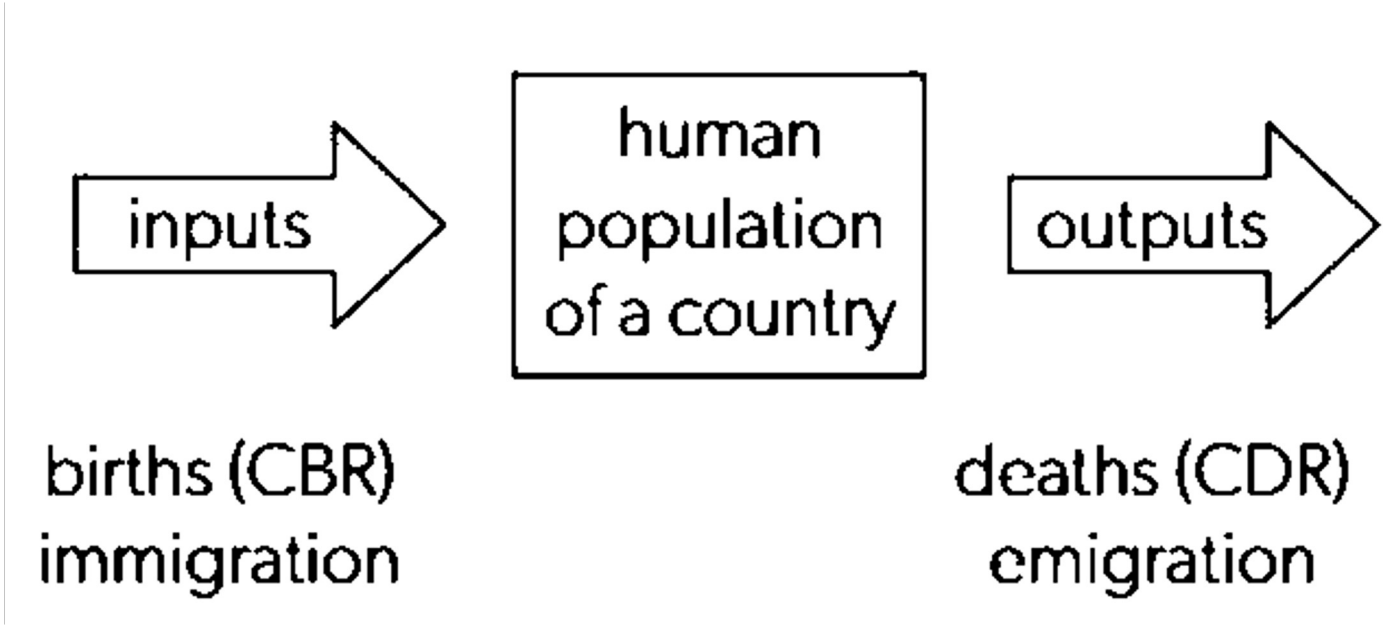
8.1.1 Objectives

- Outline how births and immigration represent inputs that contribute to the growth of a human population.
- Outline how deaths and emigration function as outputs that reduce the size of a human population.
- Describe population dynamics as measured and analysed using indicators such as total fertility rate, life expectancy, doubling time, and natural increase.
- Outline how the global human population has historically followed a pattern of rapid growth, and predictive models are used to estimate future population trends.
- Describe how human population growth can also be managed indirectly through economic, social, health, development and other policies that have an impact on births, deaths or migration.

Human popuation as a system

Demographic Indicators and Population Dynamics

Human population as a system



Input

Inputs to the human population system include fertility, birth rates, and migration.

- The fertility rate = number of births per thousand women of child-bearing age
  - typically 15–44 years
- The immigration rate = the number of individuals entering a country or region to establish permanent or semi-permanent residence
  - excluding short-term visits such as tourism.

Fertility Rate and Crude Birth Rate

- The current global average fertility rate is approximately 2.3 children per woman, representing a decline of about 50 per cent over the past five decades.
- Fertility rates do not include migration data and differ conceptually from birth rates, although the two measures are closely related.
- The crude birth rate (CBR) refers to the number of births per 1,000 individuals, or per hundred (as a percentage), in the total population.
- Unlike the fertility rate, the CBR includes males and individuals of all age groups.
- Fertility rates and CBRs can be calculated at global, regional, or local scales.

Output

Outputs from the human population system primarily include mortality and out-migration.

