Chapter 6
Long-Run Economic Growth

Multiple Choice Questions

1. Between 1870 and 1996, among the United States, Germany, Japan, and Australia, _____ grew at the fastest rate and _____ grew at the slowest rate.
   (a) the United States; Germany
   (b) Germany; the United States
   (c) Australia; Japan
   (d) Japan; Australia
   Answer: D
   Level of difficulty: 2
   Section: 6.1

2. The elasticity of output with respect to capital
   (a) is the increase in output resulting from an increase in the capital stock.
   (b) is the percentage increase in output resulting from a 1% increase in the capital stock.
   (c) is always greater than one.
   (d) is the inverse of the elasticity of output with respect to labor.
   Answer: B
   Level of difficulty: 1
   Section: 6.1

3. Suppose the current level of output is 5000 and the elasticity of output with respect to capital is 0.4. A 10% increase in capital would increase the current level of output to
   (a) 5020.
   (b) 5050.
   (c) 5200.
   (d) 5500.
   Answer: C
   Level of difficulty: 2
   Section: 6.1
4. Suppose the current level of output is 5000. If the elasticities of output with respect to capital and labor are 0.3 and 0.7, respectively, a 10% increase in capital combined with a 5% increase in labor and a 5% increase in productivity would increase the current level of output to
   (a) 5015.
   (b) 5325.
   (c) 5575.
   (d) 6000.
   Answer: C
   Level of difficulty: 2
   Section: 6.1

5. Over the past year, productivity grew 2%, capital grew 1%, and labor grew 1%. If the elasticities of output with respect to capital and labor are 0.2 and 0.8, respectively, how much did output grow?
   (a) 1%
   (b) 2%
   (c) 3%
   (d) 4%
   Answer: C
   Level of difficulty: 2
   Section: 6.1

6. Over the past year, productivity grew by 1%, capital grew by 0%, and labor grew by 5%. If the elasticities of output with respect to capital and labor are 0.4 and 0.6, respectively, how much did output grow?
   (a) 1%
   (b) 2%
   (c) 3%
   (d) 4%
   Answer: D
   Level of difficulty: 2
   Section: 6.1

7. The growth accounting equation is
   (a) \( Y = Aa_K a_N \)
   (b) \( Y = AF(K, N) \)
   (c) \( \Delta Y/Y = \Delta A/A + a_K \Delta K/K + a_N \Delta N/N \)
   (d) \( \Delta Y/Y = \Delta A/A - a_K \Delta K/K - a_N \Delta N/N \)
   Answer: C
   Level of difficulty: 1
   Section: 6.1
8. If capital and labor each grow by 5% in a year, the elasticities of output with respect to capital and labor sum to one, and productivity grows by 2% in the year, by how much does output grow during the year?
   (a) 2%
   (b) 3%
   (c) 5%
   (d) 7%
   Answer: D
   Level of difficulty: 3
   Section: 6.1

9. Total factor productivity growth is that part of economic growth due to
   (a) capital growth plus labor growth.
   (b) capital growth less labor growth.
   (c) capital growth times labor growth.
   (d) neither capital growth nor labor growth.
   Answer: D
   Level of difficulty: 1
   Section: 6.1

10. Over the past year, output grew by 4%, capital grew by 2%, and labor grew by 1%. If the elasticities of output with respect to capital and labor are 0.3 and 0.7, respectively, by how much did productivity grow?
   (a) 2.0%
   (b) 2.7%
   (c) 3.0%
   (d) 3.3%
   Answer: B
   Level of difficulty: 2
   Section: 6.1

11. Over the past year, output grew by 5%, capital grew by 5%, and labor grew by 1%. If the elasticities of output with respect to capital and labor are 0.3 and 0.7, respectively, by how much did productivity grow?
   (a) 0.5%
   (b) 1.0%
   (c) 2.2%
   (d) 2.8%
   Answer: D
   Level of difficulty: 2
   Section: 6.1
12. In the second half of the 1990s, U.S. average labor productivity grew by
   (a) 0%.
   (b) 5%.
   (c) 8%.
   (d) 13%.
   Answer: D
   Level of difficulty: 1
   Section: 6.1

13. The growth rate of average labor productivity averaged over 2% per year from _____ but less than
    2% per year from _____.
   (a) 1970 to 1975; 1975 to 2000
   (b) 1970 to 1975 and 1995 to 2000; 1975 to 1995
   (c) 1970 to 1980; 1980 to 2000
   (d) 1990 to 2000; 1970 to 1990
   Answer: B
   Level of difficulty: 1
   Section: 6.1

