

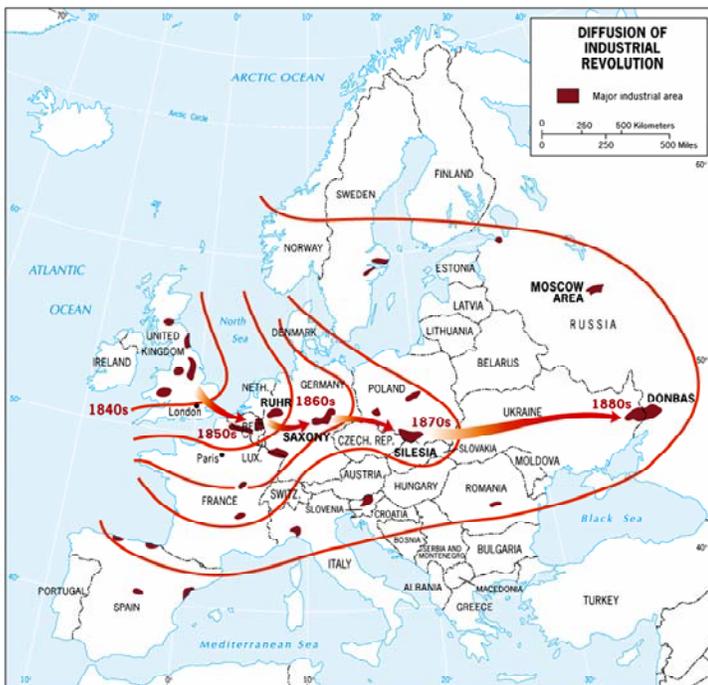
Unit 5

The Industrial Impact

Industrialization and Population Geography

Dimensions of Population Growth

Great Britain was the first country to industrialize, and therefore, had a substantial advantage over other countries of the world. Despite Britain's strict laws against exporting inventions and industrial ideas, new factories sprung up during the early 1800s in places like the United States, Belgium, Germany, and France. These nations often had more coal, iron, and other necessary raw materials. They also had the advantage of avoiding many of the mistakes and flaws Britain had committed while industrializing. Other nations, typically those of eastern and southern Europe, lacked enough natural resources or capital to effectively industrialize. Nonetheless, the ideas and practices of the industrial revolution diffused outward, and changed the world forever.



The Industrial Revolution brought many changes to the world. One of the most profound impacts dealt with a population explosion the likes of which the world had never seen. With increasing technology came the ability for mankind to cheat death more effectively and expand the average life expectancy. The many advancements and innovations in the fields of food production and storage, sanitation, and hygiene, enabled people to overcome and prevent disease.

In the 1870s, Louis Pasteur, a French microbiologist, proved the connection between microbes and disease. After proving the **germ theory** he went on to develop

vaccines against rabies and anthrax. He also invented a process in which liquids such as milk were heated to kill all bacteria and molds already present within them. This process was later called **pasteurization**.

Joseph Lister, a British surgeon, became aware of Pasteur's work and began experimenting with chemical solutions to prevent gangrene in his patients' wounds. By the 1860s, he discovered several **antiseptics** that prevented infection and greatly improved the successful recovery of his patients. He insisted that surgeons wash their hands and sterilize their instruments. The work of Pasteur, Lister, and many others had the positive effect of lowering death rates, and improving the quality of life. However, the increased life expectancy would create several challenges and difficulties around the industrialized world.

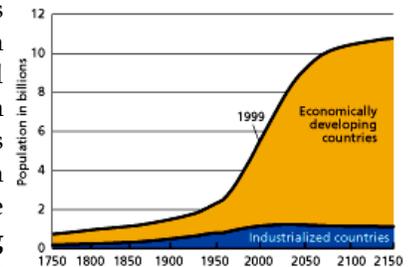
Because the death rates fell, populations soared. A population explosion descended upon Europe and North America, sparking fears that human population would exceed the world's **carrying capacity**, or ability for the environment to replenish itself (e.g., in terms of food and natural resources).

Population Theorists

A mild population expansion had begun towards the latter half of the 1700s, due in large part to the Second Agricultural Revolution. In 1798, the British economist named **Thomas Malthus** published *Essays on the Principle of Population*. In this book he stated that human population grew geometrically, (or exponentially) doubling every generation. In contrast, food production only grew linearly (or arithmetically). The result is that there would be mass starvation even when population growth was checked by wars, epidemics, famines, or other calamities.

His theories were questioned, especially around the late 1800s, because he did not anticipate the technological and industrial improvements in agriculture. Malthus also could not have foreseen the impacts of colonization or migration, and he would not have believed that the United Kingdom could sustain more than 60 million people, as it does today (it only had around 7 million people in his time).

