

## Module: 9

### Importance of the Study of Fertility in Population Dynamics

This module discusses about the “Importance of the study of Fertility in Population Dynamics”. It enhances the knowledge of students to understand the importance of fertility. Following are the learning objectives of the module:

- **Introduction to the concepts of Fertility and Demography**
- **Determinants of Demographic Change**
- **How fertility affects demographic transition.**
- **Fertility and Population Growth**
- **Global decline in Fertility**

#### 9.1 Introduction

Fertility is one of the three components of population dynamics (the others being mortality and migration) and is essential to any study on population study. Fertility is regarded as a positive force in population dynamics because it is responsible for biological replacement, and the continuation of human society. Fertility levels determine the age structure of a population which, in turn, governs the social, economic and demographic characteristics of the population. The study of fertility is of interest to scholars and researchers because it is a complex phenomenon that is influenced a host of social, cultural, psychological, economic and political factors and variables. The effectiveness of population programmes depends on a proper understanding of the interplay between fertility and other variables.

Fertility refers to the number of live births to a woman, or a group of women. It is a measure of actual performance and should not be confused with fecundity, which refers to the physiological capacity to reproduce. Since it is not possible to measure the actual reproductive capacity of a woman, fecundity can only be assessed with the help of the maximum levels of fertility (or natural fertility) ever observed in a non-contraceptive population (Misra, 1982:160).

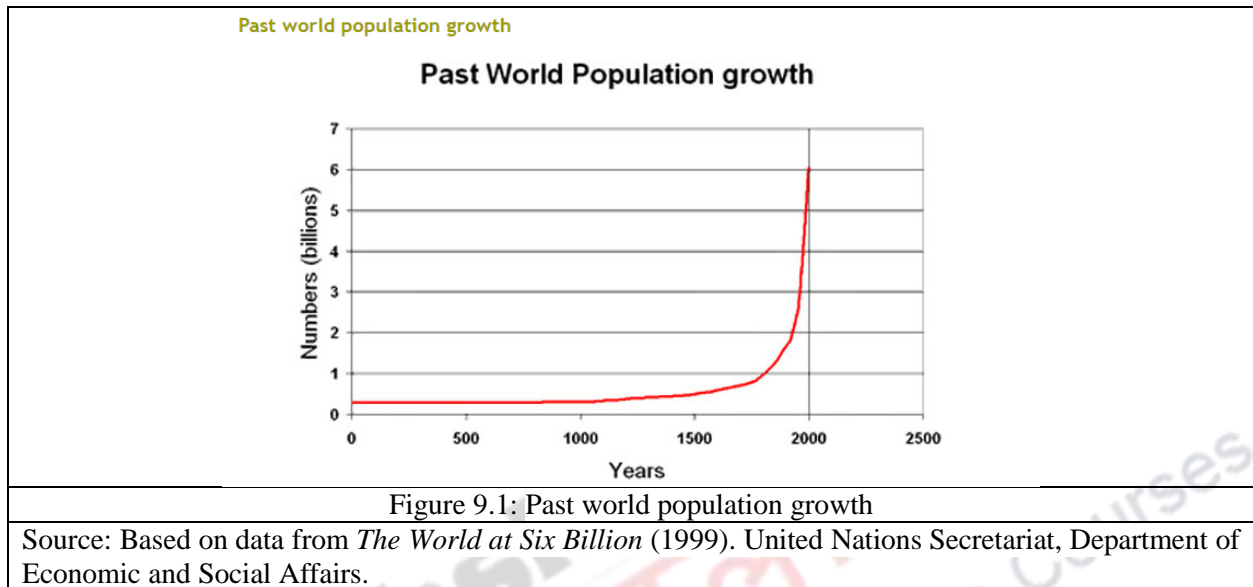
In the absence of a conscious effort to control the size of families, the larger the fraction of the population who are in the fertile age range, the more rapid will be the population growth, which will influence the average age of the population structure towards the younger end of the spectrum.

