Chapter 6

Population Growth and Economic Development: Causes, Consequences, and Controversies
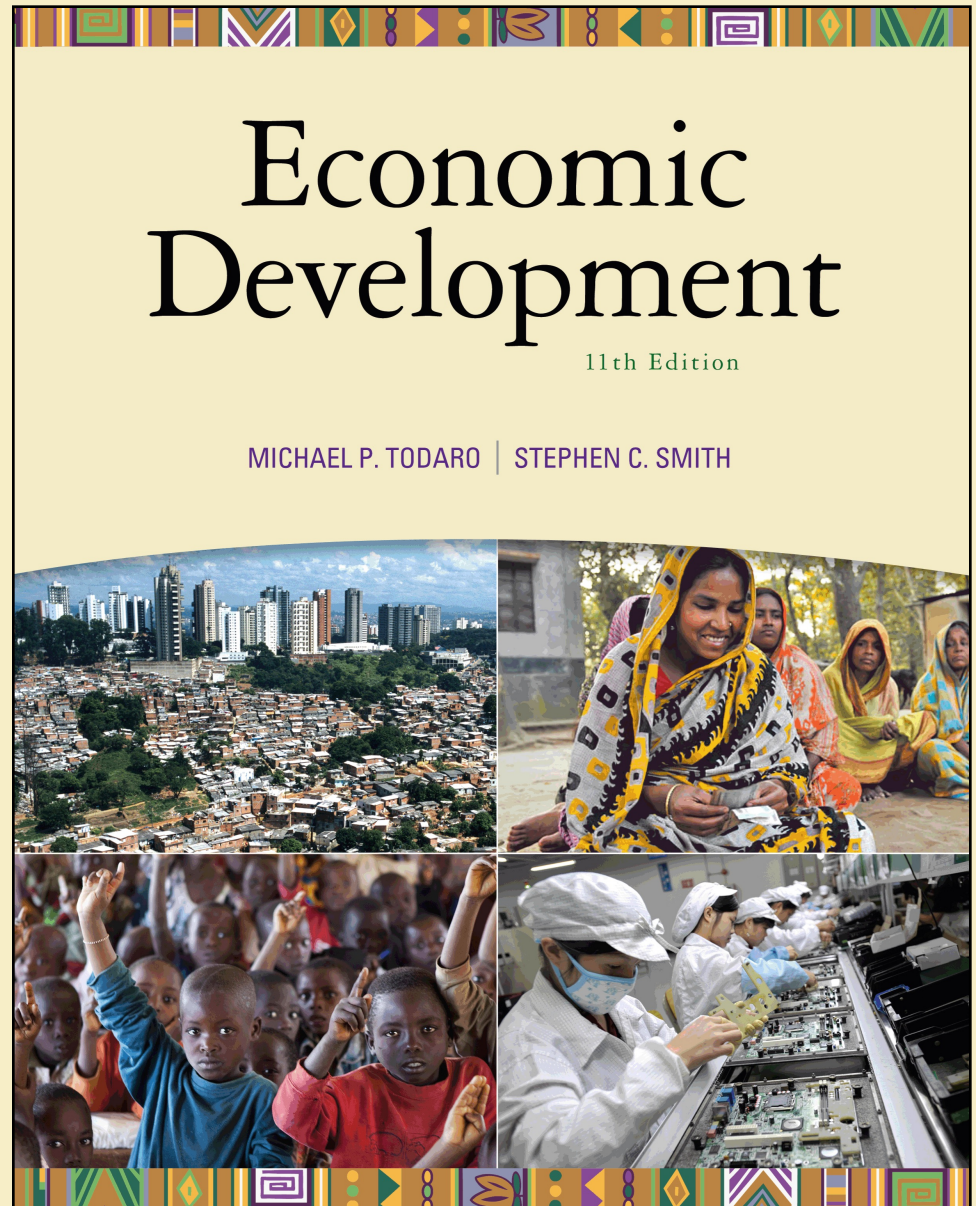
6.1 The Basic Issue: Population Growth and Quality of Life

- ## Six major issues:
  - Will developing countries be able to improve levels of living given anticipated population growth?
  - How will developing countries deal with the vast increases in their labor forces?
  - How will higher population growth rates affect poverty?

6.1 The Basic Issue: Population Growth and Quality of Life

- ## Six major issues (cont'd):
  - Will developing countries be able to extend the coverage and improve the quality of health care and education in the face of rapid population growth?
  - Is there a relationship between poverty and family size?
  - How does affluence in the developed world affect the ability of developing countries to provide for their people?

Some Ethical Question

- Suppose we can prove that large population causes relative under-development

- Is a small population living in luxury better off than a large population living under moderate circumstances?

  – We cannot answer this question in this course

  – Rather, at the macro level, we focus on GDP per capita as the measure of human welfare

6.2 Population Growth: Past, Present, and Future

- World population growth through history

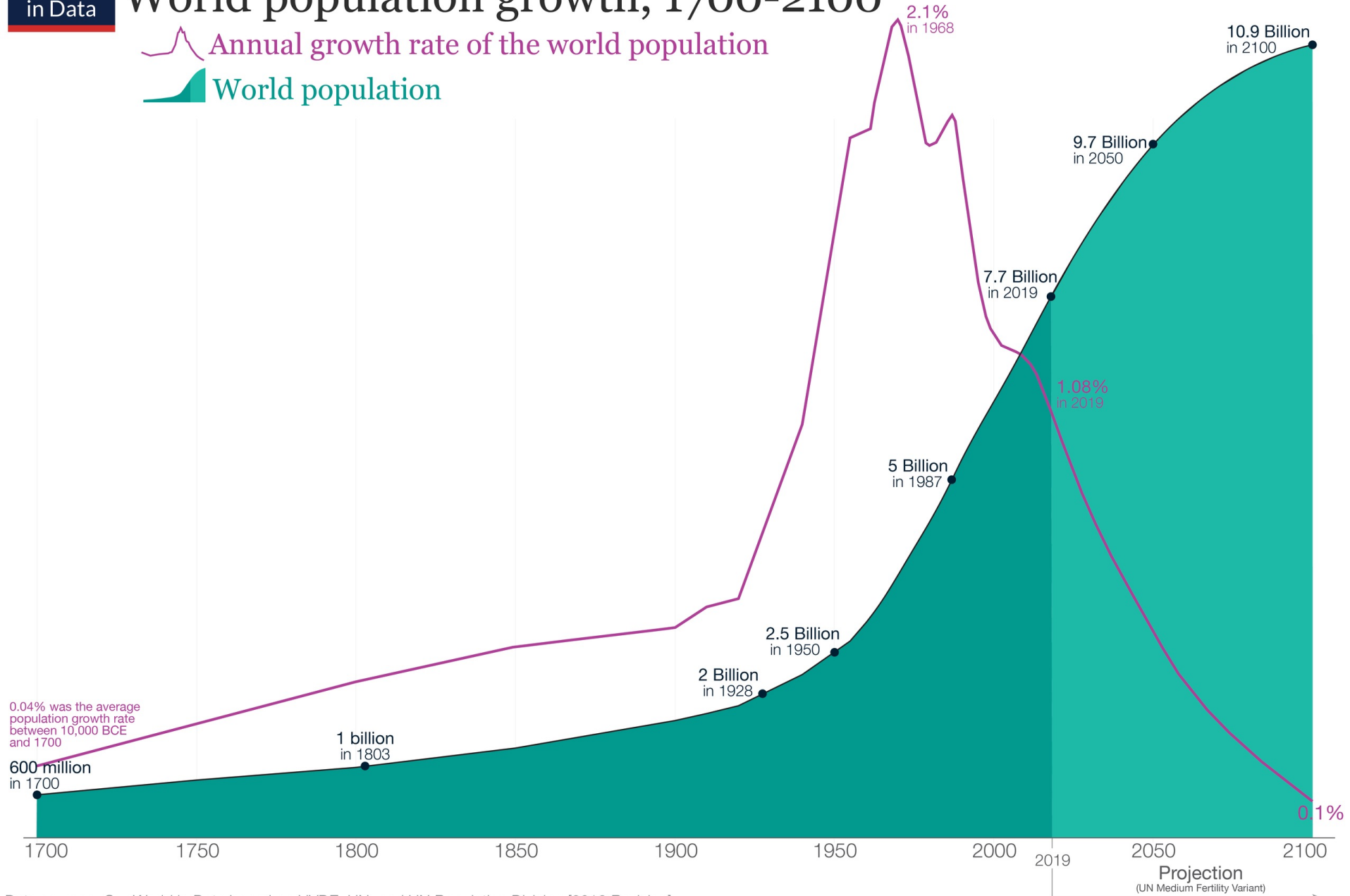| Year	Estimated Population (millions)	Estimated Annual Increase in the Intervening Period (%)	Doubling time (years)
10,000 B.C.E.	5		
1 C.E.	250	0.04	1,733
1650	545	0.04	1,733
1750	728	0.29	239
1800	906	0.45	154
1850	1,171	0.53	130
1900	1,608	0.65	106
1950	2,576	0.91	76
1970	3,698	2.09	33
1980	4,448	1.76	39
1990	5,292	1.73	40
2000	6,090	1.48	47
2010	6,892	1.22	57
2050 (projected)	9,200	0.675	103

Sources: Population Reference Bureau, *World Population Data Sheet* (Washington, D.C.: Population Reference Bureau, 2010 and previous annuals). Warren S. Thompson and David T. Lewis, *Population Problems*, 5th ed. (New York: McGraw-Hill, 1965), p. 384: United Nations, *Demographic Yearbook for 1971* (New York: United Nations, 1971); United Nations, *Report on the World Social Situation, 1997* (New York: United Nations, 1997), p. 14, and authors' calculations. An alternate system of broadly comparable and earlier estimates is found in Michael Kremer, "Population Growth and Technological Change: One Million B.C. to 1990," *Quarterly Journal of Economics* 108 (1993): 681-716.