- The crude death rate (CDR) = the number of deaths per 1,000 individuals, or per hundred (as a percentage), in the total population.
  - Like the CBR, the CDR is calculated regardless of age or gender.
  - The CDR can be calculated at global, regional, or local levels.
- The emigration rate = the number of people leaving a country or region on a permanent or semi-permanent basis.

Key Terminologies

Category	Measure	Definition
Demographic indicator	Crude birth rate (CBR)	The number of live births per 1,000 individuals in a population per year.
	Immigration rate	The number of immigrants entering a population per 1,000 individuals per year.
	Crude death rate (CDR)	The number of deaths per 1,000 individuals in a population per year.
	Emigration rate	The number of emigrants leaving a population per 1,000 individuals per year.

Population Dynamic

- Basic population measures are used to assess population size and changes over time.
- These measures are used to calculate natural increase rate (NIR) and doubling time (DT).
- More specific indicators, such as total fertility rate (TFR) and life expectancy (LE), help explain population dynamics.
- The total fertility rate (TFR) is linked to replacement fertility, conventionally set at 2.1 children per woman.
- A TFR above 2.1 results in population growth, while a TFR below 2.1 leads to population decline, assuming no migration.
- The replacement level reflects an average, accounting for variations in family size.
- In practice, replacement fertility is closer to 1.75 in most high-income countries and many low-income countries.
- Many African countries have TFRs above 3.5 due to higher infant and child mortality and cultural and societal influences.
- The natural increase rate (NIR) is calculated by subtracting the crude death rate from the crude birth rate and dividing the result by ten.
- Dividing by ten converts the NIR into a percentage.
- The NIR is used to calculate a population’s doubling time.

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$$DT = \frac{70}{NIR}$$

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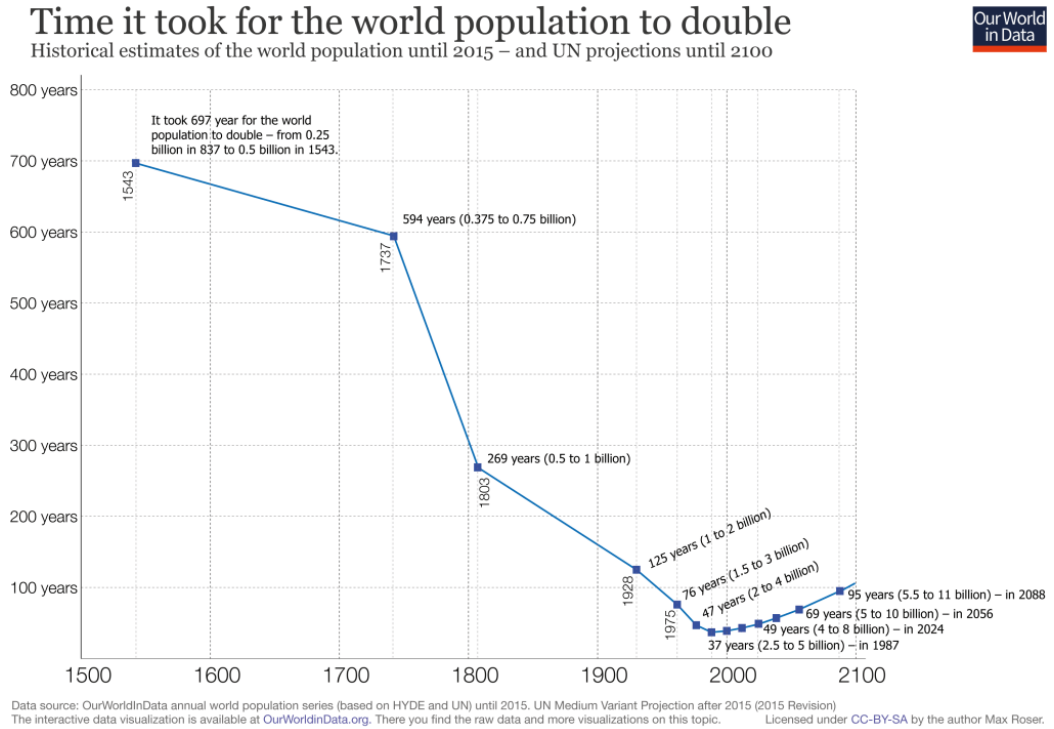
DT of World Population



Population Dynamic - TFR

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Population Dynamic - NIR

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$$\text{NIR} = \frac{\text{crude birth rate} - \text{crude death rate}}{10}$$