In terms of populations rather than individuals, fertility is usually expressed using the proxy measure of birth rate, either crude or standardized, for age and sex. Worldwide, there are significant differences between birth rates. A major study in the 1980s, carried out by the Population Division of the Department of International Economic and Social Affairs of the UN Secretariat studied the relationship between population age and sex distribution, and crude fertility rates for twenty-one countries in the developing world. They concluded that the higher the birthrate, the more markedly the birthrate is depressed by the age structure.

The mean number of children ever born also ranged widely among the twenty-one countries. Differences in completed family size ranged from 8.6 children in Jordan to 5.2 children in Indonesia. In the developed world though, there is a tendency for family sizes to be smaller than the replacement level. This is true of every country in the European Union.

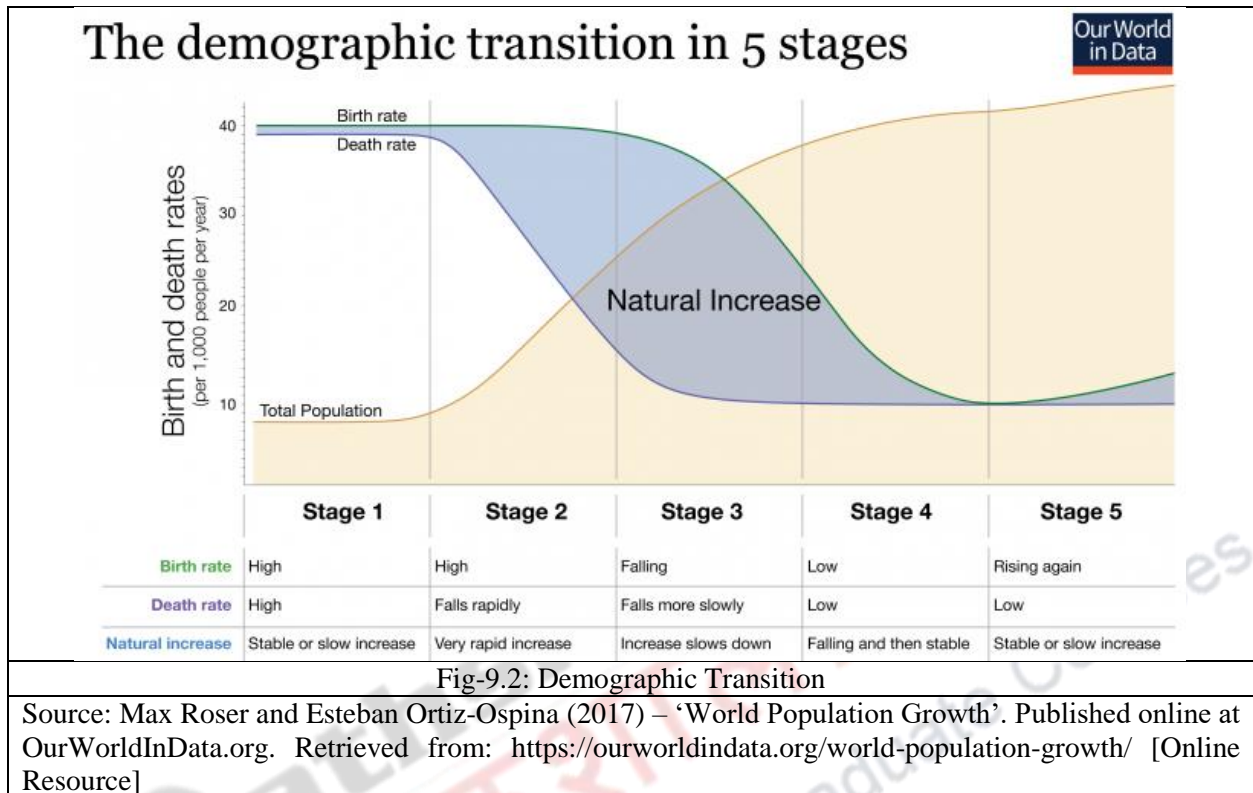
Birth and death rates are the most important determinants of population growth; in some countries, net migration is also important in this regard. Until the mid-19th century birth rates were only slightly higher than death rates, so the human population grew very slowly. The industrial era changed many factors that

affected birth and death rates, and in doing so, it triggered a dramatic expansion of the world's population (Fig. 9.1).