World population growth, 1700-2100

⌁ Annual growth rate of the world population

▰ World population

2.1%
in 1968

10.9 Billion
in 2100

9.7 Billion
in 2050

7.7 Billion
in 2019

1.08%
in 2019

5 Billion
in 1987

2.5 Billion
in 1950

2 Billion
in 1928

0.04% was the average
population growth rate
between 10,000 BCE
and 1700

1 billion
in 1803

600 million
in 1700

0.1%

1700　1750　1800　1850　1900　1950　2000　2050　2100

2019

Projection
(UN Medium Fertility Variant)

Population did not grow very fast because

- Productivity technology and food supply
- Wars
- Diseases

The Spanish Flu of 1918-1919

- Also called influenza
- Killed 20-40 million people worldwide (more people than World War I)
- Cited as the most devastating epidemic in recorded world history
- More people died of influenza in a single year than in four-years of the Black Death Bubonic Plague from 1347 to 1351.

SARS Outbreak of 2003

- Worldwide
  - 8,400 infected
  - More than 900 died
- China was the center of the outbreak

Bird Flu in 2004

- First case happened in 1878 in Italy
- Most serious one in Hong Kong in 1997: Virus H5N1
  - 18 people infected, and 6 died
  - Millions of chicken killed
- The most recent one in many Asian countries in 2004

H1N1 in 2009

- From April 12, 2009 to April 10, 2010, the United States estimated about 60.8 million infections (upper and lower limits: 43.3 million to 89.3 million), 274,000 hospitalizations (195086 to 402719), and 12,469 deaths (8868 ~ 18306)
- By March 31, 2010, China had reported more than 127,000 confirmed cases of influenza A (H1N1)

COVID-19 Outbreak

- WHO declared a global "pandemic" on March 11, 2020

- IMF: Global economy faces worst recession since the Great Depression
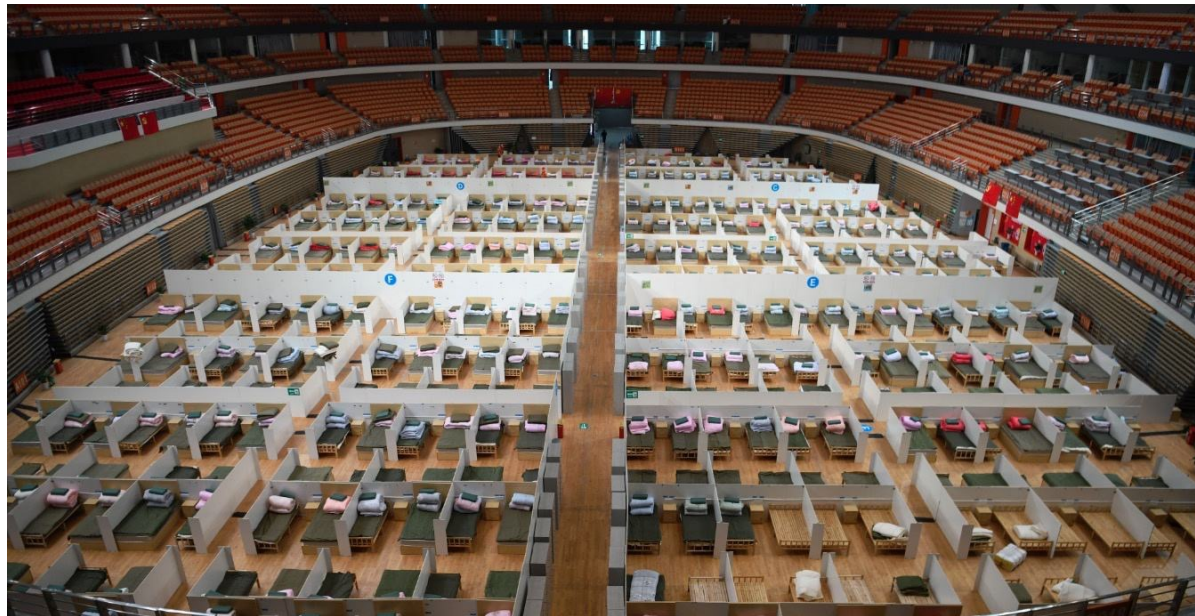
Globally, as of **7 November 2023**, there have been **771,678,854 confirmed cases** of COVID-19, including **6,977,010 deaths**, reported to WHO.

Daily new confirmed COVID-19 deaths per million people

7-day rolling average. Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19.

Our World in Data

| Table | Map | Chart | | Settings |

United States
Canada
France
Germany
India
United Kingdom

Mar 1, 2020   Feb 24, 2021   Sep 12, 2021   Mar 31, 2022   Oct 17, 2022   Nov 2, 2023

▶ Jan 8, 2020   Nov 2, 2023

6-14
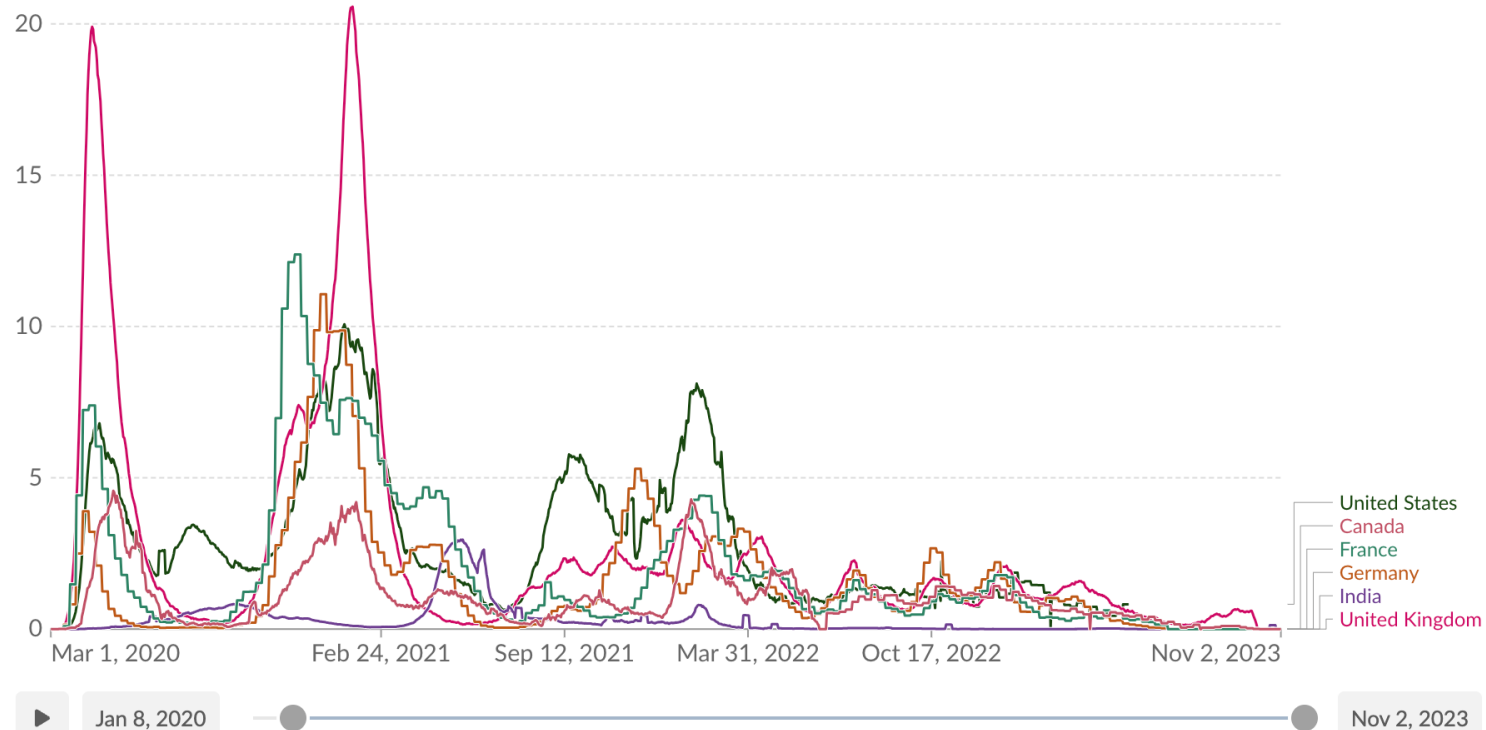
6.2 Population Growth: Past, Present, and Future

- ## Structure of the world's population
  - – Geographic region
  - – Fertility and mortality trends 出生死亡 趋势
  - – Rate of population increase
  - – Birth rates, death rates, total fertility rates
  - – Age structure and <u>dependency burdens</u>
    ↳ (aged 0-15, 65+)

