gave local officials sterilization "targets" to achieve, and rumors of forced sterilizations soon swept India. As a result, the Indian people voted President Indira Gandhi out of office. Subsequent democratically elected governments have been careful not to cross the line to the kinds of punitive methods of fertility control practiced in nondemocratic China.

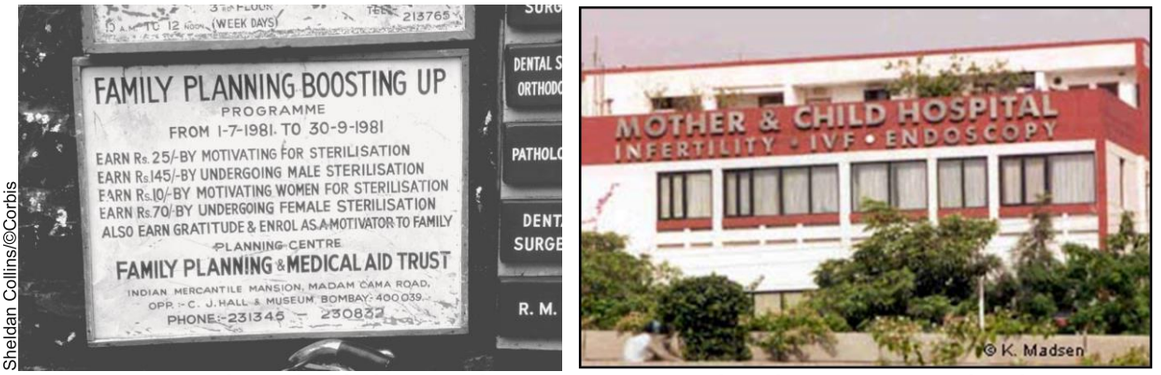

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Figure 5.12 A sign outside a medical facility in Mumbai in 1978 entices passersby with money in payment for voluntary sterilization (left); the move towards choice, for families that have had no success to start a family.

Today' s program in India offers a wide range of contraceptives. By far the most popular and effective method is permanent female sterilization, adopted by 37 percent of married women in India, compared with only 21 percent worldwide. Of course, generally sterilization is only adopted by women who have already had their desired number of children. (Another indication of the low social status of women in India is the stark difference between the 37 percent sterilization rate for females and the 1 percent rate for males.) Married Indian women also use a variety of temporary methods, such as condoms (5 percent), periodic abstinence (5 percent), oral contraceptives (3 percent), and the IUD (2 percent), and the highly ineffective withdrawal method (2.5 percent). Administration of family-planning programs is decentralized so that they can be sensitive to local area differences in language, religion, literacy, and economic development; family planning is linked to women's reproductive health rather than viewed merely as a means of population control.

Decentralization of family planning, however, also means that the efficacy varies greatly across the country. Programs are generally more aggressive and better funded in the south than the north, which has lower levels of women 's status, literacy, and effective government. The TFR varies from as low as 1.7 in southern states such as Kerala and Tamil Nadu to 3.9 in northern states such as Bihar. Keep these regional differences in mind when you work with the simulation in Activity 2, which treats all of India as a uniform whole.

India has a vast **diaspora** across the world, with people who maintain close contact with families at home and are agents of economic and social change. While India was a colony of Great Britain, many Indians emigrated to countries of the Commonwealth to provide plantation labor and to help build railroads. Large communities grew up in Guyana, Trinidad, Kenya, South Africa, and other British colonies and protectorates (Figure 5 .13).

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James P. Blair/NG Image Collection

Figure 5.13 Women of Indian descent shopping at an Indian market in Durban, South Africa. Mohandas "Mahatma" Gandhi practiced law in South Africa from 1893 to 1914, where he was mistreated by whites for defending Asian immigrants. He developed the strategy of passive resistance there, which he used to lead India to independence from Britain in 1947

More recently, Indians have moved to more-developed countries in search of high-wage jobs. This so-called brain drain draws off some of India's most ambitious and best educated people, but because emigrants send more than $3 billion to family at home, migration is a major source whether remittances to family from Indians living abroad are spent on unproductive consumer goods (houses, cars, clothing, etc.) or used for education and to start businesses—investments that reap long-run returns for the Indian economy.