How did industrialization alter population growth rates so sharply? One central factor was the mechanization of agriculture, which enabled societies to produce more food from available inputs, leading to increased nourishment levels and healthy succeeding generation. Coupled with better health services, the death rates fell. After several decades of lower mortality, people realized that they did not have to have so many children to achieve their desired family size, so birth rates began to fall as well. In addition, *desired* family size tended to decrease. As women found many more opportunities to enter the labor force, they were less inclined to devote resources to childrearing than to paid work. Further, the jobs they had were not conducive to having children beside them as they worked. The costs of raising children also increased as slightly wealthier families living in urban areas faced higher expenses for a larger array of physical and social necessities.

This phase of reduction in death and birth rates is a process called the demographic transition. Demographic Transition alters population growth rates in several stages, as shown in Figure-9.2



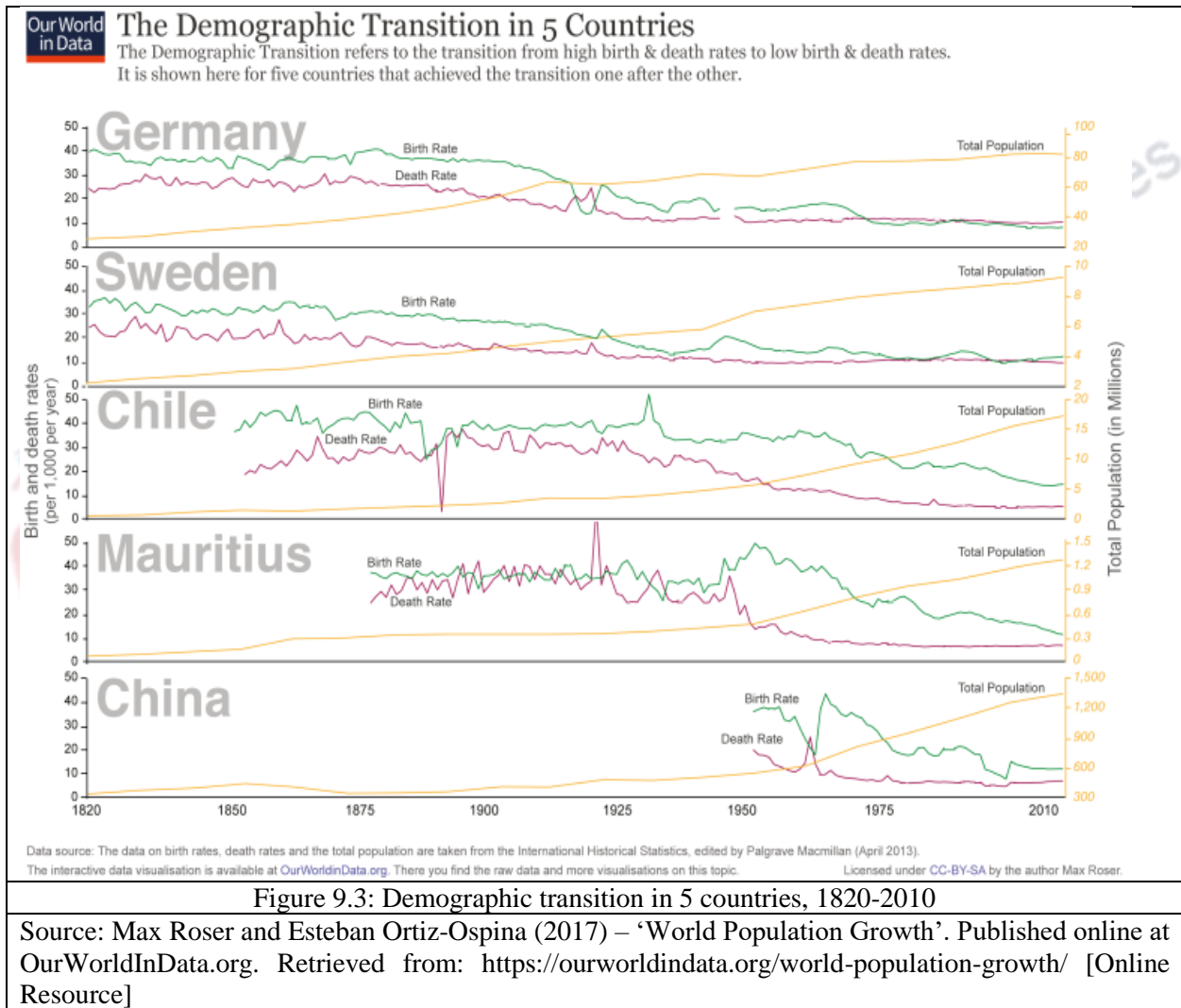
Because death rates fall before birth rates, population growth initially accelerates (a phase sometimes referred to as the mortality transition), adding a large cohort of young people to society. This group in turn will have children, although probably fewer per family than their parents did and, because this group of childbearing-age people is large, the population will continue to grow in absolute numbers even though on a per-capita basis, birth rates will decline—a phenomenon that demographers call the fertility transition.

