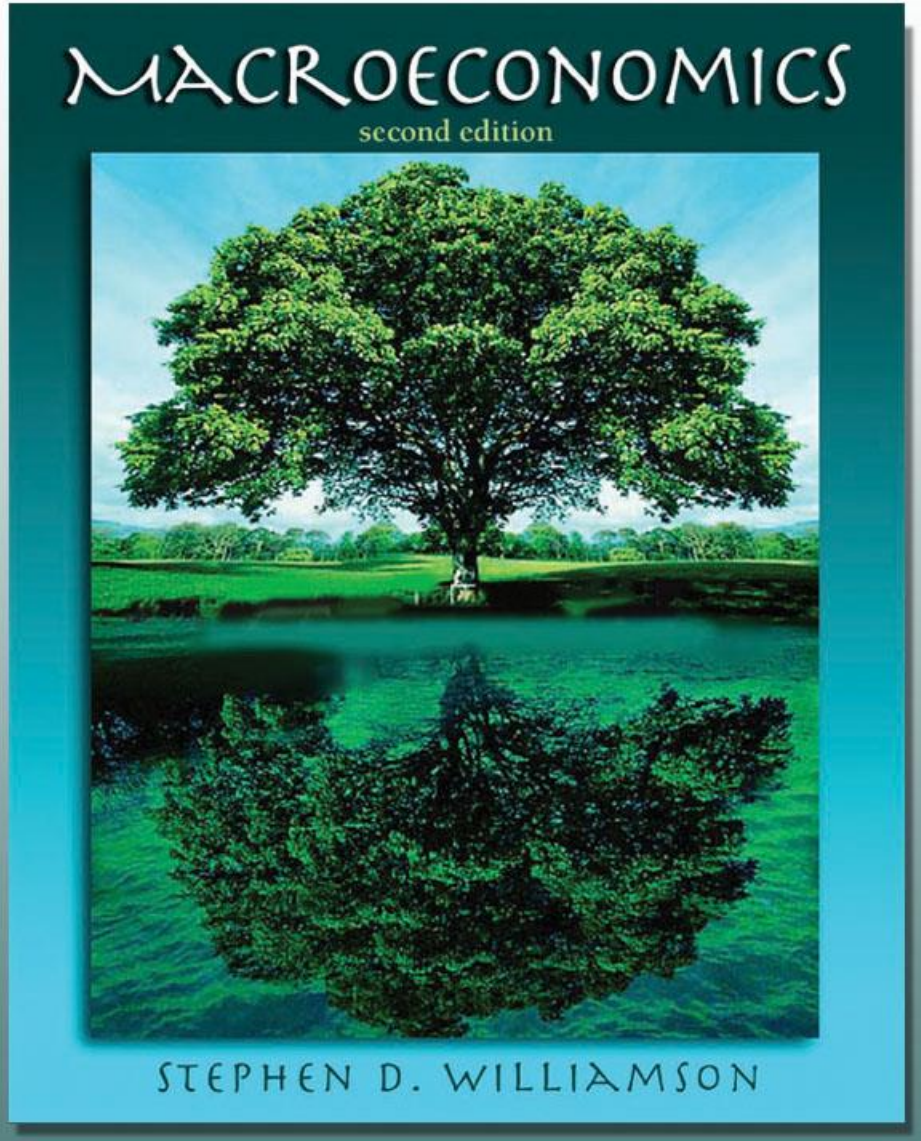


Chapter 6

Economic Growth: from Malthus to Solow

PEARSON Addison Wesley

Two Primary Phenomena that Macroeconomists study are:

- Economic Growth
- Business Cycle

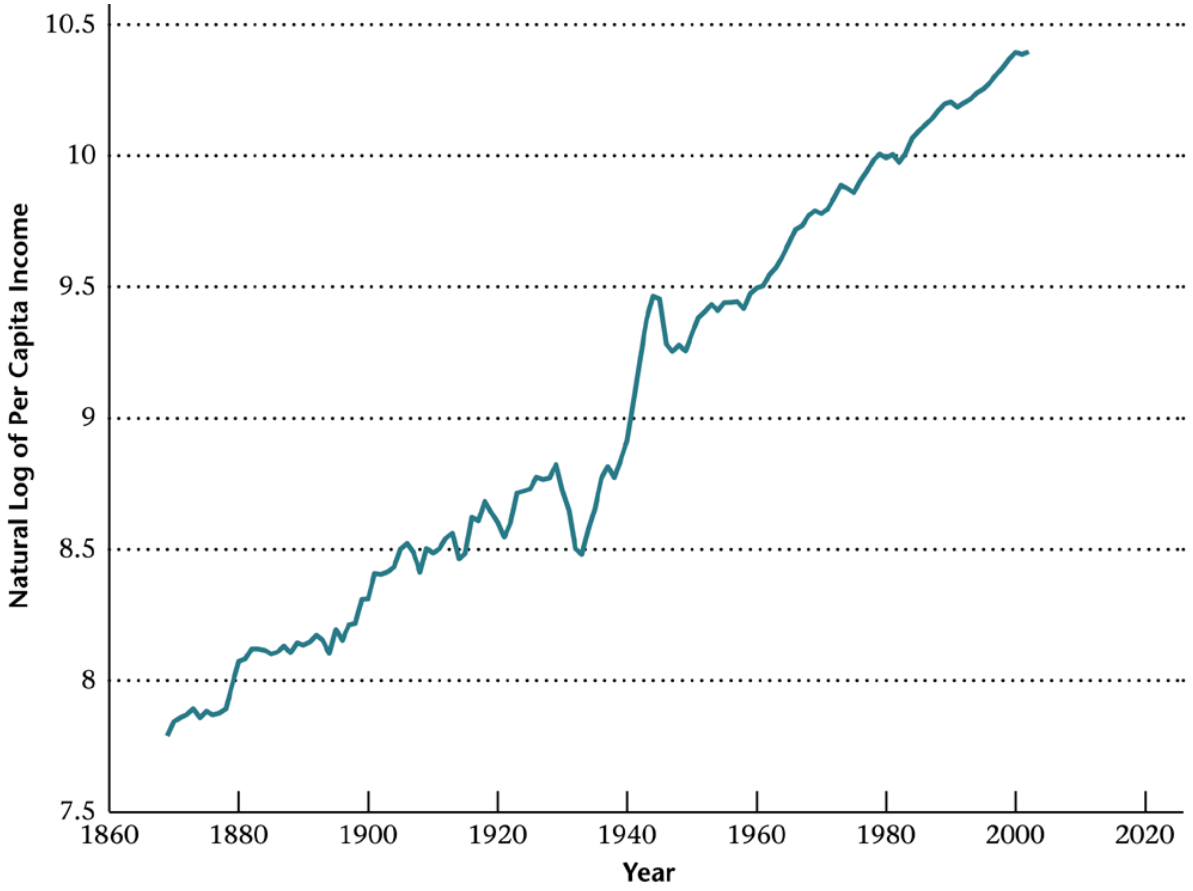
Economic Growth is Important!

- If business cycles could be completely eliminated, the worst events we would able to avoid would be deviation from the trend of GDP by 5%.
- If changes in economic policy could cause the growth rate of real GDP to increase by 1% per year to 100 years, the GDP would be 2.7 times higher than it would otherwise have been.

Economic Growth Facts

- Pre-1800 (Industrial Revolution): constant per capita income across time and space, no improvement in standards of living.
- Post-1800: Sustained Growth in the Rich Countries. In the US, average growth rate of GDP per capita has been about 2% since 1869.

Figure 6.1 Natural Log of Real per Capita Income in the United States, 1869–2002



Economic Growth Facts Con'd

- High Investment $\leftrightarrow$ High Standard of Living
- High Population Growth $\leftrightarrow$ Low Standard of Living
- Divergence of per capita Incomes: 1800–1950.