Major destinations for highly educated Indian migrants today are the United States, Great Britain, Canada, and Australia. Until 1990, the Persian Gulf also had drawn many Indian migrants, but they were forced to return home during the Persian Gulf crisis between Iraq and Kuwait. Slowing economies and the

reluctance of Middle East governments to allow workers to bring their families or settle eventually reduced this historically and economically significant migration stream.

The social and environmental implications of rapid population growth in India are serious. The challenge of 1.2 billion people puts extreme pressure on environmental resources. Supplies of fresh water are stretched to the limit, and soil exhaustion and erosion become major problems when farmland is overworked. In an effort to develop remaining arable land, farmers expand into marginal areas by cultivating low-lying, hurricane-prone islands in the Ganges delta, building terraces on steep mountainsides prone to landslides, and overgrazing arid lands. Thus far, increased use of fertilizers, pesticides, irrigation, and hybrid seeds (see discussion of the Green Revolution in Chapter 8) has enabled India to become more or less self-sufficient in food supply, but 19 percent of the population is undernourished, and many poor people cannot afford the food that is available.

India's growth is outstripping the country' s ability to provide social services and education to its entire population. Tens of millions have left rural India for the major cities, which cannot accommodate the huge influx of migrants. Millions of people are estimated to live in makeshift housing in squatter settlements around Mumbai, Kolkata, and Delhi without adequate sanitation and water supply, electricity, schools, and medical care. All three cities are predicted to grow by more than 33 percent from 2000 to 2015, with Mumbai surpassing 26 million people and possibly becoming the world 's largest city.

I t is hardly all doom and gloom, however. In addition to being the world 's largest democracy, India has the largest middle class in the world. Its universities are first rate, its railway system is extensive, and it is industrializing rapidly. Since 2000, India's economy has grown at a compounded annual rate of 7.65 percent per year—among the fastest rates in the world. Knowledge-based industries, particularly software engineering, are leading India' s economic expansion and attracting foreign investment (Figure 5.14).

NAMAS BHOJANI/©AP/Wide World Photos

Figure 5.14 India is the training ground for one of the world's largest technology workforces. Bangalore, home to the Indian Institute of Technology in South-Central India, is among India's main high-tech centers.

Courtesy Michael Kuby

Figure 5.15 Children in Bangalore, India.

Yet the rapid population growth puts the brakes on the rate of development by siphoning off capital surpluses that could have been invested in industrial infrastructure and technology but instead must be used for food, clothing, housing, health care, and education for the large cohort of children (Figure 5.15).

DEFINITIONS OF KEY TERMS

Age-Specific Birth Rate The number of births to women in a certain age cohort divided by the number of women in that cohort.

Cohort All individuals in a certain age range.

Crude Birth Rate (CBR) Annual number of live births per 1,000 population.

Crude Death Rate (CDR) Annual number of deaths per 1,000 population.

Crude Rate of Natural Increase The difference between the crude birth rate and the crude death rate.

Demographic Momentum Continued population growth long after replacement-level fertility rates have been reached.

Demographic Transition Model A model of population change from an equilibrium with high birth and death rates through a high-growth transition period in which death rates decline sooner than birth rates, to a new equilibrium with low birth and death rates.

Diaspora Scattered settlements of a particular national group living abroad.

Economic Migrant A person moving to seek better opportunities

Equilibrium A state in which forces of change are in balance.

Guest Worker A person moving to seek better economic opportunities, may not intend to be permanent or may not be allowed to be a permanent move by law (of the host country)

Hidden Momentum Same as demographic momentum.

I**nfant Mortality Rate** Number of deaths of children under 1 year of age per 1,000 live births in a year.

In-Migration The number of people moving to a new place (permanently)

Net Migration The difference between in-migrants and out-migrants

Out-Migration The number of people leaving a place (permanently)

Population Pyramid (Age-Sex Diagram) A graph showing the number of males and females in discrete age cohorts (age categories).

Refugee A person moving to get away from civil strife and/or political danger; may be permanent or may return home if dangers subside

Replacement Fertility The fertility rate at which each female in a population produces on average one female baby who survives to the time when she herself can reproduce.

Total Fertility Rate The average number of children a woman would have during her reproductive years, assuming the current fertility rates of women across all ages.

Zero Population Growth (ZPG) A state in which the crude birth rate minus the crude death rate equals zero. The number of deaths exactly offsets the number of births.