Population momentum (the continued population growth after a fall in birth rates) accounts for a significant portion of world population growth today even though the global fertility rate has declined from about 5 children born per woman in 1950 to a little over 2.5 in 2006. Developed nations have passed through the demographic transition, and most developing countries are at some point in the process today. As a result, a "bulge," or the baby-boom generation, distinctly larger than those preceding or following it, is moving through the age structure of the population in nearly all countries.

These large cohorts create both opportunities and challenges for society. Expanded work forces can help nations increase their economic output, raising living standards for everyone. But they also can strain available resources and services, which in turn may cause shortages and economic disruption. The demographic transition is a well-recognized pattern, but there are significant variations from country to country. We cannot predict when specific demographic changes will occur countries, and it is also hard to specify precisely which factors will shape a given society's path. Looking forward, a major question for the 21<sup>st</sup> century is what happens after the demographic transition, and whether some countries in areas such as Western Europe, where birth rates are very low, will start striving to raise fertility. More important in terms of environment and health, however, is the question of how to help countries that are lagging on the transition path.

If fertility fell in lockstep with mortality, increase in the population could not be seen at all. The demographic transition works through the asynchronous timing of the two fundamental demographic changes: The decline of the death rate is followed by the decline of birth rates. This decline of the death rate followed by a decline of the birth rate is something we observe with great regularity and independent of the culture or religion of the population.

The chart below (Fig: 9.3) presents the empirical evidence for the demographic transition for five very different countries in Europe, Latin America, Africa, and Asia. In all countries we observed the pattern of the demographic transition, first a decline of mortality that starts the population boom and then a decline of fertility which brings the population boom to an end. The population boom is a temporary event.



In the past the size of the population was stagnant because of high mortality, now country after country is moving into a world in which the population is stagnant because of low fertility.