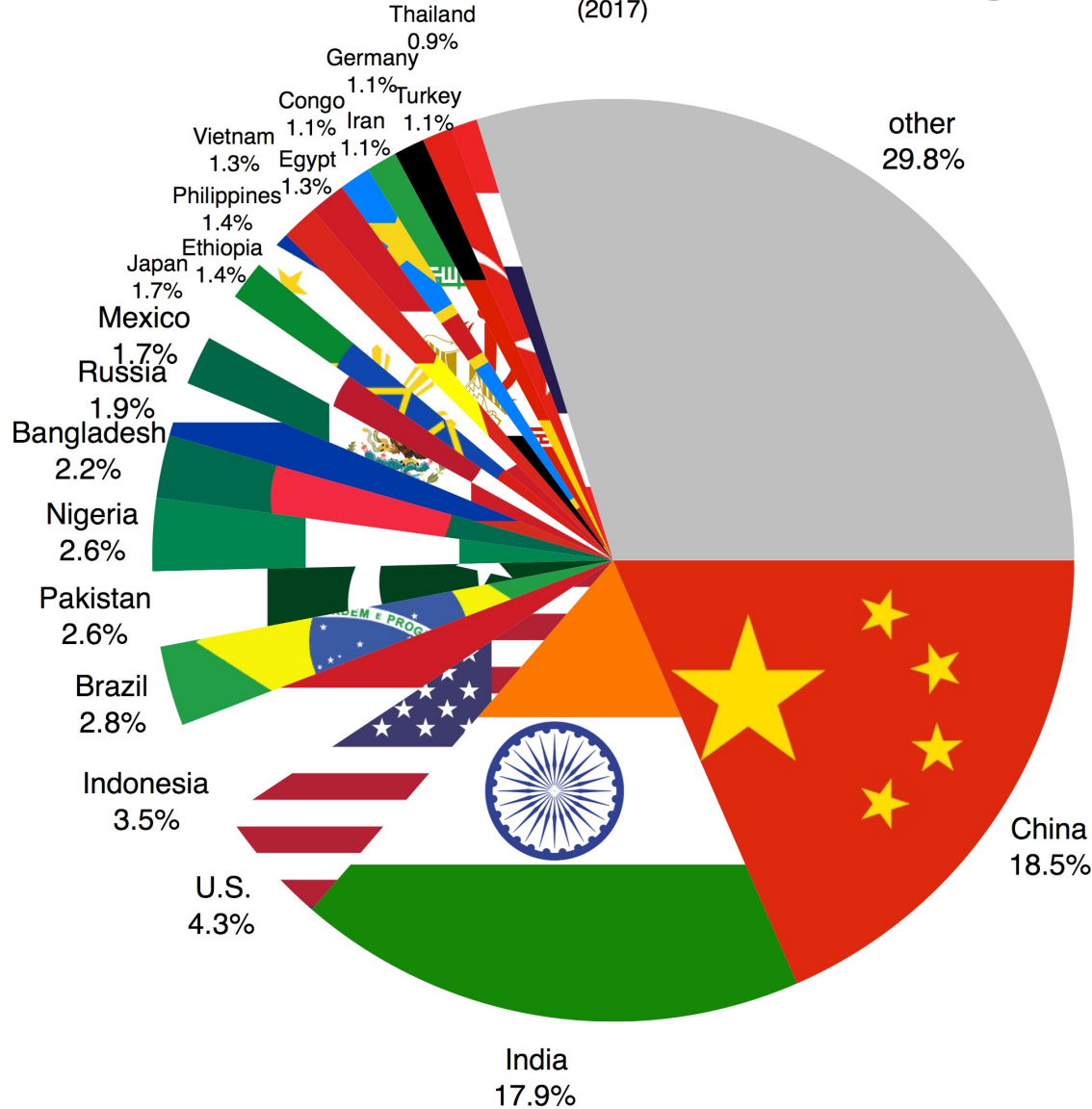# World Population Distribution by Region, 2017 and 2050

Panel A: 2017

Panel B: 2050
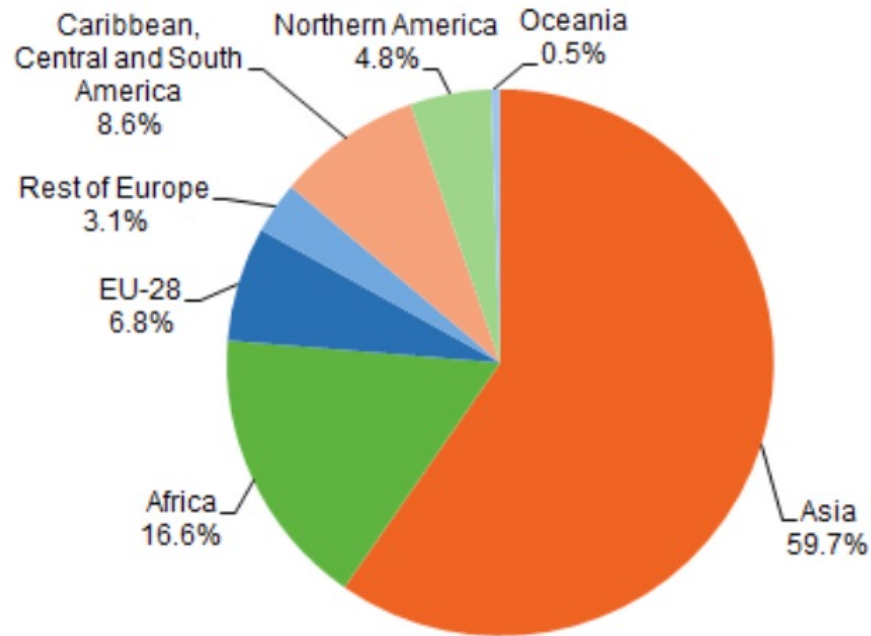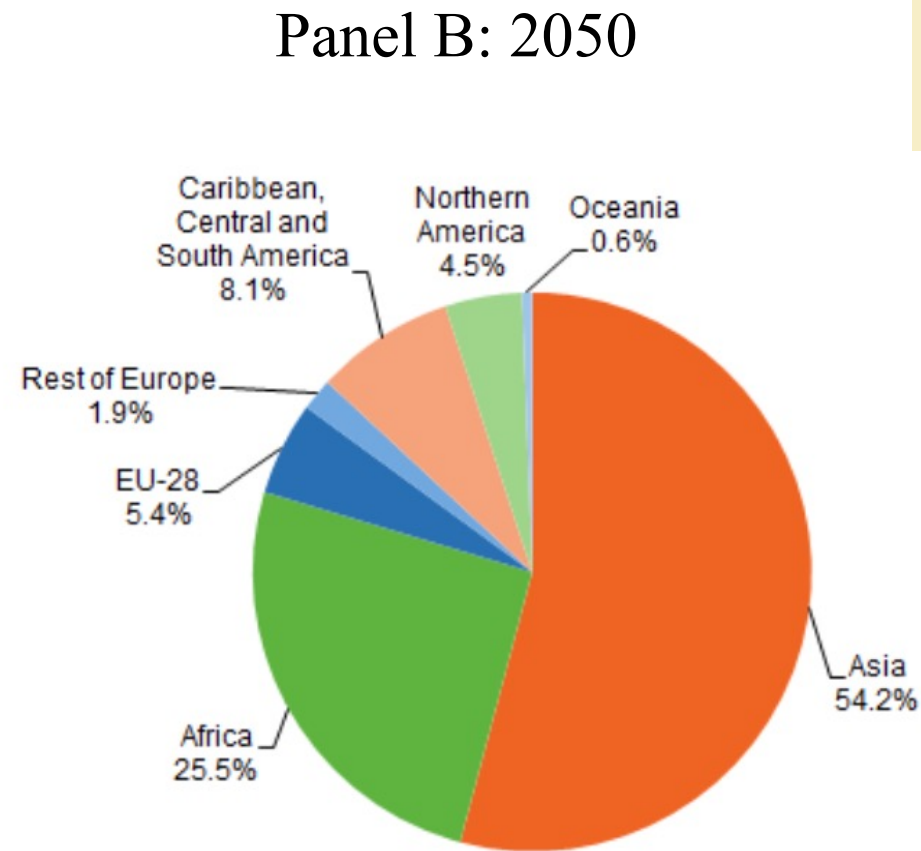
World Population Percentages

(2017)

#		Country	Population
1		China	1,452,451,082
2		India	1,412,526,216
3		U.S.A.	335,609,692
4		Indonesia	280,469,404
5		Pakistan	231,423,570
6		Brazil	216,156,831
7		Nigeria	218,857,539
8		Bangladesh	168,623,587
9		Russia	146,081,014
10		Mexico	132,185,251
11		Japan	125,577,393
12		Ethiopia	122,051,795
13		Philippines	113,107,557
14		Egypt	107,066,809
15		Vietnam	99,433,568
16		D.R. Congo	96,438,898
17		Turkey	86,519,460
18		Iran	86,589,032
19		Germany	84,415,650
20		Thailand	70,212,273

How can population grow?

- Sources
  - Natural increase = birth rate – death rate
    - Birth rate = number of newborns/population
    - Death rate = number of deaths/population
  - Immigration
- In developing countries
  - Birth rates are high
  - Death rates are not so high
    - People in developing countries live longer now

Table 6.3 Fertility Rate for Selected Countries, 1970 and 2009

Country	Total Fertility Rate[a]	
	1970	2009
Bangladesh	7.0	2.3
Colombia	5.3	2.5
Indonesia	5.5	2.4
Jamaica	5.3	2.4
Mexico	4.9	2.3
Thailand	5.5	1.8
Zimbabwe	7.7	3.9

Sources: World Bank, *World Development Report, 1994* (New York: Oxford University Press, 1994), tab. 26; Population Reference Bureau, *World Population Data Sheet* (Washington, D.C.: Population Reference Bureau, 2009).

[a]Average number of children born to women who live beyond age 49.

- This table lists seven countries that experienced significant fertility declines between 1970 and 2009.

Children born per woman, 2019

Shown is the 'Total Fertility Rate' which measures the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with the age-specific fertility rates of the specific year.