Figure 6.2 Output per Worker vs. Investment Rate

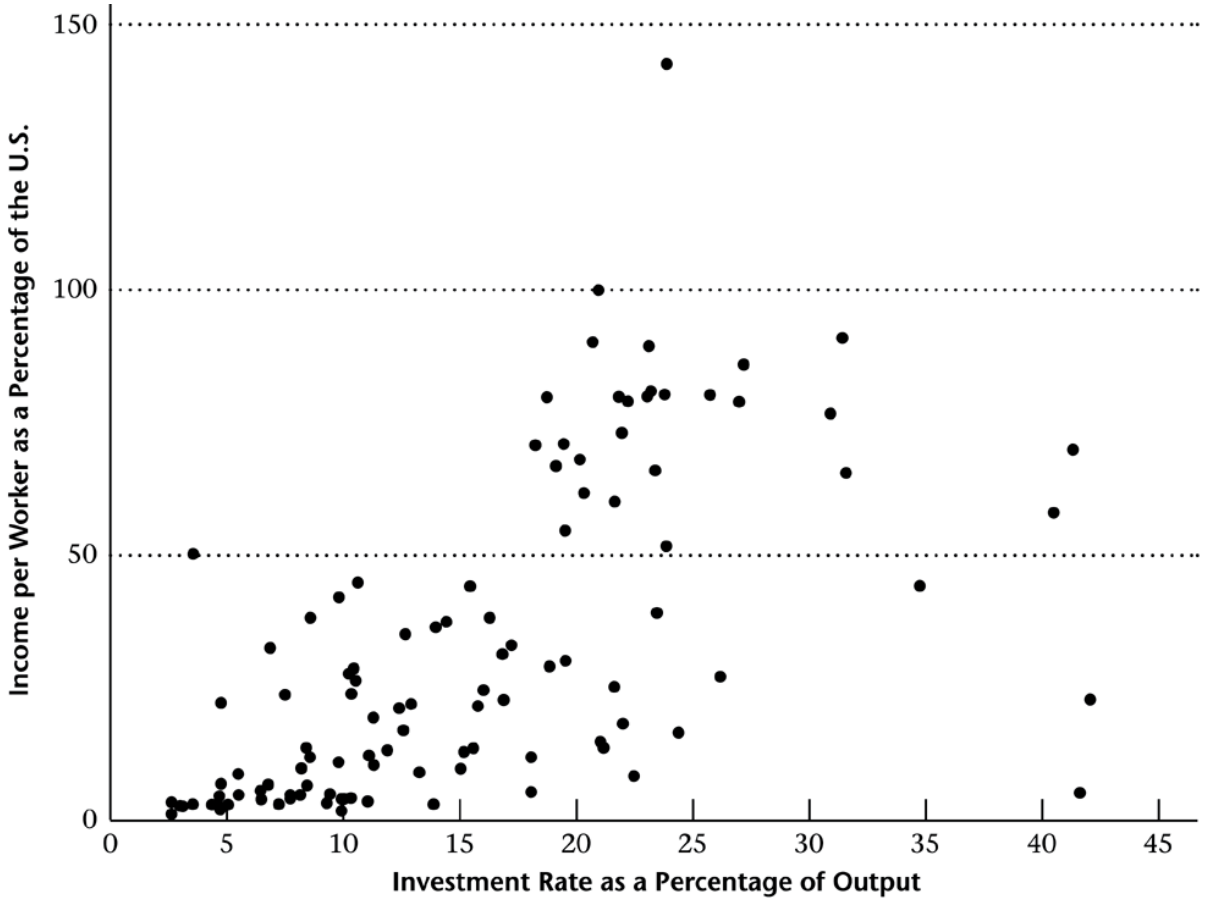
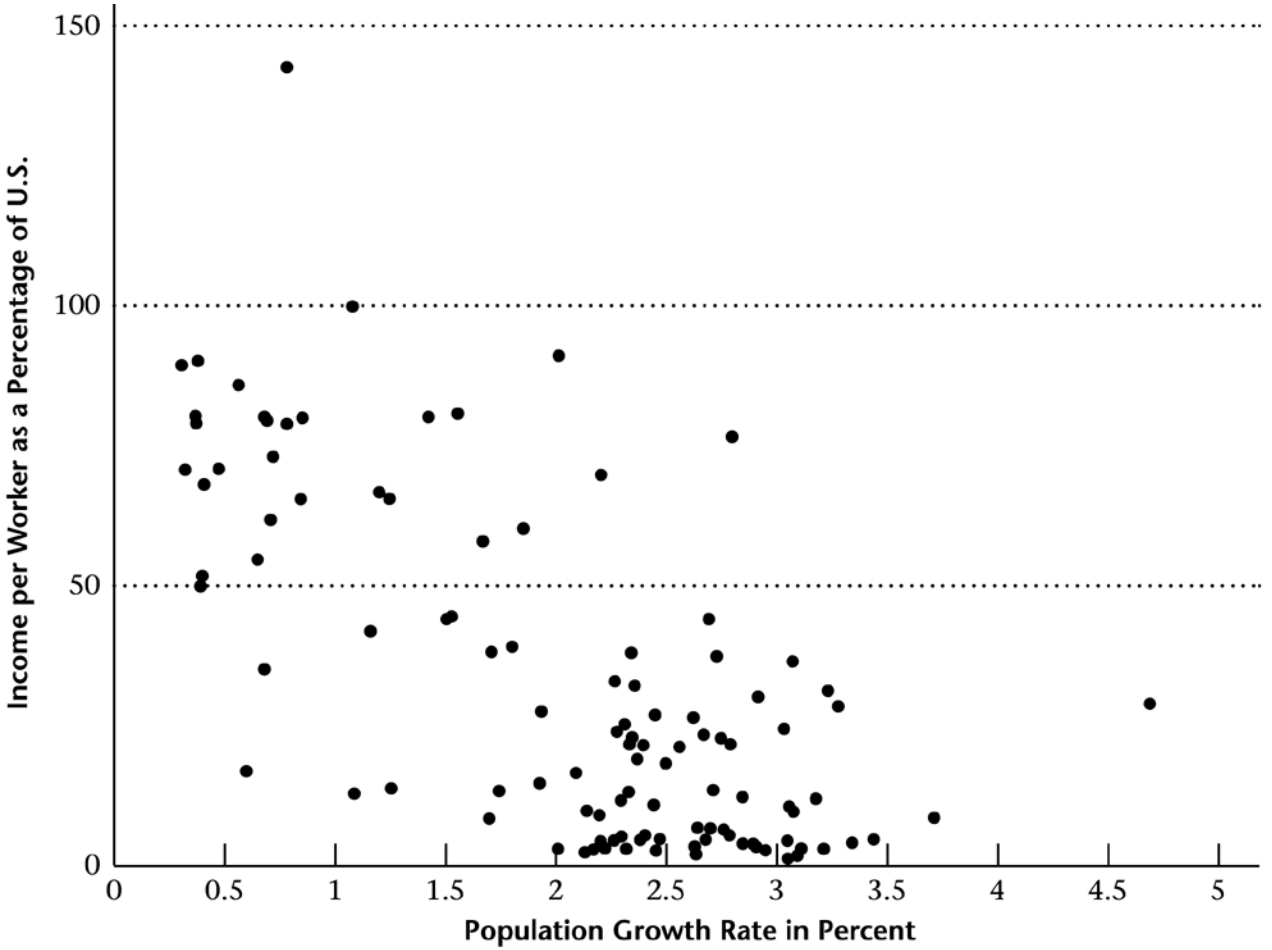


Figure 6.3 Output per Worker vs. the Population Growth Rate



Economic Growth Facts Con'd

- No conditional Convergence amongst all Countries
- (Weakly) Conditional Convergence amongst the Rich Countries
- No Conditional Convergence amongst the Poorest Countries