## **9.2 Determinants of Demographic Change**

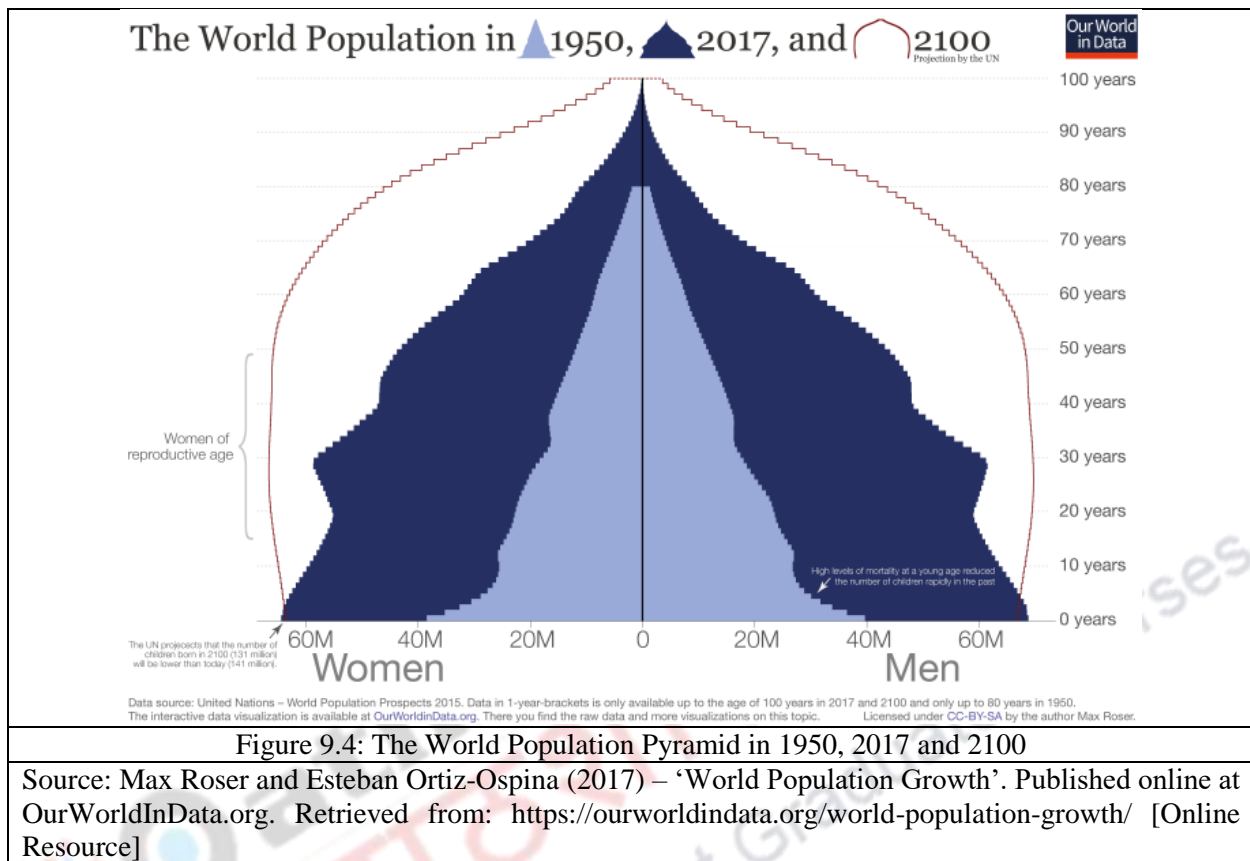
What factors drive population growth rates? One major indicator and determinant of demographic change is fertility, which demographers express as the total fertility rate, which is the number of births that can be expected to occur to a typical woman in each society during her childbearing years.

Fertility is a function of a woman's fecundity (her physiological ability to conceive and bear children and of social, cultural, economic, and health factors that influence reproductive choices in the country in question. The most important non-physical factors influencing a country's total fertility rate include relationship status (the fraction of women who are married or in a relationship that exposes them to the possibility of becoming pregnant), use of contraception, the fraction of women who are infecund (because, for example, because they are breastfeeding a child, induced abortion, etc.). Fertility levels are lower in developed countries than in developing nations because more women in developed countries work outside of the home and tend to marry later, and use contraception and abortion to delay or prevent childbearing. Nevertheless, fertility rates in nearly all countries have been falling since the 1950s. Most of the exceptions are in Central and Western Africa.