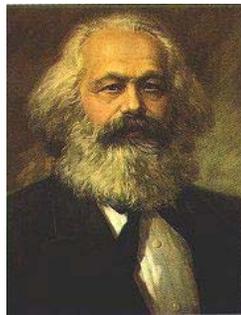
**World Population Growth,
1750–2150**





One last thing that he did not foresee was the reduction of population growth rates in Europe due to the industrial revolution. In a largely agrarian society it is more economically advantageous to have a large family since children can work in the fields at an early age, and produce more than they consume. Also, since many children may die due to disease, and since the life expectancy is usually shorter in these regions, having more children increases the chance that the parents will be taken care of when they become older. Even in the early industrial times, children of poorer families were often sent to work at young ages. However, several laws and acts were passed to protect workers and children, which made it much less economical to have larger families. Since children in more industrialized and urbanized societies cost more than they produce (at least in their younger years), parents under these conditions tend to have smaller families. Despite this fact, population growth rates did not begin to decline in the industrial world until the 1900s.

Karl Marx, the famous German social philosopher who discussed socialist theories in the mid 1800s, also discussed his beliefs on population growth. In *The Communist Manifesto* (1848), he contended that population growth was *not* the primary cause of poverty and suffering (as Malthus had stated). According to Marx, capitalism, an economic system that promotes the exploitation of *workers* and the unequal distribution of *resources* (land, capital, etc...), was the primary cause of poverty and suffering. The solution would be an economic system that promotes the equal distribution of resources and the wealth obtained from economic production among the people. Marx postulated that **socialism** would solve problems for everybody, and that a future communist society was inevitable after a worldwide revolution by the working class that would transcend political borders.



Marx's theories have *not* held up very well. The worldwide revolution that he claimed was inevitable never happened for a few reasons. First, many of the reforms passed by the governments of industrial states (e.g., minimum wage, maximum hours, legalization of unions, etc.), reduced the unrest of the working class. Although riots, strikes, and some revolts did break out – no massive revolutions toppled any of the governments. Furthermore, Marx underestimated the power of nationalism. His prediction of a massive workers revolt of many nations around the globe did

not occur, in part, because the peoples' loyalty to their country was stronger than a vague connection with laborers from other countries.

A final strike at Marx's theories lied with the failed **expansive population policies** of the U.S.S.R. and China when they first adopted communism. They encouraged their people to have as many children as they could, claiming that an equal distribution of property and wealth would prevent hunger and starvation. The U.S.S.R. was intent on repopulating their country after the massive losses from the previous world wars. Joseph Stalin even awarded medals to women who had more than 12 children! The United Nations had warned about an impending population crisis, but the Chinese government under Mao Zedong discounted this fear as a capitalist ploy to keep the communists weaker than the democracies of the world. Historically, communist countries seek to extend their borders and influence through military means, and they needed vast armies to fulfill this goal. Unfortunately for their citizens, the expansive population policies were a disaster. Tens of millions of peasants starved to death in the U.S.S.R. and China, and more **restrictive population policies** were enacted after the deaths of Stalin and Mao. China's "One Child Policy," for instance, has gone a long way in dramatically reducing growth rates among their population of more than 1.3 billion people.

Another theory was proposed by a Danish economist named **Ester Boserup**. In 1965, she wrote *The Conditions of Agricultural Growth*, stating that population growth can stimulate greater **intensification** in agricultural development, producing greater amounts of food (the opposing viewpoint of Malthus). She claimed that it was more realistic to

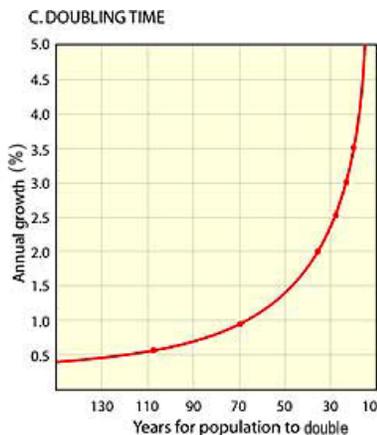


view population growth as a stimulant of the development of agricultural technology, than to view population growth as being checked by agricultural output. One major deficiency in her theory is that the intensification of agriculture in an area can lead to the depletion of nutrients in the soil, and the consequent reduction in the amount of food produced. The theories of Thomas Malthus and David Ricardo suggest a **law of diminishing returns**. In order to increase output from agriculture, farmers would have to farm less fertile land or farm existing land with more intensive production methods. In both cases, the returns from agriculture would diminish over time, causing the population to outstrip the carrying capacity of land to produce, causing a catastrophe. Since one can only grow so much food in a given area, this concept does hold merit, and displays a fundamental flaw in her theory.

The Cornucopian Theory states that the world has an abundance of resources and humans will never use them all up. People who ascribe to this philosophy tend to be confident in humanity's abilities toward technological innovation. They argue that there are little or no limits to growth and that the present world economy is projected to expand without significant bounds.