Figure 6.4 No Convergence Among All Countries

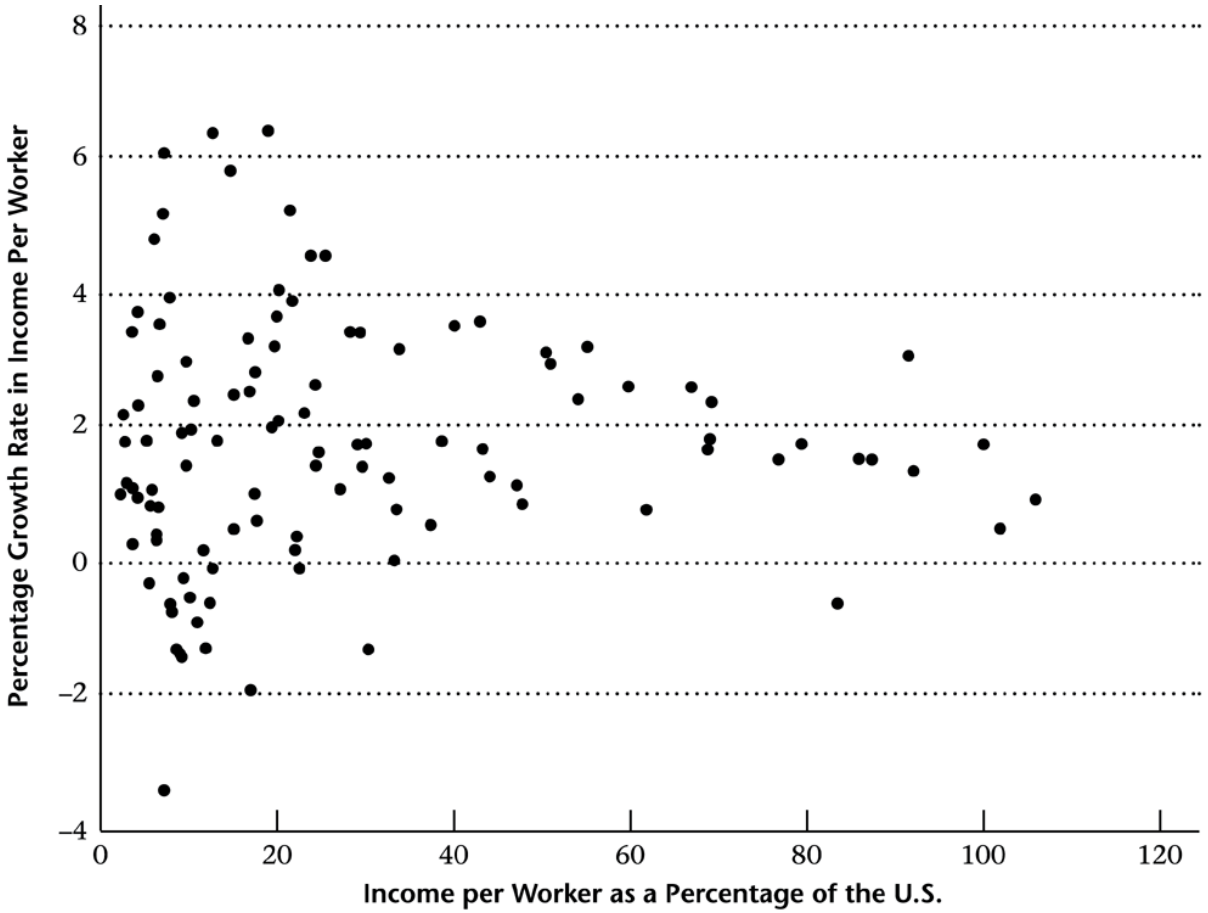


Figure 6.5 Convergence Among the Richest Countries

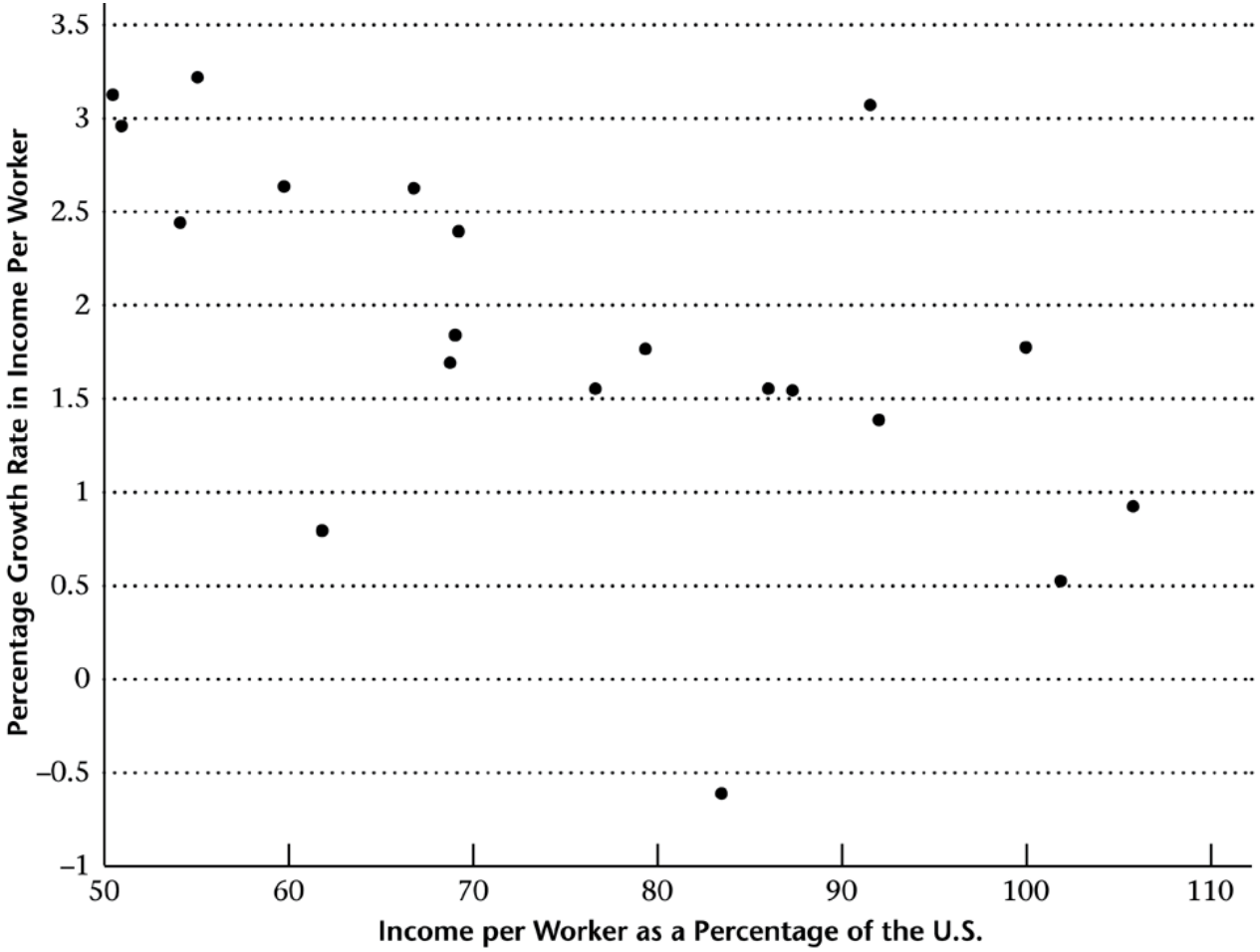
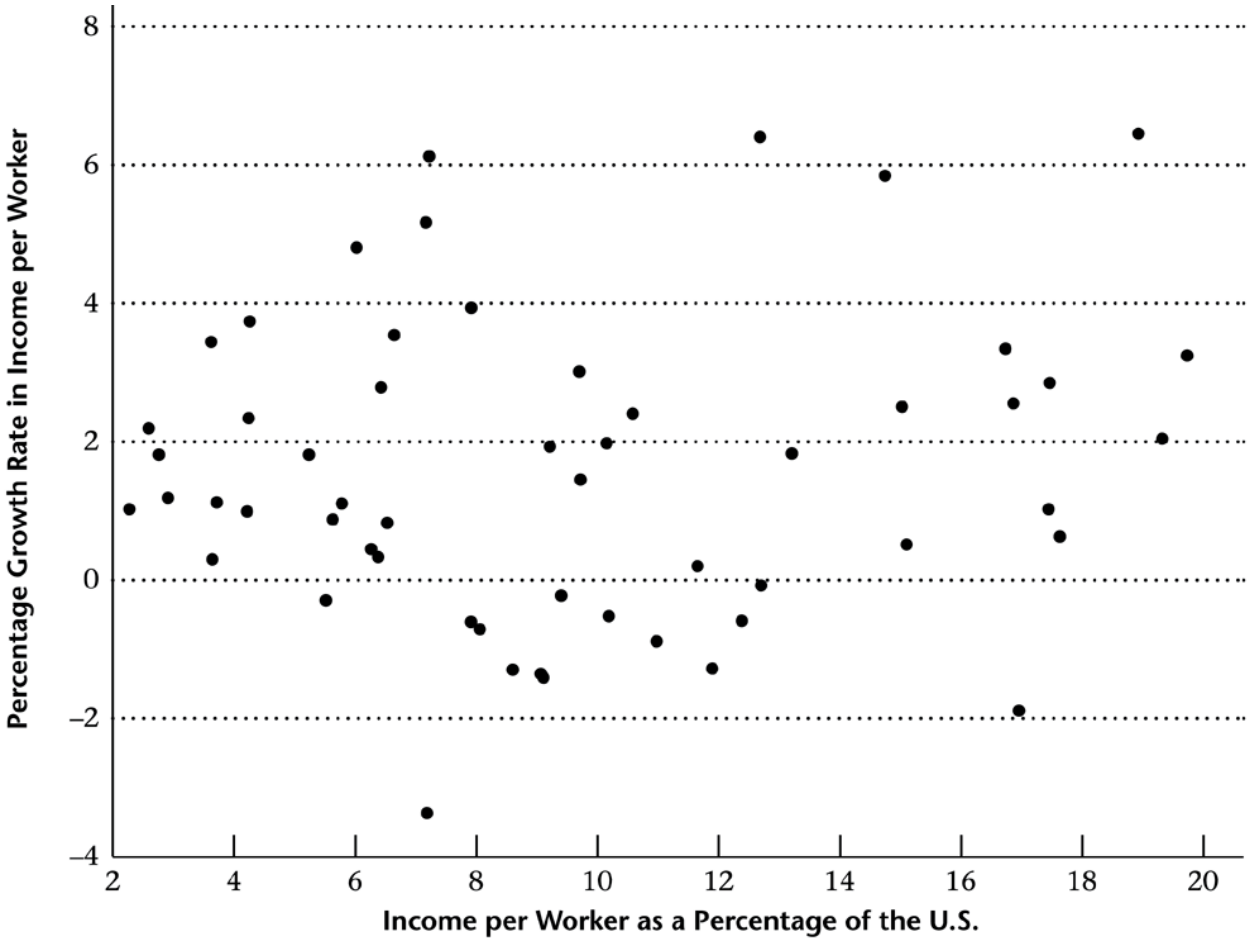