Fertility patterns can vary widely even within countries. Racial and ethnic minorities may have higher fertility rates than the majority, and families with low incomes or low levels of education typically have more children than those that are affluent or well-educated. Women who work outside the home generally have fewer children than those who stay home; and rural families have more children than city dwellers. In 2006, the number of births per 1,000 people worldwide averaged 21, with extremes ranging from a low of 8 or 9 (mainly in northern and Western Europe and some former Soviet republics) to 50 or more in a few West African nations

## **9.3 How Fertility Affect demographic structure:**

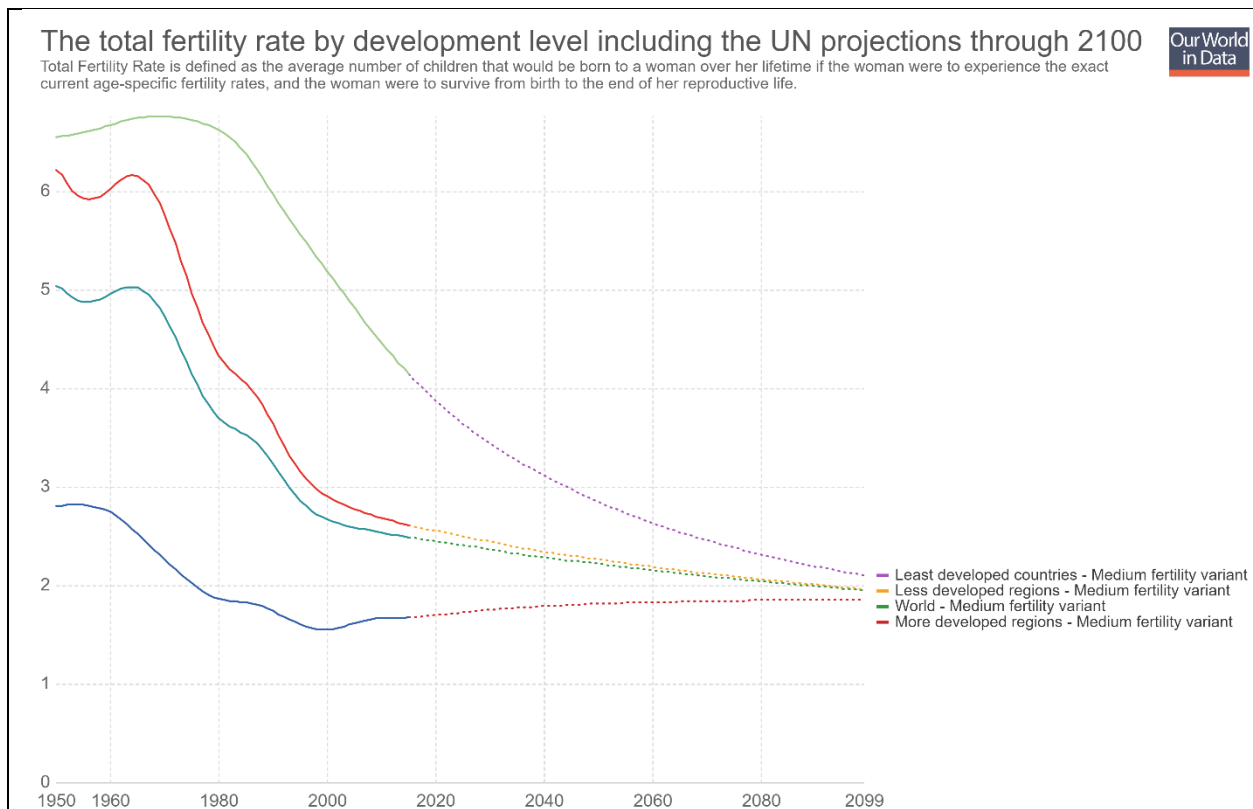
In addition to mortality it is also fertility that shapes the form of the demographic structure. The first aspect that matters for the number of new births in a population is the fertility rate, the number of births per woman in the reproductive age. But if there are only few women in reproductive age the number of births will be low even with a high fertility rate. Therefore the age structure of women in a population matters too – specifically it is the share of women in the reproductive age that determines the number of births. A bulge of women in this age keeps the number of birth high even when fertility is already low, this is what demographers refer to as 'population momentum'. The pyramid for 2016 (Fig: 9.4) shows that the largest cohort of women today are the very young women. The last decades of population growth have left us with a bulge of population in the childbearing ages. For this reason the world population will continue to increase, even as the fertility rate of the world is falling to the replacement level fertility.