Doubling Time

Since the beginning of the Industrial Revolution, the world's human population has been growing at near exponential rates. One way of looking at exponential growth is to compare a country's growth rate to its **doubling time**, or time required for a population to double in size. The formula to determine the doubling time is 70 divided by the rate of increase (growth rate). For example, China had around a 1.0% natural increase in 2002, which would constitute a doubling time of 70 years. Colombia, with a 2.0% natural increase, would have a doubling time of 35 years. Ireland, with a 0.5% natural increase, would have a doubling time of 140 years. One thing to keep in mind is that this number illustrates the current *trend*, and is not meant to be an accurate prediction of the future. Several countries are experiencing negative growth (e.g., Germany, Italy, Japan, etc.) and have no doubling time.



Another important thing to note is the base population upon which the doubling time is measured. For instance, Saudi Arabia and Nigeria both currently have a doubling time of around 25 years. The main difference is that Saudi Arabia has a population around 23 million, whereas Nigeria has more than 130 million people. To put this in another way, Nigeria is adding around 3 million more people to its population each year as compared with Saudi Arabia!

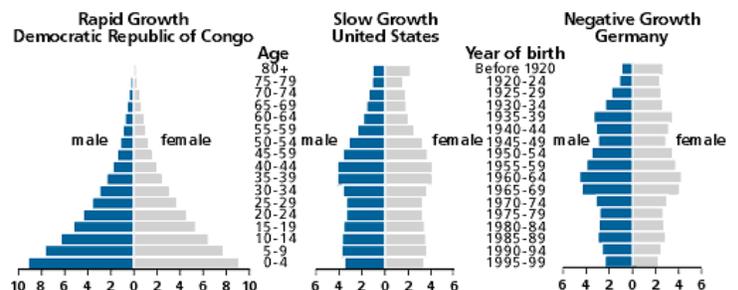
It is estimated that 2000 years ago the world's population was about 250 million. More than 16 centuries passed before this total had doubled (around 1650). Just 170 years later, in 1820, the population had doubled again. During the 1950s, when the world's average growth rate was 2.0%, its doubling time was 35 years. In the mid 1980s, when the rate declined to 1.8%, the doubling time slowed to 39 years. Today, the world is doubling at a rate of about 50 years, and the continuing slowdown is one of the bright spots in the global demographic picture.

Population Structure

The **composition** or *structure* of a population is its makeup in terms of age, sex, and other properties such as marital status and education. The key indicators are age and sex, represented visually by an age-sex pyramid. The pyramid displays the percentages of each age group in the total population (normally in five-year **cohorts**, or groups) by a horizontal bar whose length represents its share. Males in the group are to the left of the center line, females are to the right.

An age-sex pyramid can instantly convey the demographic situation in a country. In the developing world, the pyramid has a wide base near the bottom, and a short top (look at pyramid for the Democratic Republic of Congo). The youngest age groups have the largest share of the population. Conditions in these countries would illustrate relatively high fertility (births) and mortality (deaths) rates, lower life expectancy, a lower standard of living, and generally lower literacy rates.

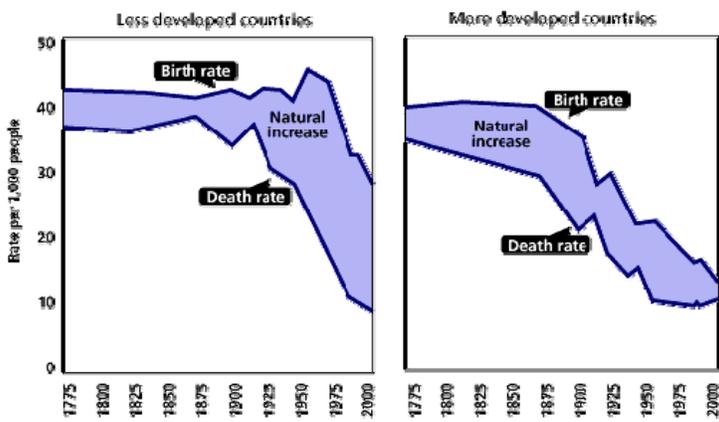
With economic development, however, the shape of the pyramid changes. Families become smaller, children fewer. Pyramids for more advanced countries look like a slightly lopsided vase, with the largest components of the population *not* at the bottom, but in the middle. And that middle-aged bulge is moving upward, reflecting the "graying" (or aging) of the population (look at the pyramid for the United States). Some countries, such as Germany, are actually experiencing negative growth, and their population problems will deal with the very old, instead of the very young (as in the case with the developing world).