No data 0   1   1.5   2   2.5   3   4   5   6   7   8   9
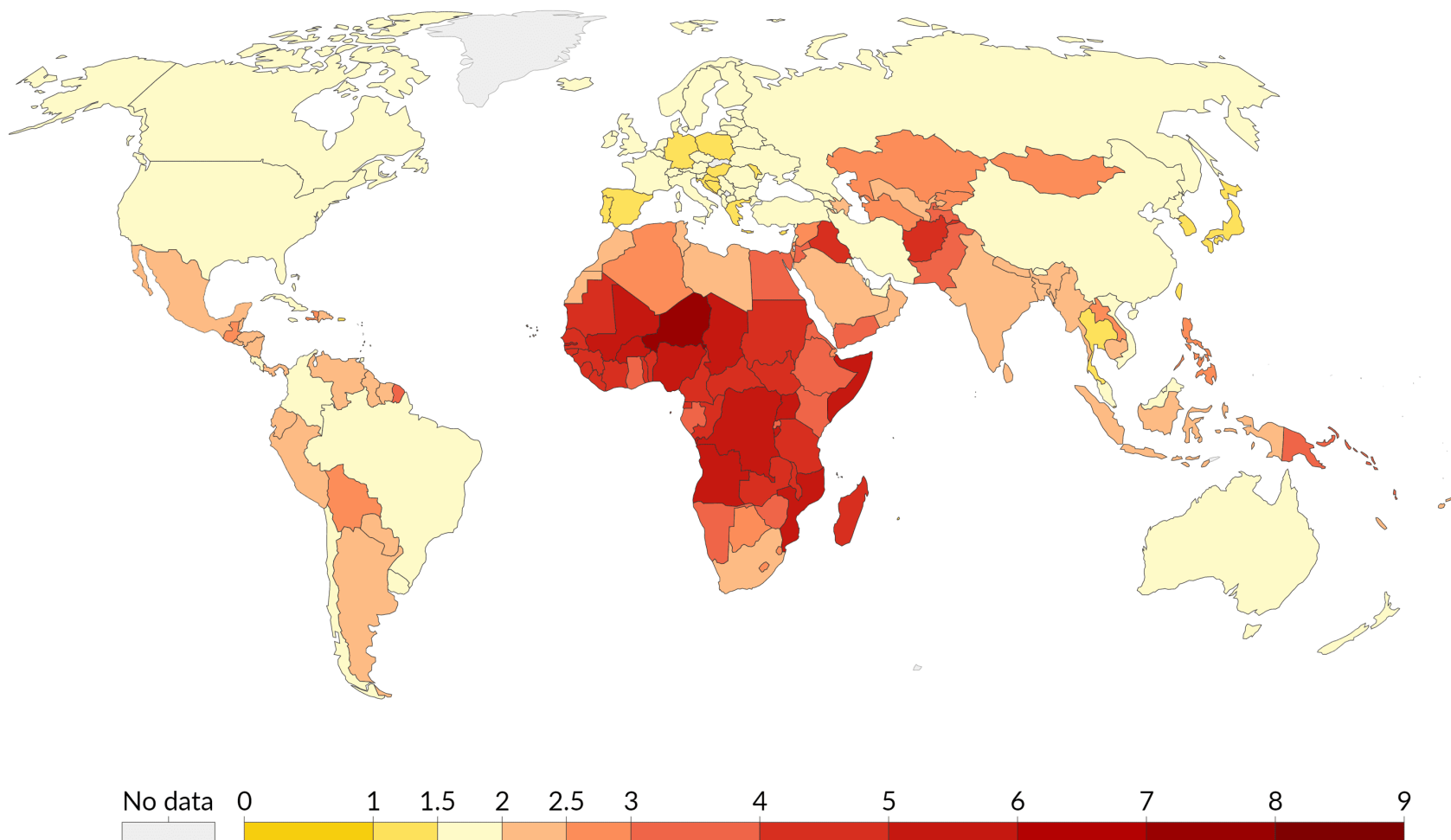
China's Birth Rate Continues To Decline

Total population of Chinese mainland (in millions)

Birth rate (%)

1971: Top officials formally promote later, fewer, and less frequent births.

1980: Stricter family-planning measures, including one-child policy, enforced.

2016: Two-child policy implemented.

China experienced a serious famine between 1959 and 1961.

SIXTH TONE
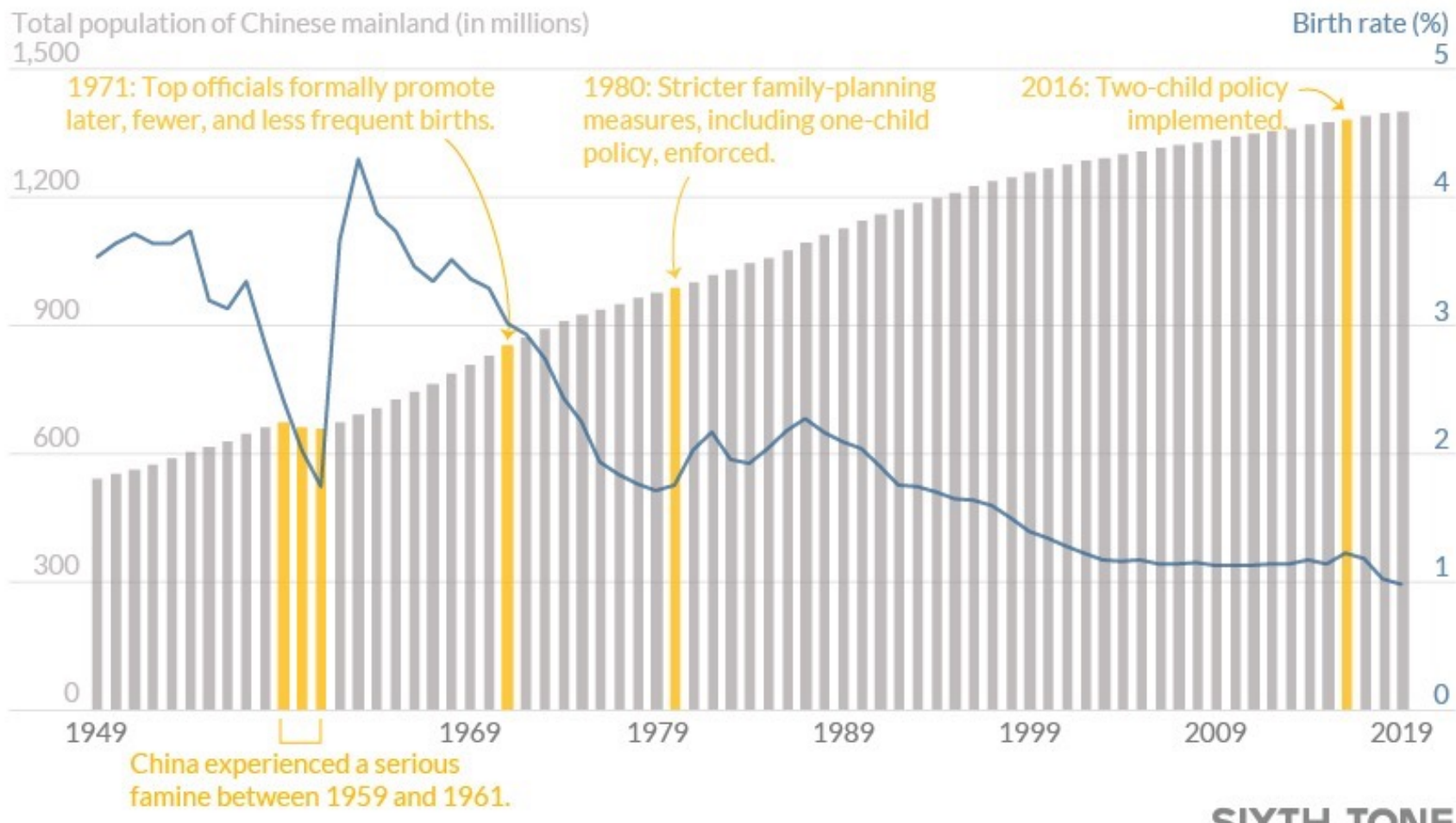
China's total fertility rate (births per woman) was 2.6 in the late 1980s – well above the 2.1 needed to replace deaths. It has been between 1.6 and 1.7 since 1994, and slipped to 1.3 in 2020 and just 1.15 in 2021.

- In 1980, Chinese government advocated one-child policy. In 1982, the 12th National Congress of the Communist Party of China established family planning as a basic national policy, and it was written into the Constitution宪法.

- In November 2013, China initiated the policy allowing couples, where one partner is an only child, to have two children. From 2016, each couple was allowed have two children was fully implemented, to actively address population aging problem.

- Starting from May 2021, a couple is allowed to have three children.

- In 2023, among Shanghai's resident population, the proportion of one-child families was 66.24%, two-child families accounted for 29.10%, and three-child families made up 4.21%.

- The total fertility rate for Shanghai was. The average age of first-time mothers was 31.66 years old.

6.2 Population Growth: Past, Present, and Future

- ## The Hidden Momentum势头 of Population Growth
  - High birth rates cannot be altered overnight
  - Age structure of developing country populations
- ## Demographic dividend人口红利
  - The high economic growth that can be achieved during the demographic transition when the working-age population share is significantly greater than the non-working-age population share, with much of the labour force in their prime productive years.

Figure 6.4 Population Pyramids

FIGURE 6.4 Population Pyramids: Low-, Middle-, and High-Income Countries, 1965; and 2016

Low income   Middle income   High income

1965

Middle-income countries used to have young populations similar to those of low-income countries today.

2016

Over time their populations have transitioned to be more like those of high-income countires.

Distribution of population in five-year age bands by sex (%)