Key Terminologies

Category	Measure	Definition
Demographic indicator	Crude birth rate (CBR)	The number of live births per 1,000 individuals in a population per year.
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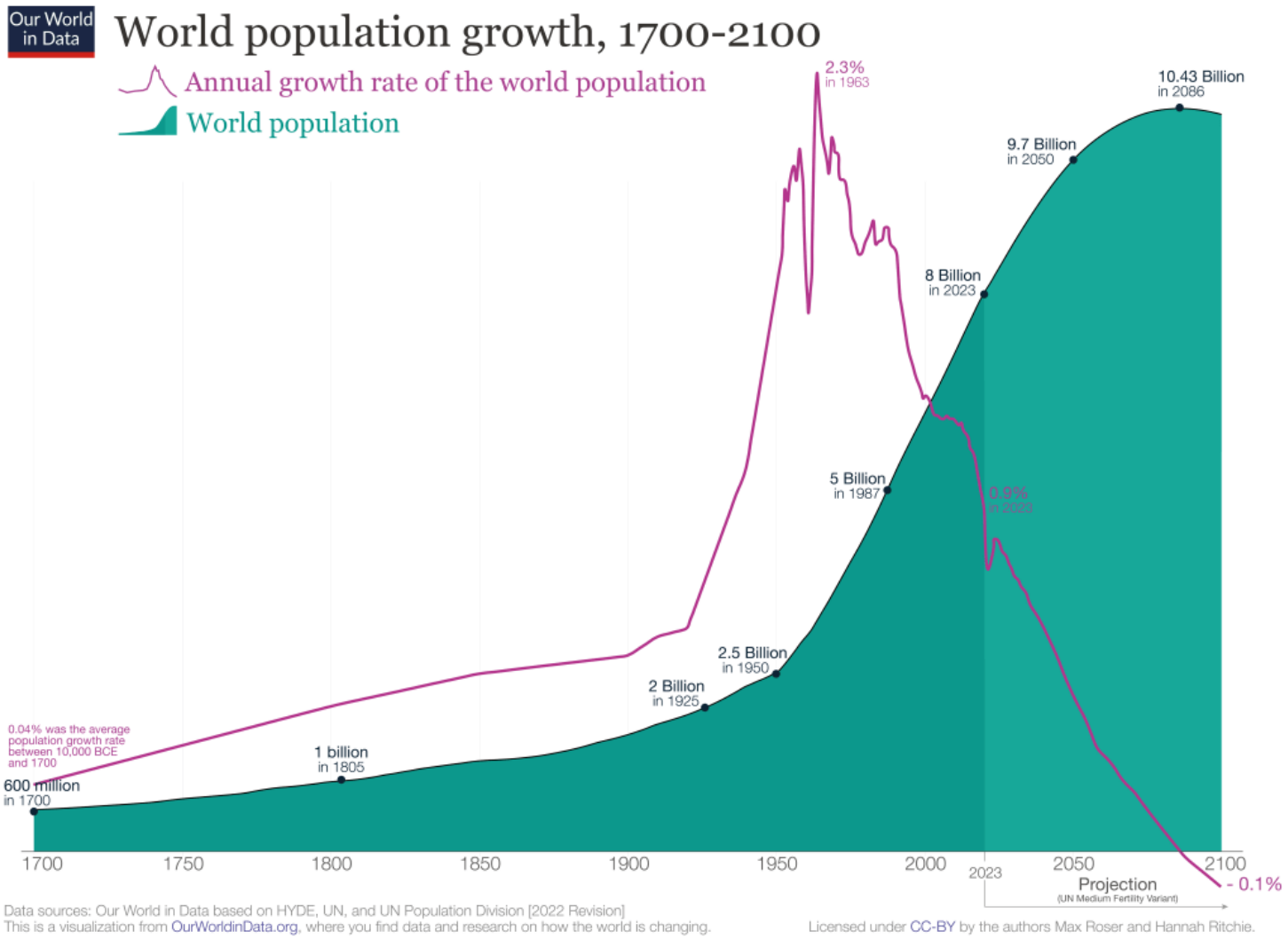
	Emigration rate	The number of emigrants leaving a population per 1,000 individuals per year.
Population demographic dynamic	Natural increase rate (NIR)	The rate of population growth expressed as a percentage per year, calculated from birth and death rates and excluding migration.
	Doubling time (DT)	The number of years required for a population to double in size, assuming a constant growth rate.
	Total fertility rate (TFR)	The average number of children a woman is expected to have over her lifetime.
	Life expectancy (LE)	The average number of years a person can be expected to live, based on current mortality patterns.