Figure 6.6 No Convergence Among the Poorest Countries



The Malthusian Model

- Idea was provided by Thomas Malthus in his highly influential book *An Essay on the Principle of Population* in 1798.
- He argued technological change ✹ improvement in standard living ✹ population growth ✹ reduce the average person to the subsistence level again

- In the long run there would be no increase in the standard of living unless there were some limits on population growth.
- It is a pessimistic theory!

The Malthusian Economy

- Production technology

$$Y = zF(L, N)$$

L is the fixed amount of land, *N* is the labor input. *F* has all the properties.

- No investment technology (no refrigerator, food perish)
- No government

- No leisure in the utility function.

$$U(C) = C$$

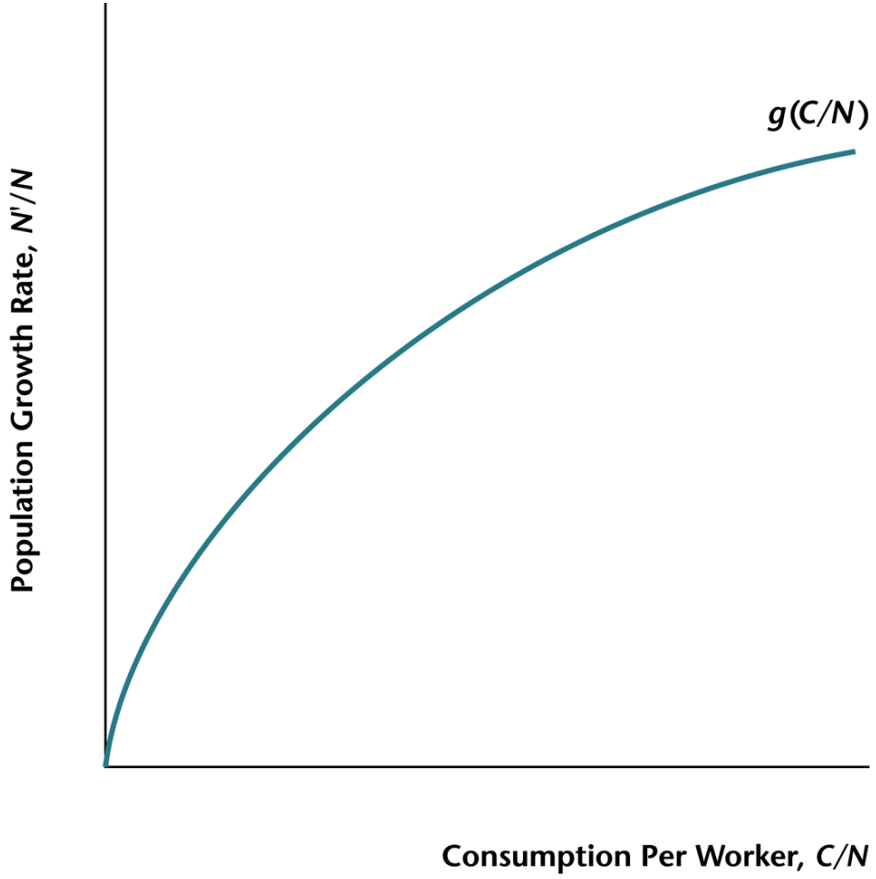
- We normalize the labor endowment of each person to be 1, so *N* is both the population and the labor input

- Assume the population growth depends on the quantity of consumption per worker (standard of living)

$$\frac{N'}{N} = g\left(\frac{C}{N}\right)$$

g is a increasing function

Figure 6.7 Population Growth Depends on Consumption per Worker in the Malthusian Model



Steady State

- When $N'=N$, we say the economy reaches the steady state (SS).
- In SS, $N=N^*$, $C^*=zF(L,N^*)$.
- Define variable in terms of per capita, for example, $y=Y/N$, $c=C/N$, $l=L/N$. we have