Male   Female

6-24
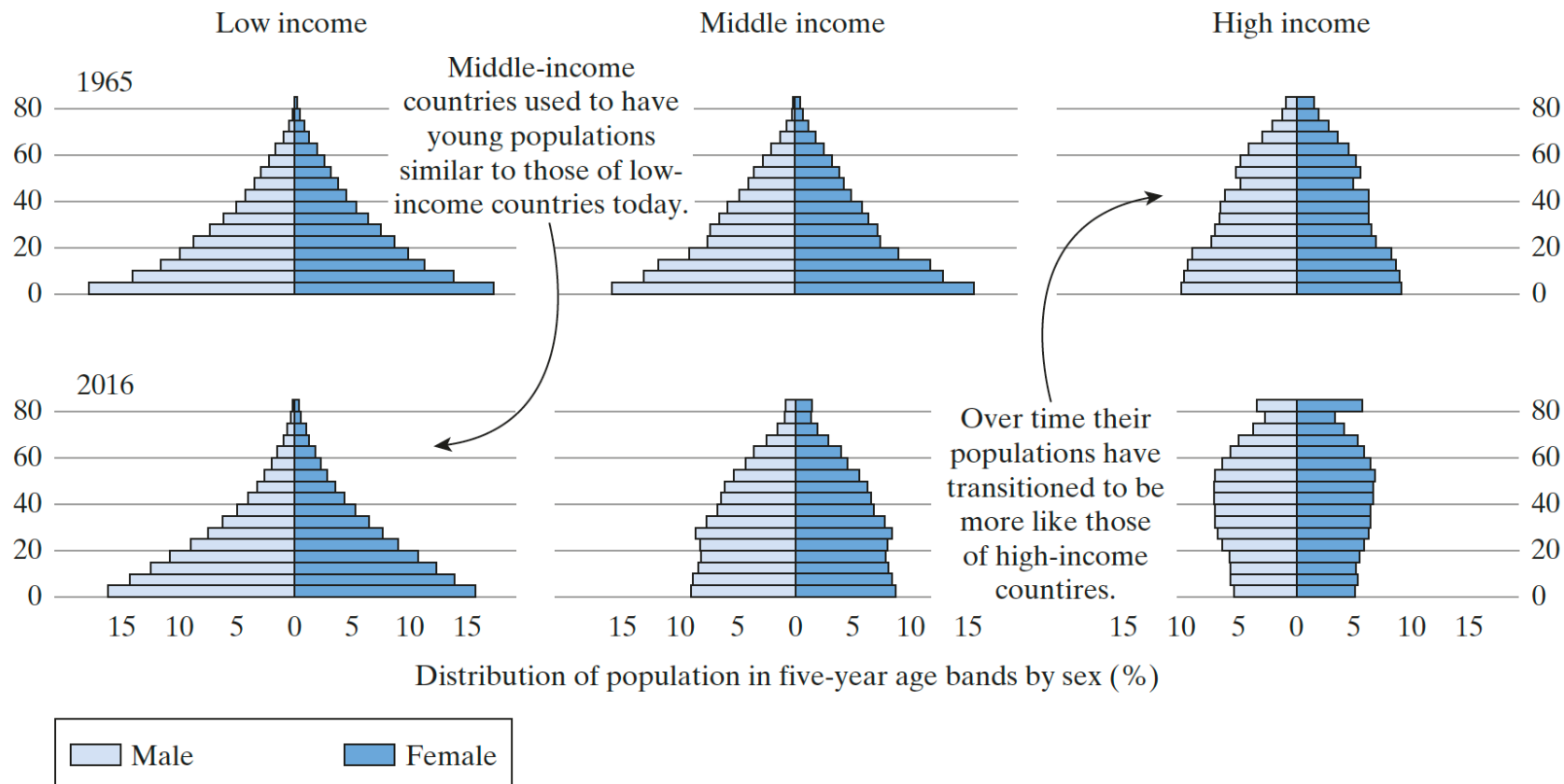
By 2019, there were 254 million older people aged 60 and over, and 176 million older people aged 65 and over. By 2040, an estimated 402 million people (28% of the total population) will be over the age of 60.

CHINA'S POPULATION PYRAMIDS: 1960, 2015, 2050

AGE

Male Female

Source: World Bank
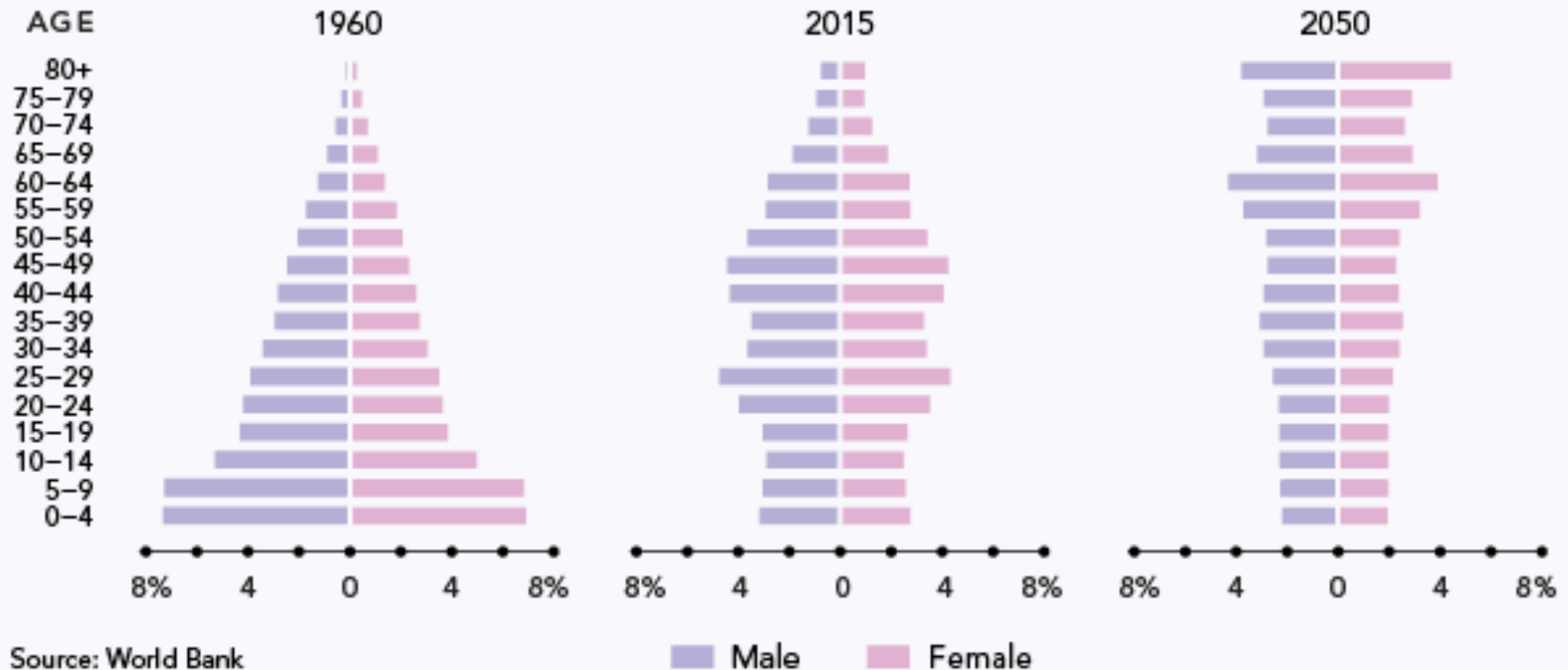
6.3 The Demographic Transition

人口统计营讨论

- Stage I: High birthrates and death rates
- Stage II: Continued high birthrates, declining death rates
- Stage III: Falling birthrates and death rates, eventually stabilizing

Figure 6.5 The Demographic Transition in Western Europe
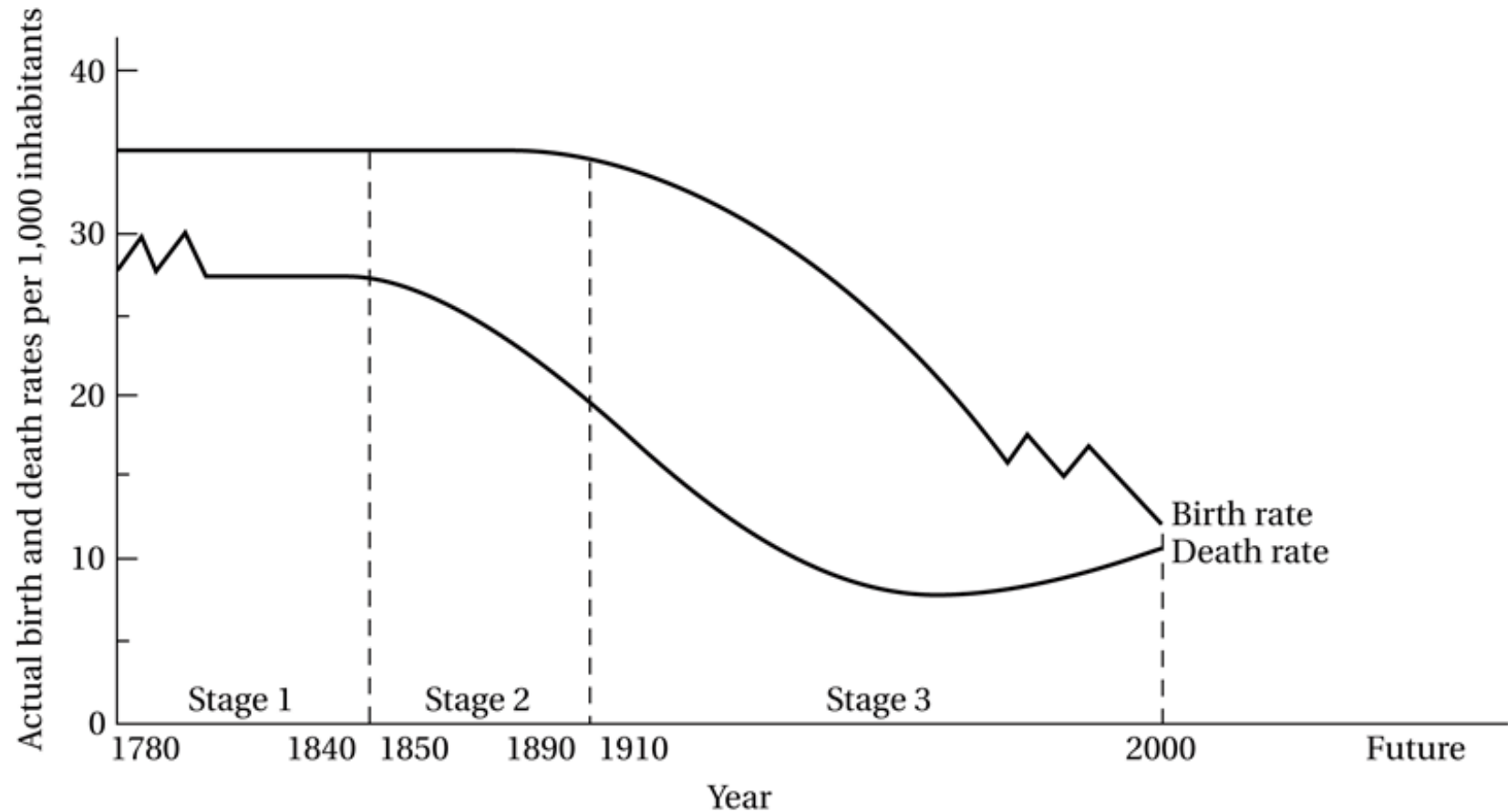
Figure 6.6 The Demographic Transition in Developing Countries
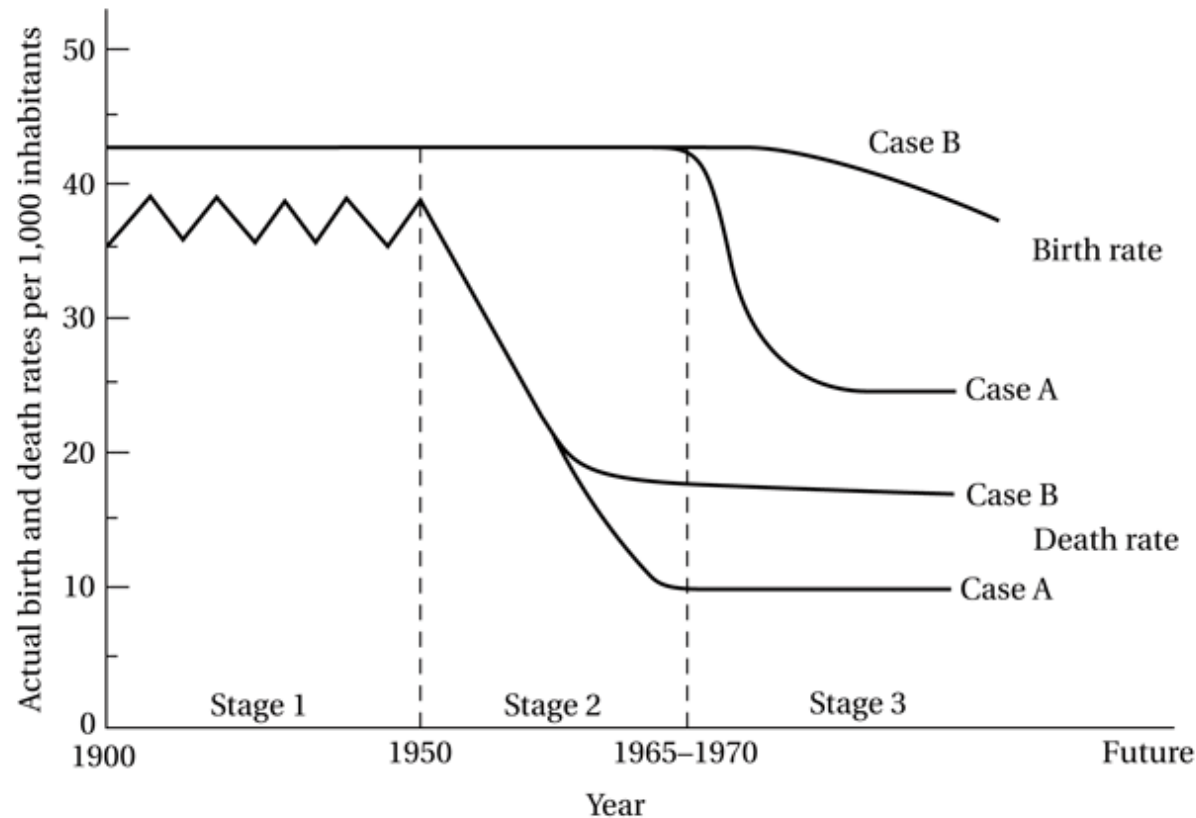
The Demographic Transition of Developing Countries