Human Population Growth



Data sources: Our World in Data based on HYDE, UN, and UN Population Division [2022 Revision]
This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.

Human Population - Pattern

- Human population growth has accelerated significantly over the past 300 years, with most growth occurring in recent history.
- The global population doubled from about 1 billion to 2 billion between 1804 and 1922.
- It doubled again from 2 billion to 4 billion between 1922 and 1974.
- The population was projected to double once more to approximately 8 billion by 2028.
- These trends show that the time required for population doubling has progressively shortened.
- Despite this, the overall rate of population growth has slowed since around 1999.
- Up to 95 per cent of current population growth occurs in low- and middle-income countries (LICs and MICs).
- The global population is expected to peak at around 11 billion before stabilising at approximately 8.5 billion.

Human Population – Possible Reasons

- In 1990, the global average total fertility rate was 3.3 children per woman.
- This declined to 2.6 in 2002 and further to 2.42 by 2020.
- The 2020 figure is only slightly above replacement level.
- If current trends continue, global fertility is expected to fall below replacement level before 2050.
- The HIV/AIDS epidemic has caused over 40 million deaths in the past 40 years.
- AIDS has reduced life expectancy at birth in several countries, particularly in developing regions of Asia, Latin America, and sub-Saharan Africa.
- Countries such as Botswana and South Africa may experience population decline due to AIDS-related mortality.
- Global deaths attributed to COVID-19 are estimated at approximately 7 million.

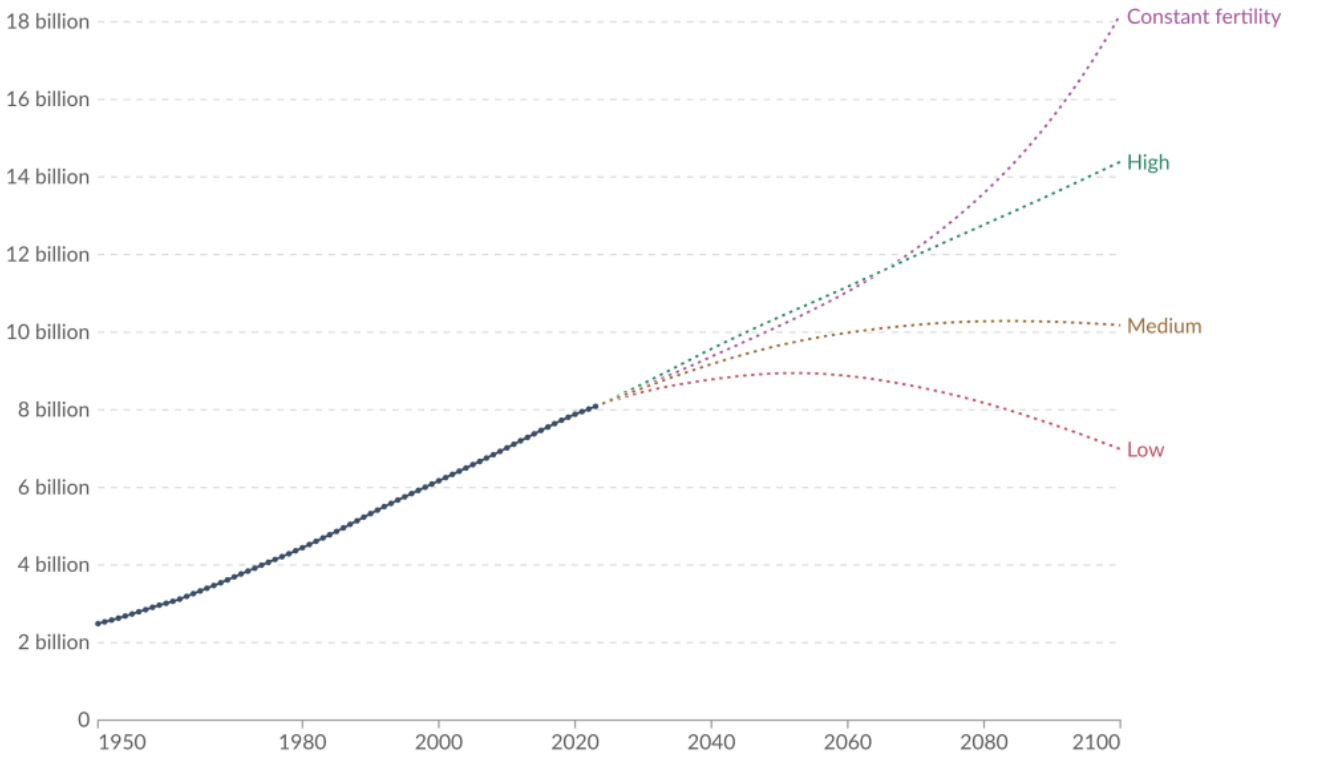
Human Population – What's next?