$$y=F(l,1)$$

- In equilibrium, *c=y.* Hence we have

$$c=zF(l,1) \qquad (1)$$

- Law of motion of population

$$N'/N=g(c) \qquad (2)$$

- *(1)* + *(2)* consist the dynamic economic system for this economy

Figure 6.8 Determination of the Population in the Steady State

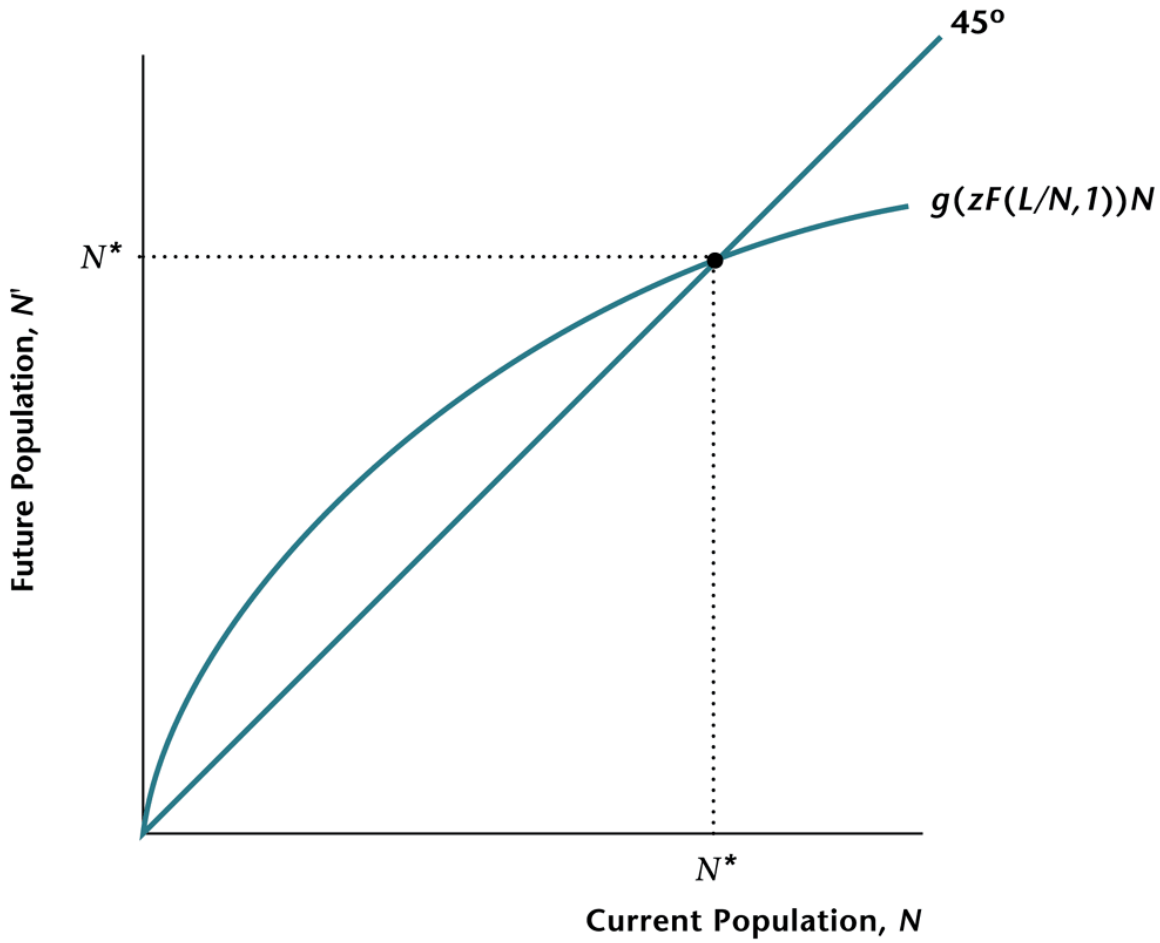


Figure 6.9 The Per-Worker Production Function

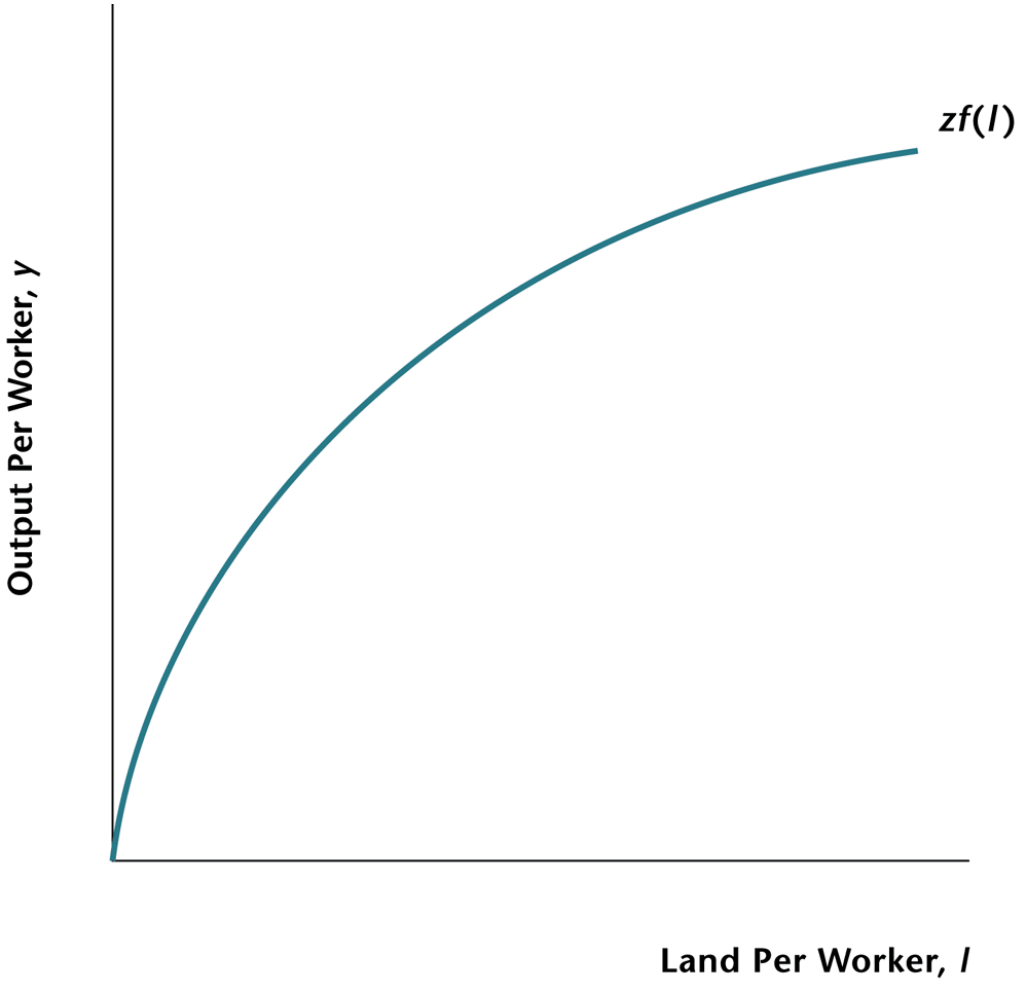
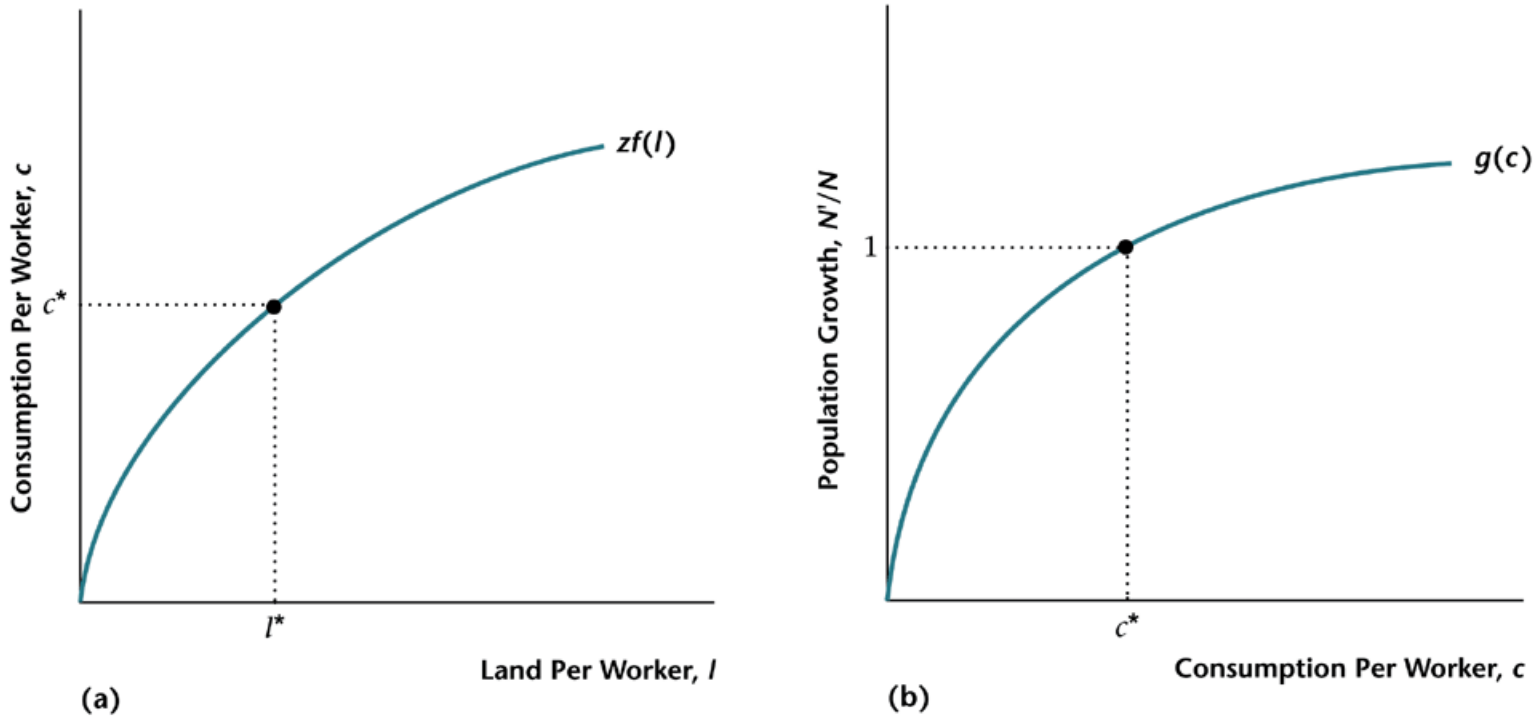