- Differs from that of Europe
  - Stage II: higher population growth (in excess of 2-2.5%)
  - Stage III
    - Case A: South Korea, Costa Rica, China, Cuba, Chile and Sri Lanka
    - Case B: due to poor living standard and AIDS
  - In sub-Saharan and the Middle East, the Stage III has not come yet

6.4 The Causes of High Fertility in Developing Countries: The Malthusian and Household Models

马尔萨斯人口陷阱

- ## The Malthusian Population Trap
  - The idea that rising population and diminishing returns to fixed factors result in a low levels of living (population trap)
  - Let's look at the graph
    - The horizontal line is the level of income per capita.
    - Per capita income growth rate is the difference between income growth and population growth
    - The shape of population growth curve accords with demographic transition

Figure 6.7 The Malthusian Population Trap

$$\frac{\Delta Y}{Y} < \frac{\Delta P}{P}, \quad \frac{\Delta Y}{Y} \downarrow$$

Population growth rate ($\Delta P/P$)

Total income growth rate ($\Delta Y/Y$)

Growth rates

S   T

Income per capita

收敛到 S.

$$\frac{\Delta Y}{Y} > \frac{\Delta P}{P}, \quad \frac{\Delta Y}{Y} \uparrow.$$
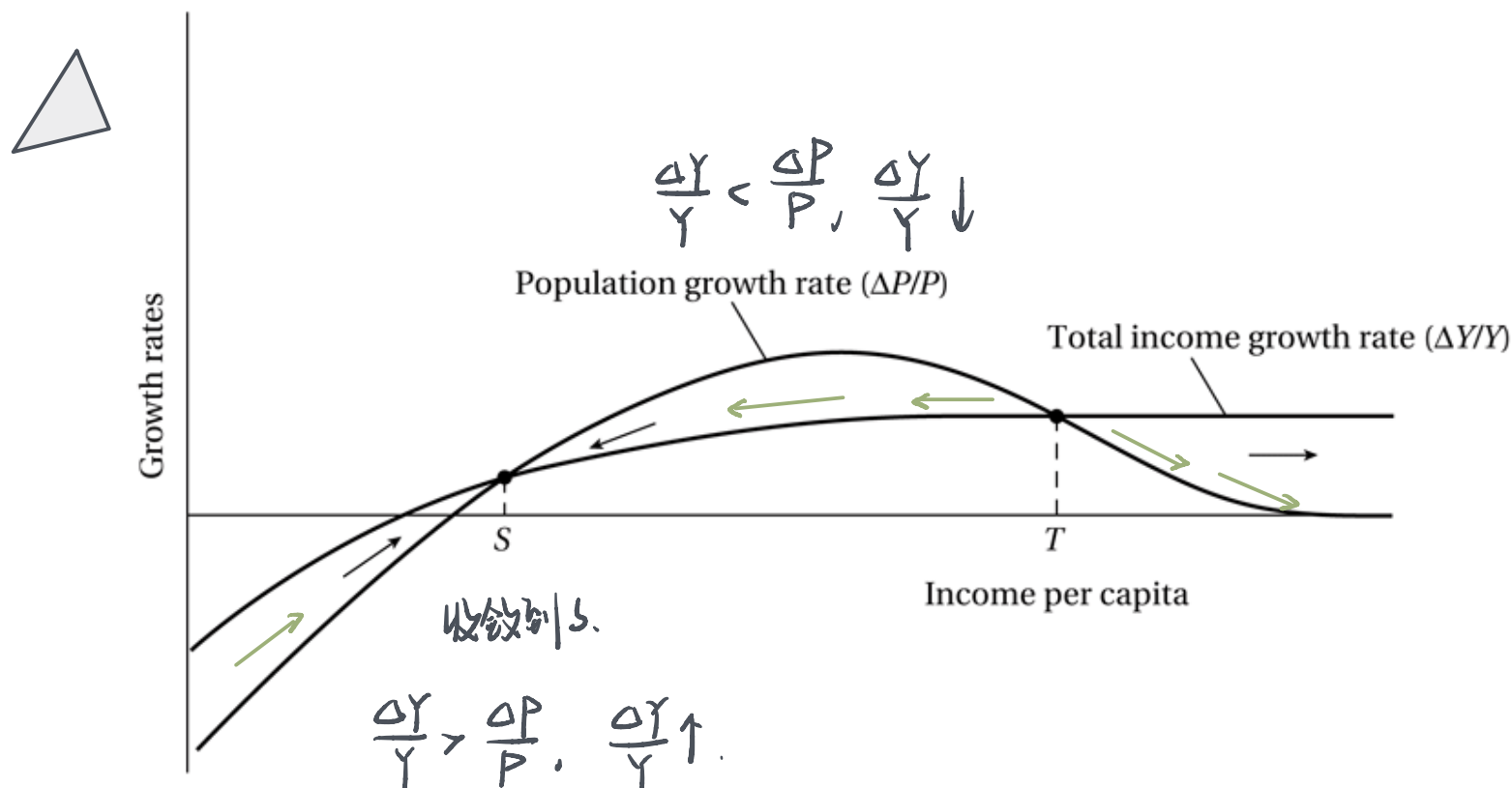
- Similar to the Harrod-Domar model, whenever the rate of total income growth is greater, income per capita is rising; this corresponds to moving to the right along the x-axis. Otherwise, income per capita is falling.

- When the two rates are equal, income per capita is unchanging.

- Point S represents a stable equilibrium
  - This very low population growth rate along with a very low income per person is consistent with the experience of most of human history.
- If a country initiates preventive checks (**birth control**), and per capita income reaches a threshold level (T), it is possible that per capita income will grow continually at a rate such as 2% per year (the approximate U.S. per capita growth rate from 1870 to 2008).

6.4 The Causes of High Fertility in Developing Countries: The Malthusian and Household Models (cont'd)

- ## Criticisms of the Malthusian Model
  - Assumes no technological improvement 低收入时. 只随些个而个
  - Assumes that population growth increases with per capita income at low income level
    - Fertility rates vary widely for countries with the same per capita income, especially below $1000.
  - Focus on the wrong variable, per capita income, as the principal determinant of population growth rates. In fact, family size decision is made based on individual, and not aggregate, levels of living. 出生率及人均发本水平