- Overall population growth curves indicate a gradual slowing of global population growth.
- Long-term population projections are highly uncertain, particularly in high-fertility countries.
- Projections by the United Nations, Institute for Health Metrics and Evaluation, and the Joint Research Centre of the European Commission compare population trends from 2022 to 2100 under multiple scenarios.
- There is a 95 per cent probability that the global population will be between 9.4 and 10.0 billion by 2050.
- By 2100, projections place the global population between 8.9 and 12.4 billion.
- Uncertainty increases further into the future, reflected in widening prediction intervals.
- United Nations projections to 2100 vary by approximately 7 billion, ranging from about 7 billion to 14 billion, with a medium estimate of around 10 billion.

Population, comparison of United Nations projections, World

Our World in Data

Projections from 2021 to 2100 are based on different UN scenarios[1].



Data source: UN, World Population Prospects (2024)

OurWorldinData.org/population-growth | CC BY

1. United Nations projection scenarios The United Nations' World Population Prospects include a range of projected scenarios for population change. These scenarios rely on different assumptions for fertility, mortality, and migration patterns to project different demographic futures.
Read more on population.un.org

Human Population Indirect Management

1. Gender Equality

- Greater gender equality is associated with lower birth and fertility rates.
- High levels of female participation in the workforce are linked to low fertility.
- This relationship is evident at national and sub-national scales.
- For example, Kerala in India has high gender equality and among the lowest fertility rates in the country.
- Societies with limited female labour force participation tend to have higher fertility rates.
- Increased reproductive autonomy for women leads to lower birth rates.

2. Level of Education

- Equal access to education for girls is strongly associated with low fertility rates.
- Countries such as Norway, Sweden, and Germany have low fertility linked to high female educational attainment.
- Countries where girls have limited access to education, such as Afghanistan, tend to have high fertility rates.
- Higher levels of parental education are generally associated with smaller family sizes.

2. Level of Education

- Poor households often have larger families due to limited resources and social security.
- Middle-income families with high aspirations but limited means tend to have the smallest families.
- Higher educational qualifications often lead to better-paid employment and lifestyle choices that prioritise material well-being over large families.

3. Economic Factors

- Economic prosperity is generally linked to higher birth rates.
- Rising living costs, economic recession, and unemployment are associated with declining fertility.
- The cost of raising a child in the United States can exceed US$240,000, partly due to lost maternal earnings.
- Some governments, such as France and Russia, provide financial incentives to support families.

3. Economic Factors

- Perceived affordability is as important as actual cost in influencing fertility decisions.
- Parents who believe that children will reduce their standard of living are less likely to have them.
- A strong global relationship exists between fertility and economic development.
- The UN and NGOs argue that reducing high fertility in LICs and MICs requires improvements in living standards.

4. Social Factors: The Need for Children

- In agricultural societies, large families provide labour and security in old age.
- This need is less significant in middle-income countries with fewer farming households.
- Urbanisation has significantly reduced birth rates worldwide.
- The proportion of people living in urban areas increased from one-third in 1960 to over half today.
- Children are economic assets in rural areas but financial costs in urban environments.
- Urban women have greater access to education, employment, and contraception.
- High infant mortality in very poor countries encourages higher fertility through replacement or compensatory births.

5. The Impact of Disease

- Economic development reduces mortality from infectious diseases through improved public health and living conditions.
- As infectious disease mortality declines, deaths from non-communicable diseases increase.
- Longer life expectancy increases exposure to degenerative diseases such as heart disease, cancer, and stroke.
- The COVID-19 pandemic reduced population growth by lowering fertility and migration rates.
- In high-income countries, most births are planned and depend on optimism about the future.

5. The Impact of Disease

- Economic and social uncertainty during COVID-19 led to delayed or foregone childbearing.
- The USA recorded approximately 300,000 fewer births during the pandemic.
- Australia experienced its first population decline since the First World War in 2020 due to border closures.
- Canada granted significantly fewer permanent residencies than planned in 2020.
- COVID-19 reduced life expectancy in the USA, particularly among African American and Latin American populations.
- Global COVID-19 deaths were estimated at 6–7 million by February 2024, though figures remain uncertain.

Activity

Download the file on the website on post 8.1.1