Figure 6.10 Determination of the Steady State in the Malthusian Model



The Effect of TFP on the SS

- Do not improve the standard of living c^* in the long run
- Only increases the population

Figure 6.11 The Effect of an Increase in z in the Malthusian Model

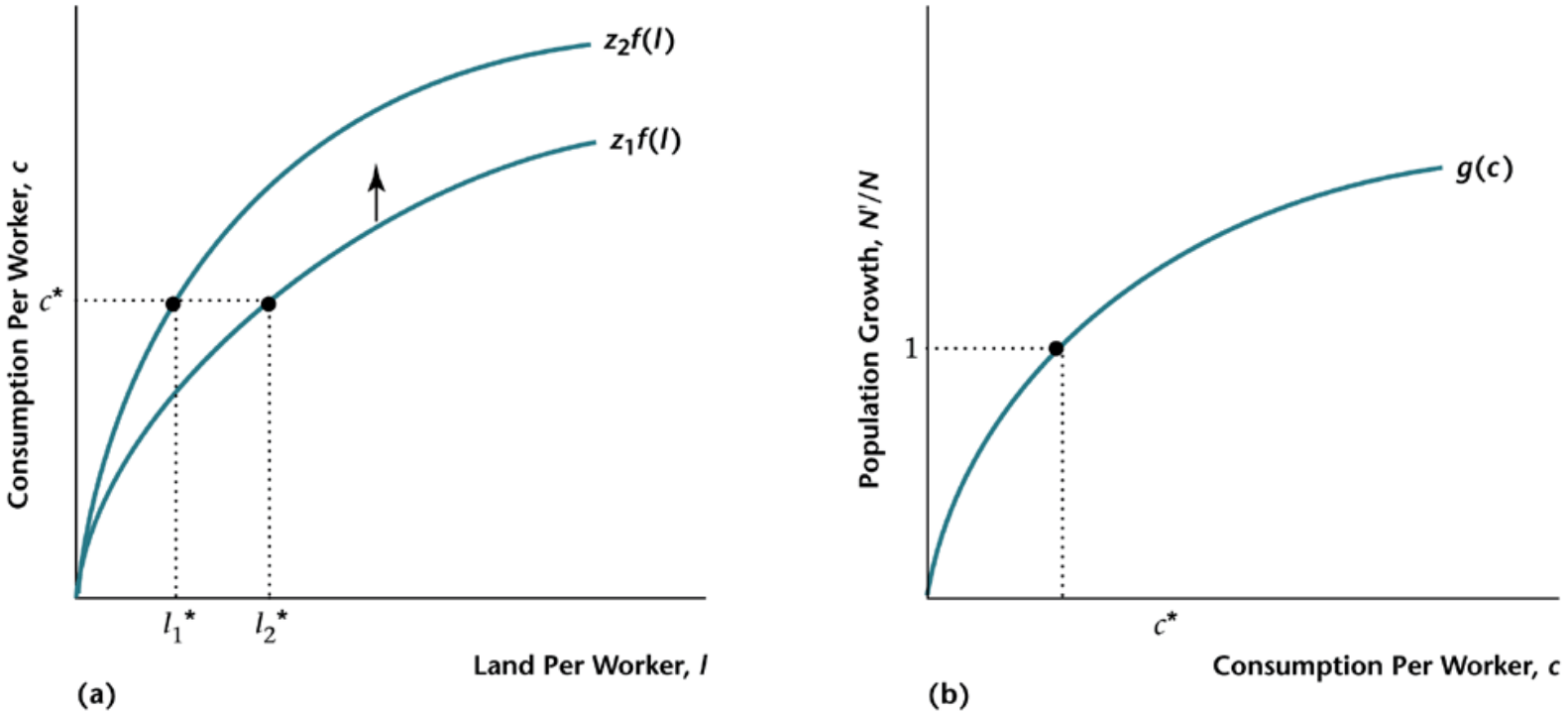
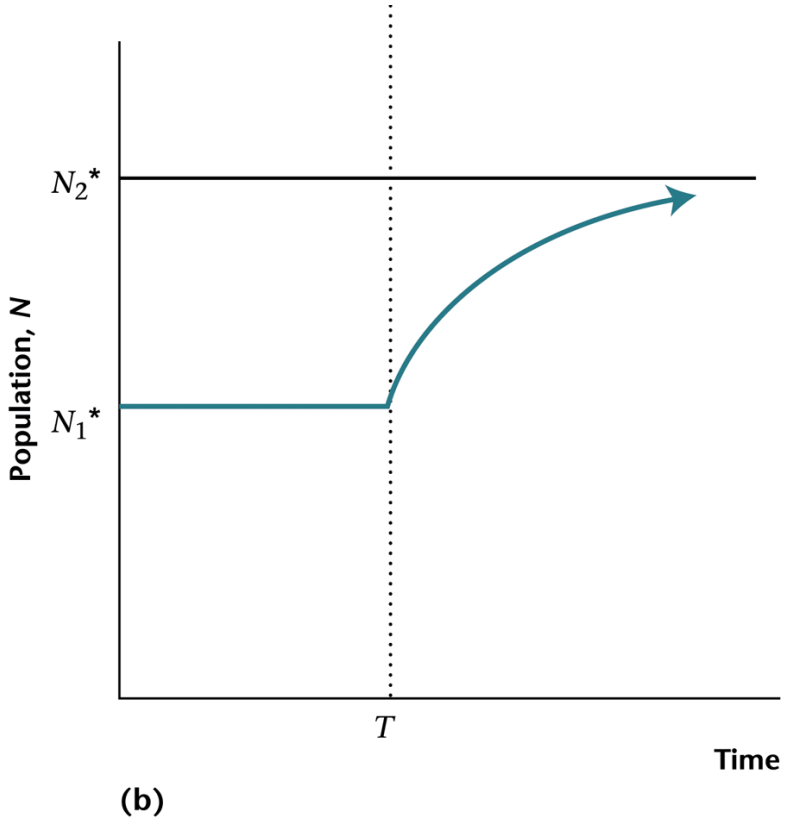
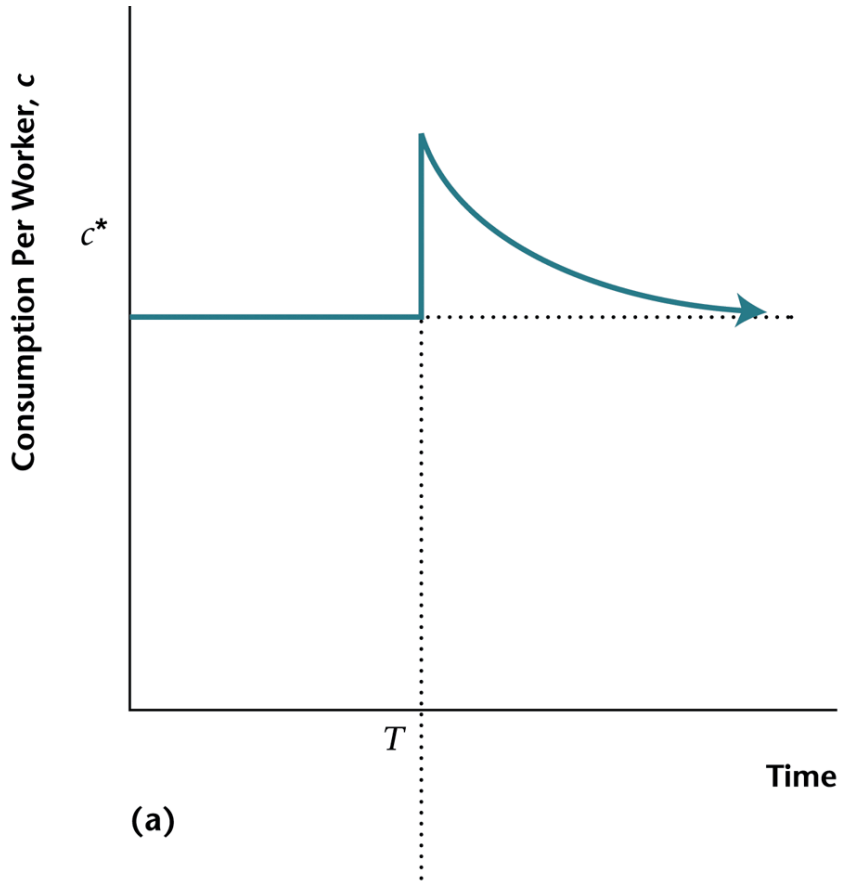