Figure 6.8 How Technological and Social Progress Allows Nations to Avoid the Population Trap
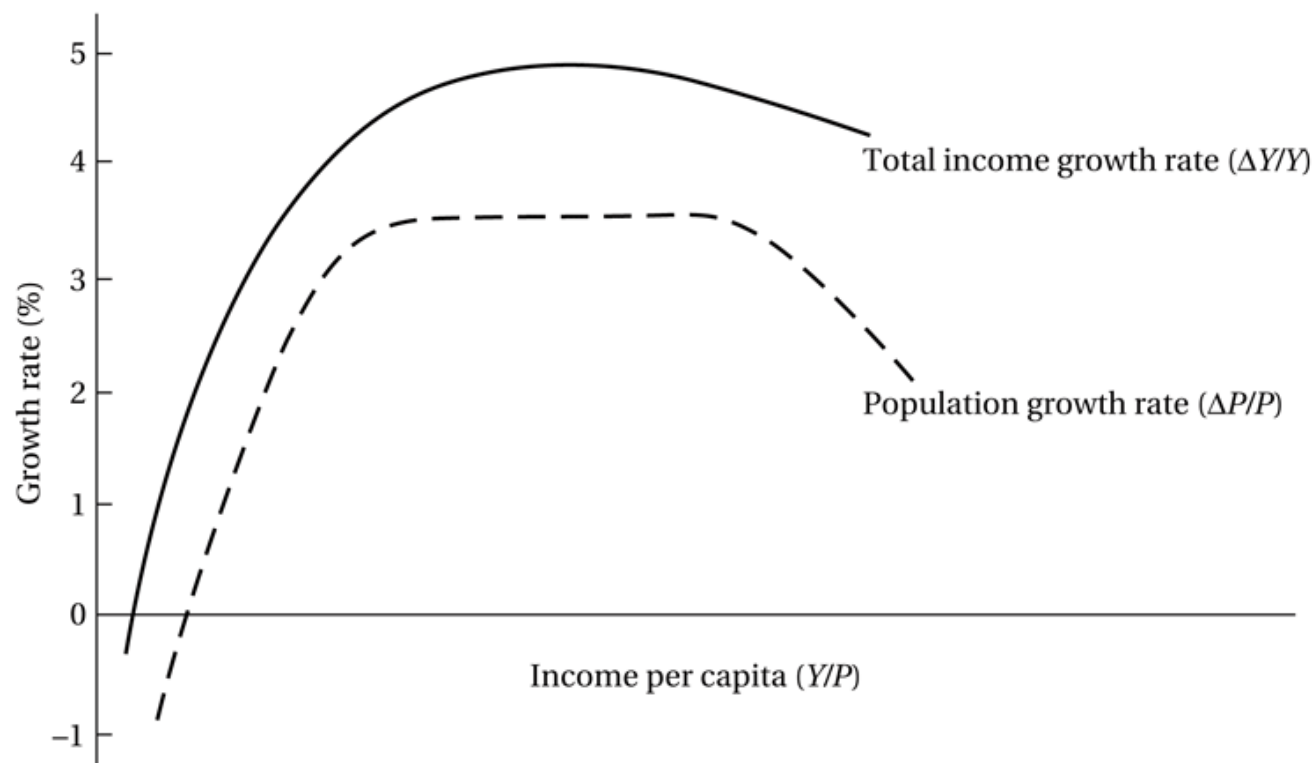
- Rapid and continuing technological progress drives an upward shift of the income growth. Thus, per capita income will continue to grow.
- All countries have the potential of escaping the Malthusian population trap.

Figure 6.10 Fertility in Relation to Income in Developing Countries and regions
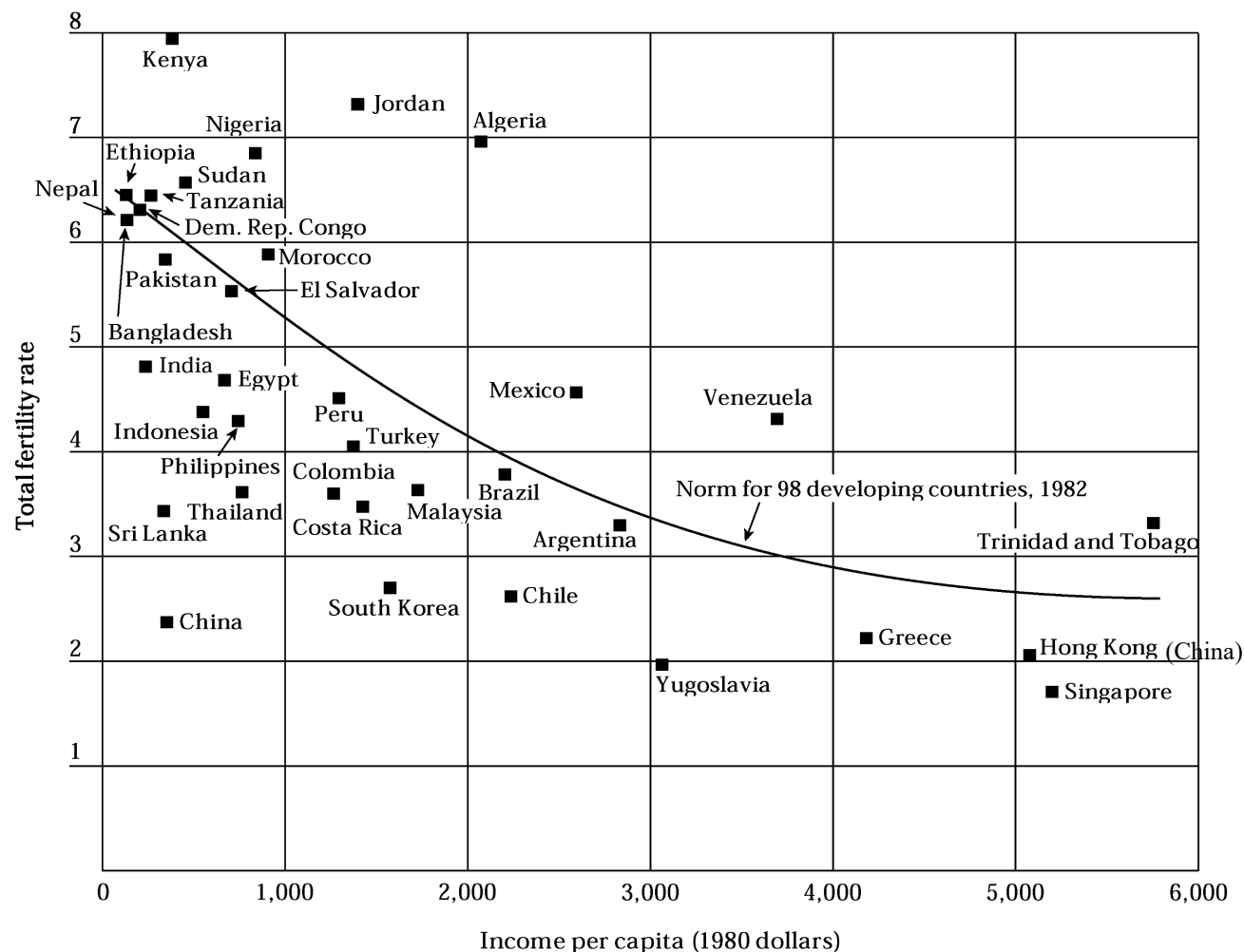
Source: Nancy Birdsall, "Economic approaches to population growth," in Hollis B. Chenery and T. N. Srinivasan (eds.), *Handbook of Development Economics*, vol. 1 (Amsterdam: Elsevier–North Holland, 1988), p. 482. Reprinted with permission.

Note: Total fertility rate and birthrate, though not conceptually the same, are nevertheless highly correlated.

6.4 The Causes of High Fertility in Developing Countries: The Malthusian and Household Models (cont'd)

- The Microeconomic Household Theory of Fertility

  – The theory that family formation has costs and benefits that determine the size of families formed.

  – Provide a better theoretical and empirical explanation for the observed falling birth rates associated with stage 3 of the demographic transition

- Children are considered as a special kind of consumption good so that fertility becomes a rational economic response to the consumer's (family's) demand for children relative to other goods
  - The usual income and substitution effects are assumed to apply.
- Suppose C_d is the demand for surviving children
  - An important consideration in low-income societies where infant mortality rates are high

Demand for Children Equation

$$C_d = f(Y, P_c, P_x, t_x), x = 1, \ldots, n$$

Where Y is the level of household income

P_c is the "net" price of children (the difference between anticipated costs, mostly the opportunity cost of a mother's time, and benefits, potential child income and old-age support) 养育成本-养育回报

P_x is price of all other goods

t_x is the tastes for goods relative to children

Under neoclassical conditions, we would expect:

$\partial C_d / \partial Y > 0$ The higher the household income, the greater the demand for children.

$\partial C_d / \partial P_c < 0$ The higher the net price of children, the lower the quantity demanded.

$\partial C_d / \partial P_x > 0$ The higher the prices of all other goods relative to children, the greater the quantity of children demanded.

$\partial C_d / \partial t_x < 0$ The greater the strength of tastes for goods relative to children, the fewer children demanded.

Figure 6.9 Microeconomic Theory of Fertility: An Illustration
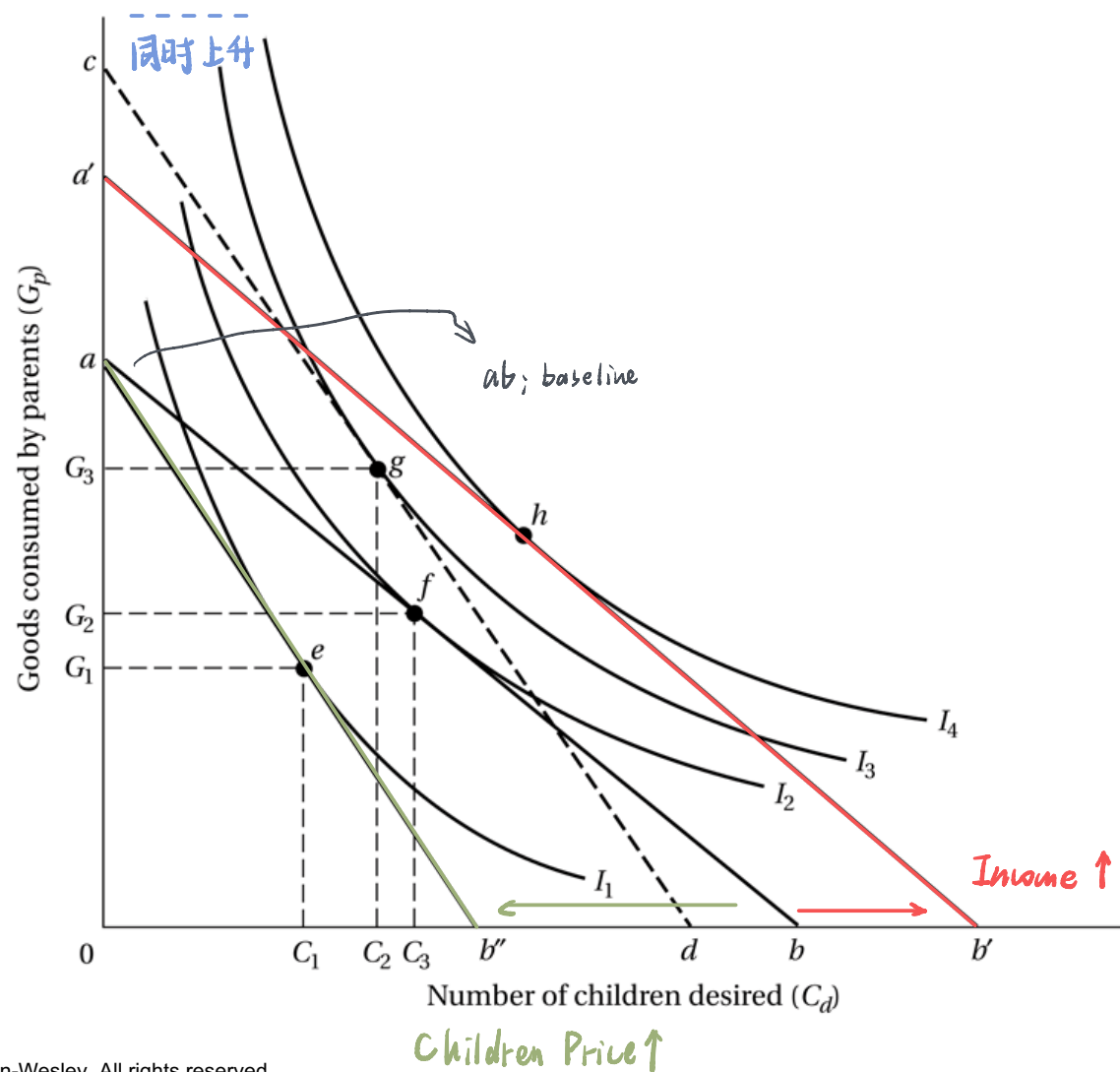
- Each individual indifference curve portrays a locus of commodity-child combinations that yield the same amount of satisfaction.