Rates and Measurements of Population

The study of population is called **demography**, and its spatial component is population geography. Populations in different parts of the world, and sometimes even in different parts of the same country, are at different stages in their demographic cycles - and these differences can have serious economic and political consequences. There are several rates and measures that are used to determine a country's or region's level of development.

The rate of **natural increase** is the difference between the number of births and deaths during a specific period. These two measures are reported as the **crude birth rate (CBR)** - the number of live births per year



per thousand people in the population – and the **crude death rate (CDR)** – the number of deaths per thousand. Crude death rates should be viewed in the context of **infant mortality** (the number of babies that die within the first year in a given population), and **child mortality** (the number of children between ages one and five that die in a given population). High CDRs tend to reflect high infant and child mortality, since sanitation, hygiene, nutrition, and medicine is not as readily available in these parts of the world.

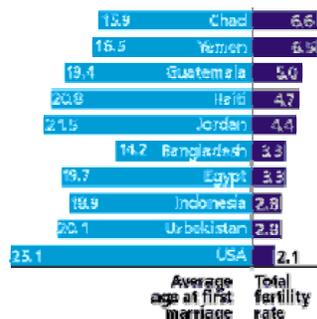
To calculate demographic change in a country or region, we use a simple formula:

$$TP = OP + B - D + I - E$$

where TP (total population) equals OP (original population) plus B (births) minus D (deaths) plus I (immigration) minus E (emigration). Only births and deaths are used in calculating the natural increase. Taking immigration and emigration into account paints a much more accurate picture of the demographic situation of a country.

Another measure of the reproductive status of a population is the **total fertility rate (TFR)**. This is a measure of the number of children born to women of child bearing age. The TFR is usually reported as the number of children per woman. At the height of Kenya's population explosion in the 1980s, the TFR was 8.1, among the highest ever recorded. Today, TFRs are falling almost everywhere on Earth. Kenya's TFR is now down to 4.3; China's fell from 6.1 to 1.7 in just 30 years (thanks mostly to the One Child policy). Some of the highest TFRs exist in the Islamic world, but Iran's fell from 6.4 in 1980 to 2.7 in 2000. Such reductions are indeed possible under traditional Islamic rule when governments allow family planning and supports reproductive rights.

These are encouraging data, for the TFR is a good indicator of future population change. A good thing to remember is that a TFR of 2.1 is required to keep a population stable over time without immigration. A final thing to consider

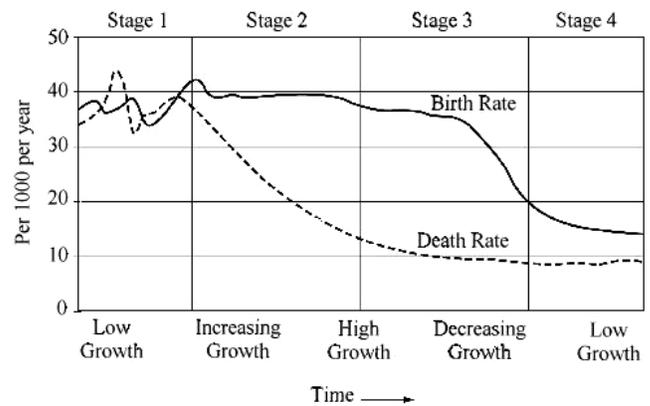


when analyzing the TFR of a population is the average age of the woman at her first marriage. Although children are being born to mothers outside of marriage today more often than in any other era, most children are still born to wedded mothers.

The Demographic Transition

The Demographic Transition (or Cycle) is a multi-stage model based on Western Europe's (UK's) experience of changes in population growth due to the industrial revolution. The United Kingdom was the first country to industrialize, and as it did, it passed through several demographic stages. The four stages according to the **demographic transition** are:

1. **High stationary stage**, with high fertility and high mortality; a highly variable population, with little long-term growth (no modern country is in this stage).
2. **Early expanding stage**, with high fertility and declining mortality; this leads to increasing growth (many developing countries are in this stage today).
3. **Late expanding stage**, with declining fertility, but with already-low mortality, population growth continues (e.g. the United States is in this stage).
4. **Low stationary stage**, with low fertility and low mortality, and a very low rate of growth (some countries are actually experiencing negative growth such as Russia, Germany, and Japan).



The actual *demographic transition* is represented by stages 2 and 3, in which birth and death rates fall. The dimensions of the expansion depend on the size of the base population and the rate of decline in the death rate. In Europe the birth rate declined largely because of the effects of industrialization, urbanization, and general modernization. It became too costly for people to have large families in an industrialized society, so the traditionally large families began to reduce in size. In contrast, in much of the developing world, the majority of the people have not been greatly affected by such changes. Furthermore, when Europe's population revolution began, the base was much smaller. Therefore, it may be unwise to assume that all countries' demographic cycles will follow the sequence that occurred in industrializing Europe.