Figure 6.12 Adjustment to the Steady State

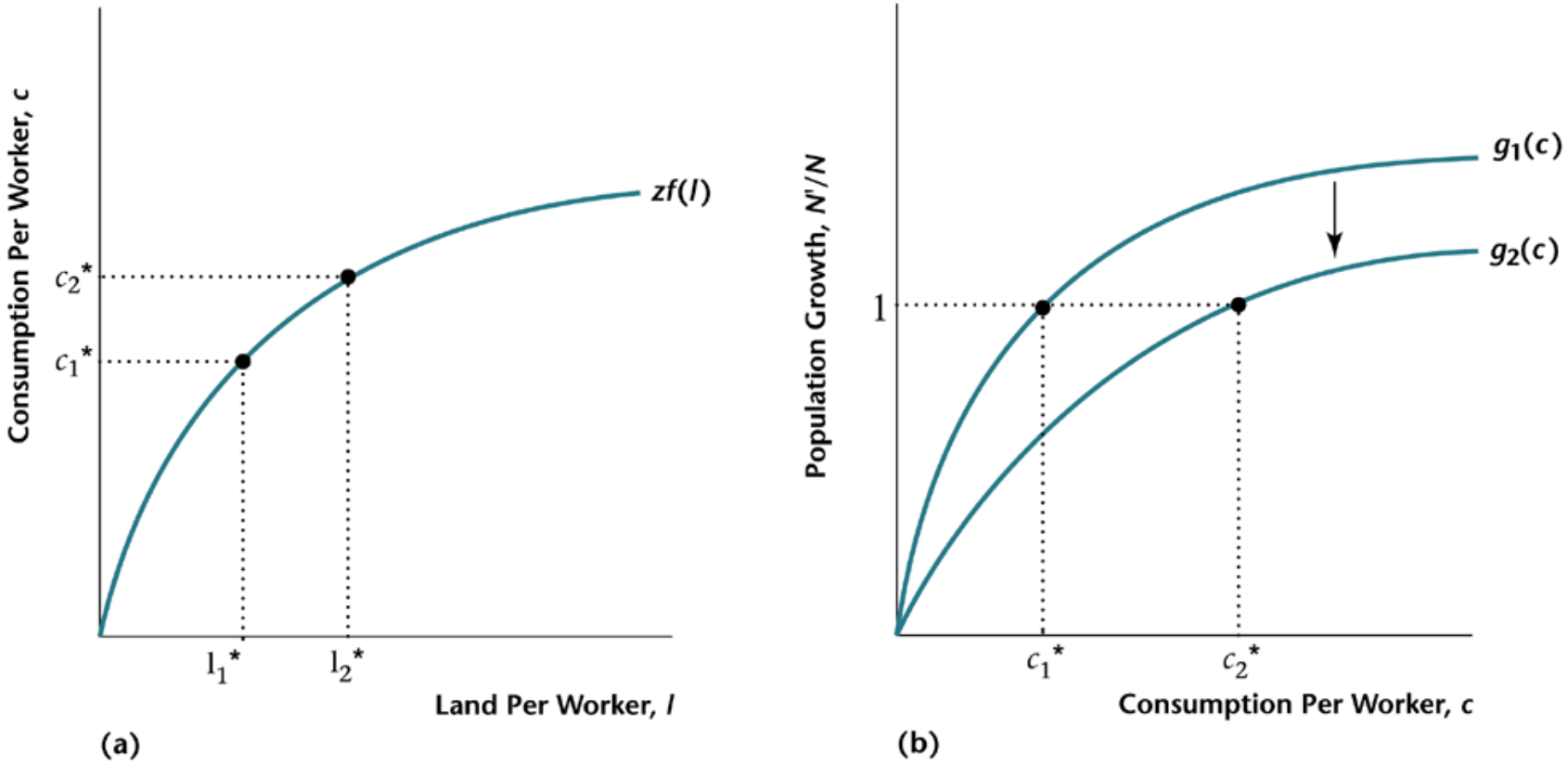




Policy Implication: Population Control

- Government directly controls the population growth
- In SS: Standard of living increases.
- The quantity of land per worker increases too
- Theoretical foundation of Chinese “One Child” policy.

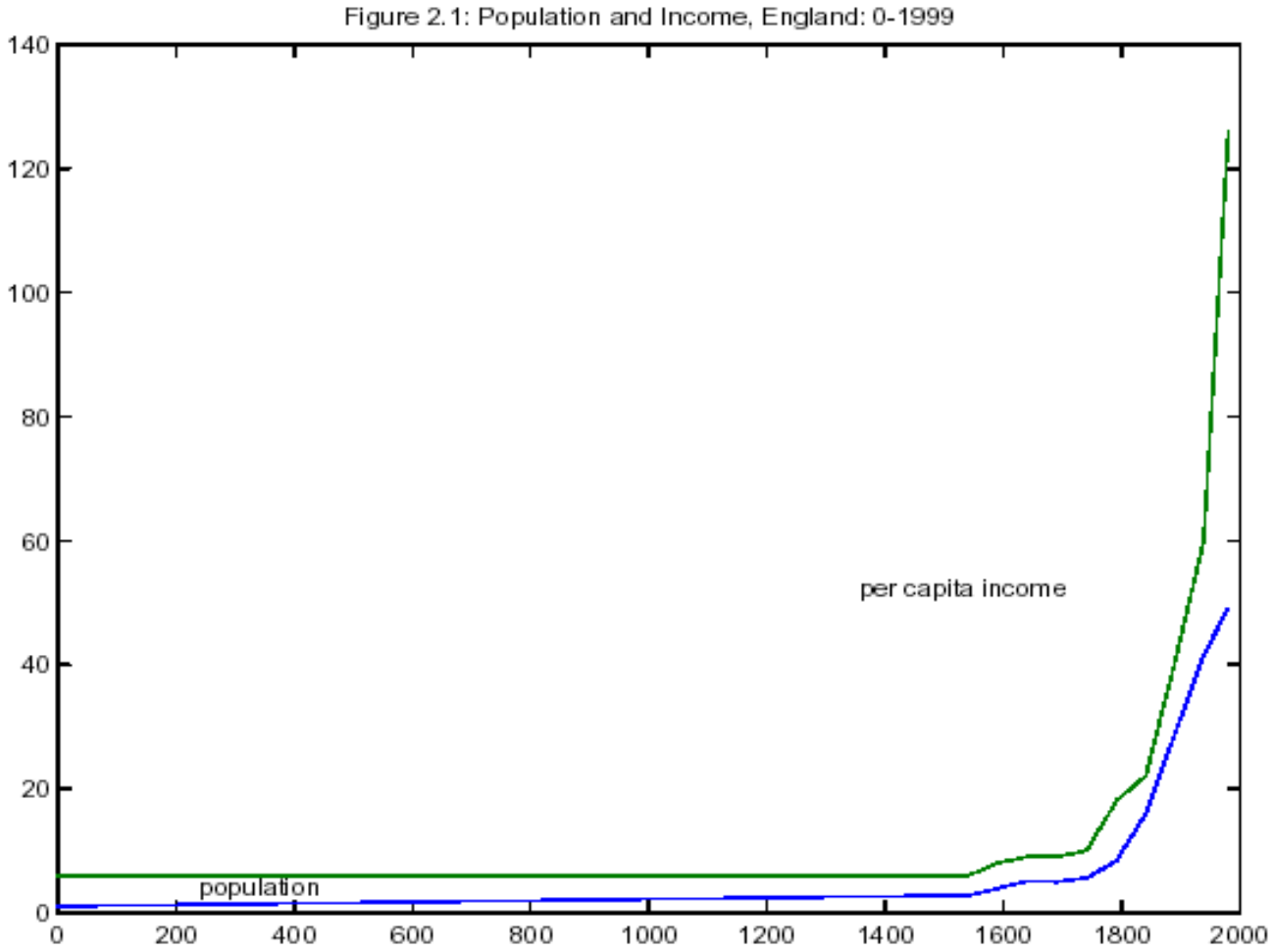
Figure 6.13 Population Control in the Malthusian Model