- The household's ability to "purchase" alternative combinations of goods and children is shown by the budget constraint line, *ab*.
  - The steeper the slope of the budget line, the higher the price of children relative to goods.

- This optimal combination is represented by point *f*, the tangency point between the budget constraint, *ab*, and indifference curve I_2. Therefore, C_3 children and G_2 goods will be demanded.

- A rise in family income, shown as an outward shift of the budget line from *ab* to *a'b'*, enables the household to attain a higher level of satisfaction (point *h* on curve I_4) by consuming more of both commodities and children.

- A rise in the relative price of children causes the household utility-maximizing consumption combination to occur on a lower indifference curve, as shown by moving from f to *e* when the budget line rotates around point *a* to *ab''*.

- If there is a simultaneous increase in household income and net child price as a result of, expanding female employment opportunities and a rise in wages coupled with a tax on children beyond a certain number per family, the result is a new utility-maximizing combination that includes fewer children per family (point *g*).

The Demand for Children in Developing Countries

- First two or three as "consumer goods"

- Additional children as "investment goods": parents are assumed to weigh private economic benefits against private costs

  - Benefits: work on family farm, microenterprise; old age security motivation

  - Opportunity costs: mother's time (the income she could earn if she were not at home caring for her children) and the cost of educating children

Some Empirical Evidence

- Statistical studies in developing countries underline the importance of educating women and improving public health and child nutrition programs in reducing fertility levels.

  - It is found that high female employment opportunities outside the home and greater female school attendance, especially at the primary and secondary levels, are associated with significantly lower levels of fertility.

  - Also confirm the strong association between declines in child mortality and the subsequent decline in fertility.

Implications for Development and Fertility

- Fertility lower if
  - Raise women's education, role, and status
  - More female nonagricultural wage employment
  - Rise in family income levels
  - Reduction in infant mortality
  - Development of old-age and social security
  - Expanded schooling opportunities
- Well-executed family-planning programs can be an effective tool.

6.5 The Consequences of High Fertility: Some Conflicting Perspectives

- Population growth: "It's Not a Real Problem":
  - The real problem is not population growth but the following,
    - Underdevelopment
    - World resource depletion 枯竭 and environmental destruction
    - Population Distribution
    - Subordination 从属地位 of women
- Overpopulation is a Deliberately Contrived False 刻意捏造 Issue
- Population Growth is a Desirable Phenomenon
  - An essential ingredient to stimulate economic development

6.5 The Consequences of High Fertility: Some Conflicting Perspectives

- **"Population Growth *Is* a Real Problem"**
  - Extremist arguments: population and global crisis
  - Theoretical arguments
    - Population-poverty cycles and the need for family-planning programs
    - Use Solow type neoclassical growth equation to demonstrate adverse consequences of rapid population growth

6.5 The Consequences of High Fertility: Some Conflicting Perspectives

- "Population Growth *Is* a Real Problem" (con't)
  - Empirical arguments
    - Lower economic growth
    - Poverty
    - Adverse impact on education
    - Adverse impact on health
    - Food issues
    - Impact on the environment
    - Frictions over international migration

Goals and Objectives: Toward a Consensus 趋于共识

- Despite the conflicting opinions, there is some common ground on the following:
  - Population is not the primary cause of lower living levels, but may be one factor
  - Population growth is more a consequence than a cause of underdevelopment
  - It's not numbers but quality of life
  - Market failures: potential negative social externalities
  - Voluntary decreases in fertility is generally desirable for most developing countries with still-expanding populations

Goals and Objectives:
Toward a Consensus

- Some Policy Approaches
  - Attend to underlying socioeconomic conditions that impact development
  - Family planning programs should provide education and technological means to regulate fertility
 - Developed countries have responsibilities too

6.6 Some Policy Approaches

- ## What Developing Countries Can Do
  - Persuasion through education
  - Family planning programs
  - Address incentives and disincentives for having children through the principal variables influencing the demand for children
  - Coercion is not a good option
  - Raise the socioeconomic status of women
  - Increase employment opportunities for women (increases opportunity cost of having more children, as in microeconomic household theory)

6.6 Some Policy Approaches

- ## What the Developed Countries Can Do Generally
  - Address resources use inequities
  - More open migration policies
- ## How Developed Countries Can Help Developing Countries with Their Population Programs
  - Research into technology of fertility control
  - Financial assistance for family planning programs

Exercise: Consider the following graph:
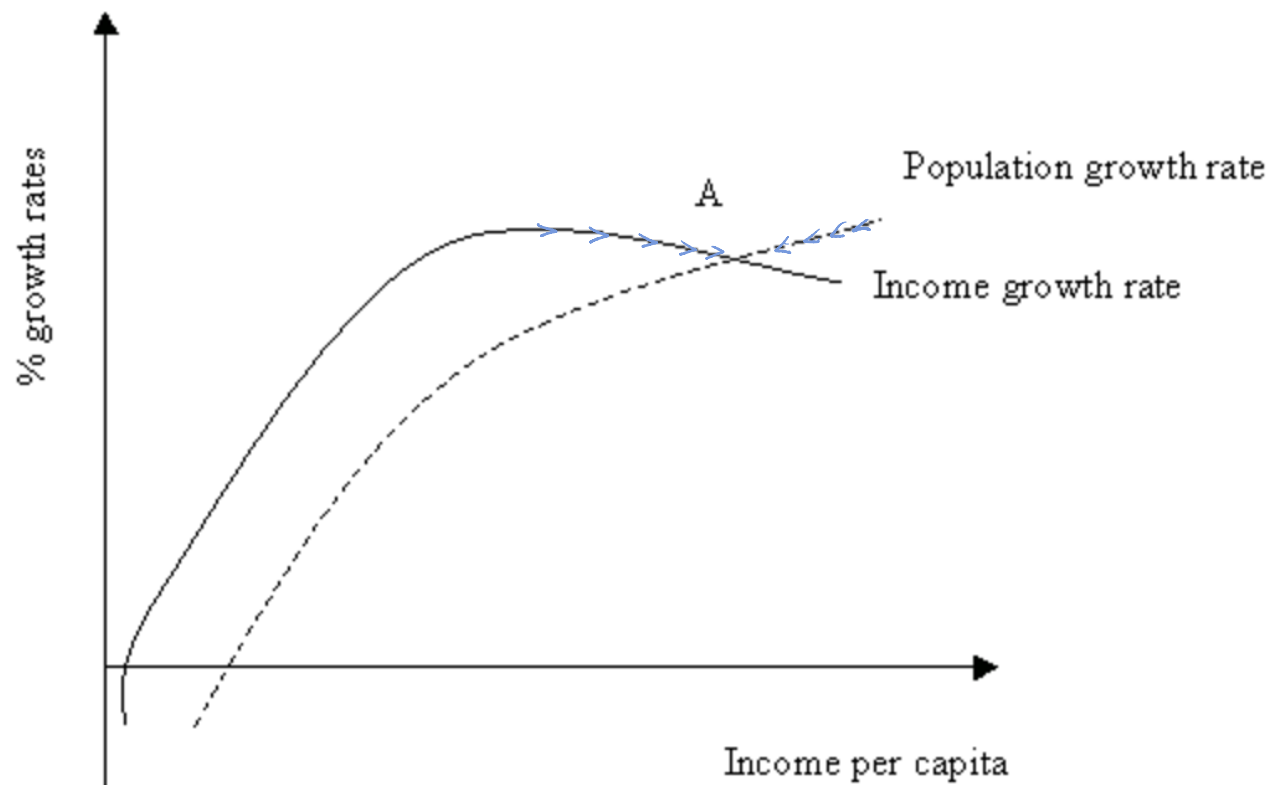
Is point A an equilibrium? Why? Is it stable? ✓

1. The number of live births per 1000 people in the population per year is the

A. hidden momentum of population growth.

B. population growth rate.

C. demographic transition.

D. crude birth rate. 自然出生率

2. In stage III of the demographic transition,

A. the birth rate and the death rate are relatively low.

B. the birth rate and the death rate are relatively high.

C. the birth rate is relatively high and the death rate is relatively low.

D. the birth rate is relatively low and the death rate is relatively high.