#### **9.4 Fertility and population growth**

All countries in the world have moved so far into the demographic transition that high mortality is now associated with *higher* rather than *lower* population growth. It is therefore the changing fertility that is determining what happens to population growth.

The below visualization (Fig: 9.5) shows the rate of fertility using data from the UN Population Division. Since the 1970s fertility rates in the less developed regions of the world are falling rapidly began to converge. As we see in the projection, the demographers from the UN predict this convergence to continue over the course of this century.



**Figure 9.5: The total fertility rate by development level including the UN projections through 2100**

Source: United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, DVD Edition.

### **9.5 Global decline of Fertility:**

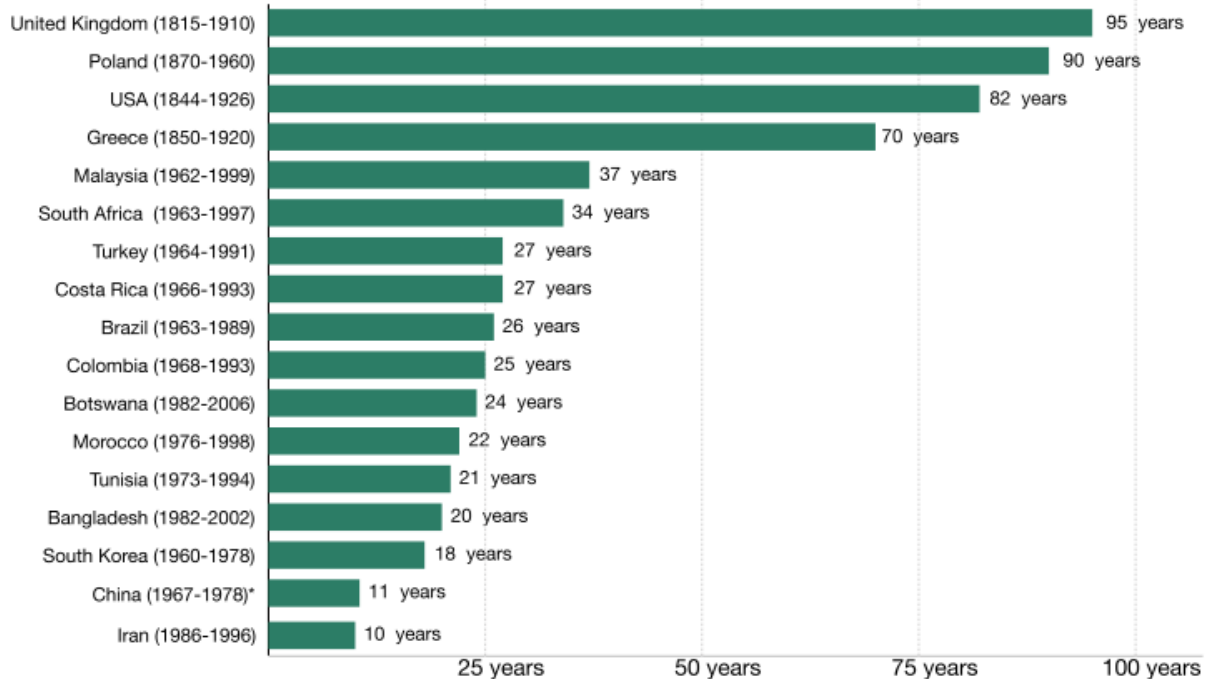
The global fertility rate has halved in the last 50 years. The number of children per woman was very high in the past and up to the second half of the 20th century. Globally, up to 1965 the average woman had more than 5 children. Over the last 50 years the global fertility rate has halved and globally the average woman has fewer than 2.5 children today.

The decline of the fertility rate is one of the most fundamental social changes that happened in human history. It is therefore especially surprising how very rapidly this transition can indeed happen.