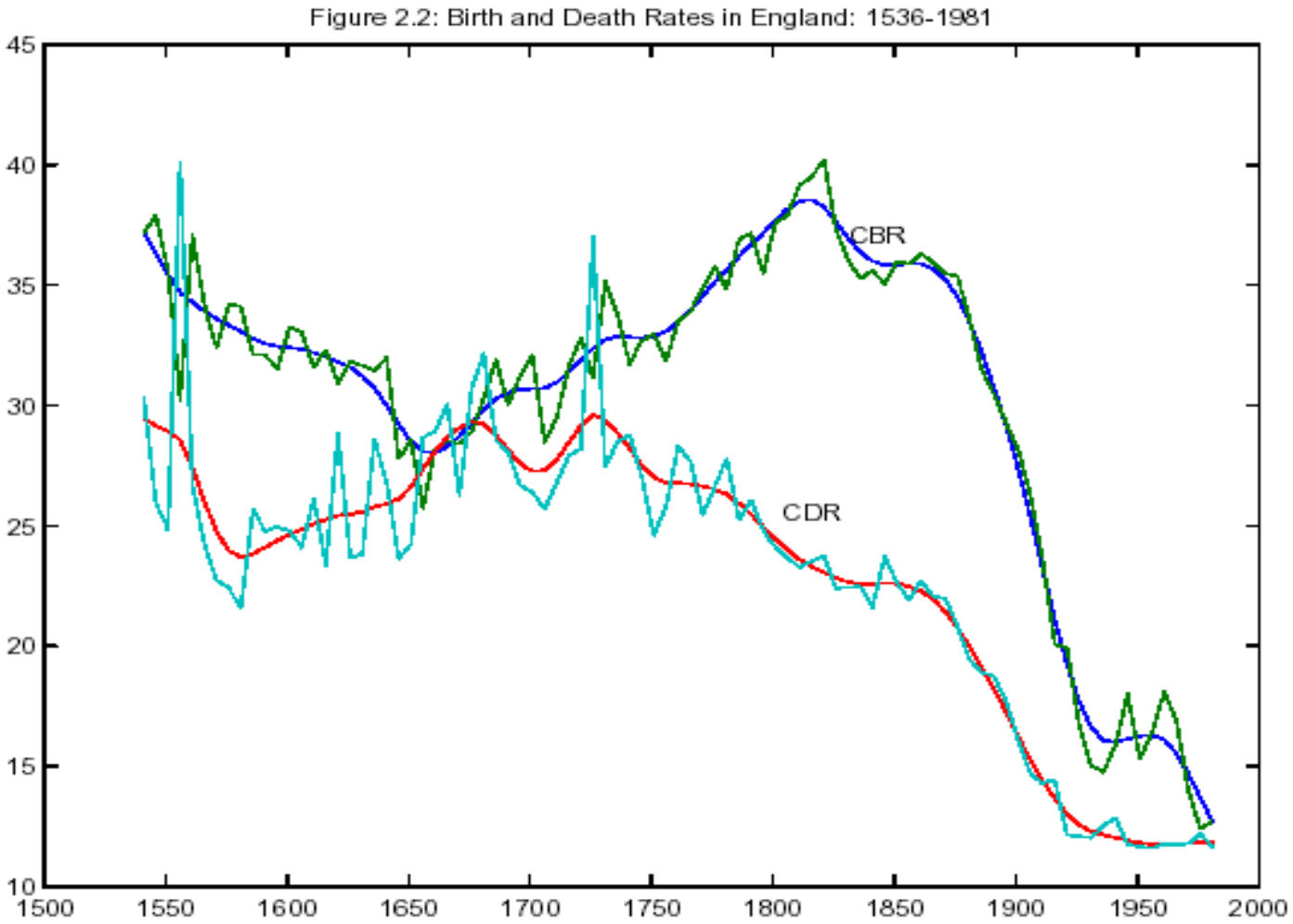
Evaluation of Malthusian Model

- Consistent with the growth facts before 1800: production was mainly agricultural, population grew over time, but no significant improvements in the average standard of living
- What did happen after 1800?
  - Sustained growth in standards of living in the richest countries
  - The richest countries also have experienced a large drop in birth rates

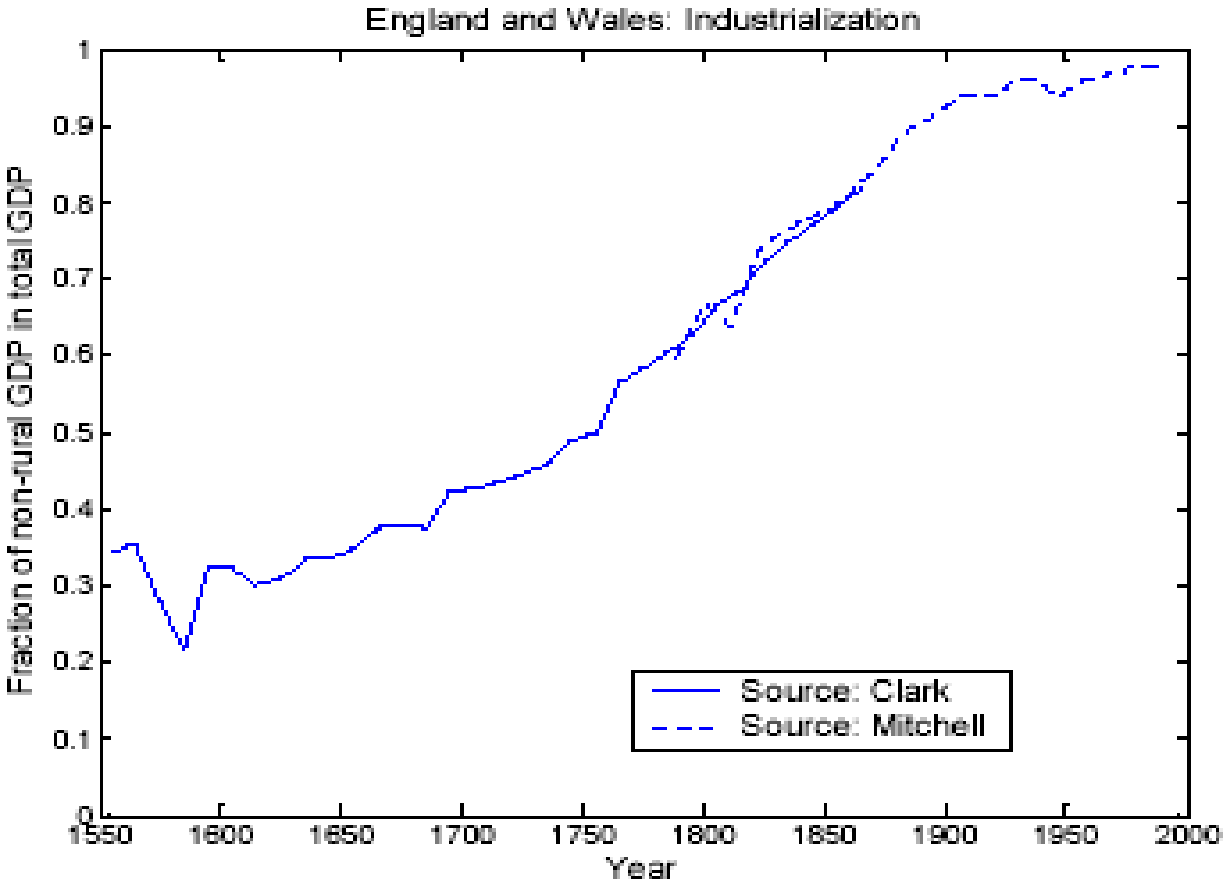
- Malthus was wrong on these two dimensions
  - He did not allow for the effect of increases in *K* on production. Capital can produce itself.
  - He did not account for all of the effects of economic forces on population growth. As economy develops, the opportunity cost of raising a large family becomes large. Fertility rate decreases.
- We need a GROWTH theory!



Source: Fernandez-Villaverde (2001)



Source: Fernandez-Villaverde (2001)



Source: Bar and Leukhina (2005)