14. Labor productivity increased so much in the second half of the 1990s because of
   (a) improved information and communications technologies.
   (b) higher levels of educational attainment by workers.
   (c) cheaper foreign imports used in production.
   (d) increased foreign competition.
   Answer: A
   Level of difficulty: 1
   Section: 6.1

15. Edward Denison found that labor’s contribution to output growth in the United States since 1929
    was attributable to all the factors below EXCEPT
    (a) rising population.
    (b) an increase in the percentage of the population in the labor force.
    (c) an increase in the number of hours worked per person.
    (d) higher educational levels.
    Answer: C
    Level of difficulty: 1
    Section: 6.1

16. Comparing the period from 1982 to 1997 with the earlier period from 1929 to 1982, productivity
    growth has _____ and input growth has _____.
    (a) risen; slowed
    (b) risen; risen
    (c) slowed; slowed
    (d) slowed; risen
    Answer: D
    Level of difficulty: 2
    Section: 6.1
17. All of the following are explanations of the post-1973 productivity slowdown EXCEPT
(a) problems in measuring productivity.
(b) changes in the legal and human environment.
(c) higher oil prices.
(d) greater competition from foreign imports.
Answer: D
Level of difficulty: 1
Section: 6.1

18. The idea that measurement problems could explain the productivity slowdown since 1973 is based on the fact that
(a) official output measures make no adjustment for quality.
(b) output can’t be measured.
(c) capital can’t be measured.
(d) quality improvements aren’t fully accounted for in the data.
Answer: D
Level of difficulty: 1
Section: 6.1

19. Official statistics show that between 1967 and 1986, productivity in the construction industry
(a) rose by 40%.
(b) was unchanged.
(c) fell by 40%.
(d) fell by 100%.
Answer: C
Level of difficulty: 1
Section: 6.1

20. A new pollution law requires businesses to pay for inspections of their plants by independent pollution-monitoring firms. What effect is this likely to have?
(a) Increase productivity
(b) Increase the capital stock
(c) Reduce productivity
(d) Increase the demand for labor in those firms
Answer: C
Level of difficulty: 1
Section: 6.1

21. Why do some people think that the productivity slowdown since 1973 is just a return to normalcy after fast productivity growth during the previous 25 years?
(a) Productivity growth of the previous 25 years was abnormally low.
(b) The Great Depression and World War II had prevented technological opportunities from being exploited.
(c) The United States is the only country to face the slowdown, due to poor regulatory decisions.
(d) The United States has allowed countries like Japan to steal its technological breakthroughs.
Answer: B
Level of difficulty: 1
Section: 6.1
22. William Nordhaus’s idea that technological innovation has temporarily dried up rests on the argument that
   (a) greater competition from foreign countries has reduced the capital American firms have to invest in research and development.
   (b) government support of research and development has fallen, reducing the amount of technological innovation that occurs in the United States.
   (c) the backlog of technological opportunities not exploited during the Great Depression and World War II has largely been used up.
   (d) government “red tape” has prevented many innovations from coming to market.
Answer: C
Level of difficulty: 1
Section: 6.1

23. Greenwood and Yorukoglu view the post-1973 productivity slowdown as resulting from
   (a) the information technology revolution.
   (b) high oil prices.
   (c) measurement errors.
   (d) technological depletion.
Answer: A
Level of difficulty: 1
Section: 6.1

24. The per-worker production function in the Solow model assumes
   (a) constant returns to scale and increasing marginal productivity of capital.
   (b) constant returns to scale and diminishing marginal productivity of capital.
   (c) increasing returns to scale and diminishing marginal productivity of capital.
   (d) decreasing returns to scale and diminishing marginal productivity of capital.
Answer: B
Level of difficulty: 1
Section: 6.2

25. The bowed shape of the per-worker production function is caused by
   (a) wealth effects that reduce labor supply.
   (b) diminishing marginal productivity of capital.
   (c) increasing marginal productivity of labor.
   (d) increasing marginal productivity of capital.
Answer: B
Level of difficulty: 1
Section: 6.2

26. In the Solow model, if productivity doesn’t change,
   (a) the economy must eventually reach a steady state.
   (b) the capital-labor ratio must decline.
   (c) the capital-labor ratio must rise.
   (d) there can be no saving.
Answer: A
Level of difficulty: 1
Section: 6.2
27. In a steady state
   (a) both consumption per worker and the capital-labor ratio are constant.
   (b) consumption per worker is constant, but the capital-labor ratio can change.
   (c) capital and labor, by definition, are inversely related to one another.
   (d) consumption per worker can change, but the capital-labor ratio is constant.
   Answer: A
   Level of difficulty: 2
   Section: 6.2