The chart below (Fig: 9.6) shows the speed of the decline of fertility rates. As we see from the chart below it took Iran only 10 years for fertility to fall from more than 6 children per woman to fewer than 3 children per woman. China made this transition in 11 years – before the introduction of the one-child policy. The chart shows that the speed with which countries can make the transition to low fertility rates has increased over time. In the 19th century it took the United Kingdom 95 years and the US 82 years to reduce fertility from more than 6 to less than 3.

This is a pattern that we see often in development: those countries that first experience social change take much longer for transitions than those who catch up later: Countries that were catching up increased life expectancy much faster, they reduced child mortality more quickly and were able to grow their incomes much more rapidly.

## How long did it take for fertility to fall from more than 6 children per woman to fewer than 3 children per woman?



\* The one-child-policy in China was introduced after the decline of the total fertility rate below 3. It was introduced between 1978 and 1980.

Data source: The data on the total fertility rate is taken from the Gapminder fertility dataset (version 6) and the World Bank World Development Indicators.

The interactive data visualization is available at [OurWorldInData.org](https://ourworldindata.org). There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.

Figure 9.6: Years-it-took-Fertility-to-fall-from-6-to-below-3 for selected countries

Source: Max Roser and Esteban Ortiz-Ospina (2017) – ‘World Population Growth’. Published online at [OurWorldInData.org](https://ourworldindata.org). Retrieved from: <https://ourworldindata.org/world-population-growth/> [Online Resource]

### References

1. M Goodyear, 2008. The effect on population structure of fertility, mortality and migration. Accessed online from <https://www.healthknowledge.org.uk/public-health-textbook/health-information/3a-populations/fertility-mortality-migration>
2. Annenberg Foundation, 2017 Human Population Dynamics // Section 3: Determinants of Demographic Change, Accessed online from <https://www.learner.org/courses/envsci/unit/text.php?unit=5&secNum=3>
3. Annenberg Foundation, 2017. Human Population Dynamics // Section 2: Mathematics of Population Growth, Accessed online from <https://www.learner.org/courses/envsci/unit/text.php?unit=5&secNum=2>
4. Source: Max Roser and Esteban Ortiz-Ospina (2017) – ‘World Population Growth’. Published online at [OurWorldInData.org](https://ourworldindata.org). Retrieved from: <https://ourworldindata.org/world-population-growth/> [Online Resource]
5. Cox, P.R. 1976. Demography. 5th ed. Cambridge: Cambridge University Press.



6. United Nations, Multilingual Demographic Dictionary, Population Studies No. 29, 1958, p. 3. 3. Donald J. Bogue, Principles of Demography, New York : John .
7. Beard, J., Biggs, S., Bloom, D., Fried, L., Hogan, P. et al. (2012). Global population ageing: Peril or promise? PGDA Working Paper No. 89 (Global Agenda Council on Ageing Society), URL <http://www.hsph.harvard.edu/pgda/working.htm>.
8. The impact of population structure on crude fertility measures: a comparative analysis of World Fertility Survey results for twenty-one developing countries. *POPLINE Document Number: 013152 Corporate Author(s): United Nations. Department of International Economic and Social Affairs. Population Division Source citation: New York, New York, UN, 1982. 42 p. (ST/ESA/SER.R/49)*
9. Latinas/os in the United States: Changing the Face of América 10.1007/978-0-387-71943-6\_4 , Havidán Rodríguez, Rogelio Sáenz and Cecilia Menjívar, 4. *Demographic Patterns: Age Structure, Fertility, Mortality, and Population Growth, Jorge del Pinal, Population Division, U.S. Census Bureau, USA*
10. <https://www.ucar.edu/communications/gcip/m9popgrowth/m9pdfc3.pdf>
11. Cleland, J. 2001. Potatoes and pills: An overview of innovation-diffusion contributions to explanations of fertility decline, in J. Casterline (ed.), Diffusion Processes and Fertility Transition: Selected Perspectives. Washington, D. C.: National Research Council, pp. 39-65.
12. Bloom E. David, & Williamson G. Jeffrey (1997). Demographic Transitions and Economic Miracles in Emerging Asia, The World Bank Economic Review, Vol. 12: 419-55