28. Steady-state investment per worker is positively related to the capital-labor ratio because the higher
    the capital-labor ratio
   (a) the lower the capital depreciation rate.
   (b) the greater the amount of resources available for capital investment.
   (c) the more investment per worker is required to replace depreciating capital.
   (d) the less the economy needs to equip new workers with the same high level of capital.
   Answer: C
   Level of difficulty: 2
   Section: 6.2

29. In the absence of productivity growth, in a steady-state economy
   (a) output per worker and consumption per worker remain constant over time.
   (b) output per worker remains constant over time, but consumption per worker grows over time.
   (c) output per worker grows over time, but consumption per worker remains constant over time.
   (d) output per worker and consumption per worker both grow over time.
   Answer: A
   Level of difficulty: 2
   Section: 6.2

30. The level of the capital-labor ratio that maximizes consumption per worker in the steady state is
    known as the
   (a) Solow residual capital-labor ratio.
   (b) Golden Rule capital-labor ratio.
   (c) $q$ theory capital-labor ratio.
   (d) dynamically efficient capital-labor ratio.
   Answer: B
   Level of difficulty: 1
   Section: 6.2

31. The Golden Rule capital-labor ratio is the level of the capital-labor ratio that, in the steady state,
   (a) maximizes output per worker.
   (b) maximizes investment per worker.
   (c) maximizes consumption per worker.
   (d) maximizes capital per worker.
   Answer: C
   Level of difficulty: 1
   Section: 6.2
32. If the capital-labor ratio is above the Golden Rule capital-labor ratio, then in the steady state,
   (a) capital per worker is above its maximum.
   (b) output per worker is less than it would be at the Golden Rule capital-labor ratio.
   (c) investment per worker exceeds output per worker.
   (d) consumption per worker is not at its maximum.
   Answer: D
   Level of difficulty: 1
   Section: 6.2

33. The idea that saving equals investment in the Solow model means that a steady state can be reached
   only when
   (a) $s = k$.
   (b) $s = n + d$.
   (c) $sf(k) = (s + d)k$.
   (d) $sf(k) = (n + d)k$.
   Answer: D
   Level of difficulty: 1
   Section: 6.2

34. If $f(k) = 2k^{0.5}$, $s = 0.3$, $n = 0.05$, and $d = 0.15$, what is the value of $k$ at equilibrium?
   (a) 1
   (b) 3
   (c) 6
   (d) 9
   Answer: D
   Level of difficulty: 2
   Section: 6.2

35. If $f(k) = 2k^{0.5}$, $s = 0.1$, $n = 0.1$, and $d = 0.05$, what is the value of $f(k)$ at equilibrium?
   (a) $2/3$
   (b) $4/3$
   (c) 2
   (d) $8/3$
   Answer: D
   Level of difficulty: 3
   Section: 6.2

36. If $f(k) = 8k^{0.5}$, $s = 0.2$, $n = 0.3$, and $d = 0.1$, what is the value of $k$ at equilibrium?
   (a) 1
   (b) 4
   (c) 9
   (d) 16
   Answer: B
   Level of difficulty: 2
   Section: 6.2
37. If \( f(k) = 6k^{0.5} \), \( s = 0.1 \), \( n = 0.1 \), and \( d = 0.2 \), what is the value of \( c \) at equilibrium?
   (a) 10
   (b) 10.4
   (c) 10.8
   (d) 11.2
   Answer: C
   Level of difficulty: 3
   Section: 6.2

38. If \( k = 8 \), \( y = 20 \), and \( s = 0.2 \), what is \( c \)?
   (a) 24
   (b) 20
   (c) 16
   (d) 12
   Answer: C
   Level of difficulty: 3
   Section: 6.2

39. The Solow model demonstrates that
   (a) in the absence of productivity growth, economic growth will turn negative in the long run.
   (b) in the absence of productivity growth, economic growth will reach a steady state of zero per-capita growth in the long run.
   (c) productivity growth must exceed the rate of growth in the population to avoid a steady state in the long run.
   (d) productivity growth will inevitably decline due to diminishing marginal productivity.
   Answer: B
   Level of difficulty: 1
   Section: 6.2

40. An earthquake destroys a good portion of the capital stock. How would you expect this to affect the capital-labor ratio in the long run? There would be
   (a) a rightward movement along the saving-per-worker curve and an increase in the capital-labor ratio.
   (b) no change in the long-run capital-labor ratio.
   (c) a downward shift in the saving-per-worker curve and a decrease in the capital-labor ratio.
   (d) a leftward movement along the saving-per-worker curve and a decrease in the capital-labor ratio.
   Answer: B
   Level of difficulty: 2
   Section: 6.2
41. Which of the following changes would lead, according to the Solow model, to a higher level of long-run output per worker?
   (a) A lower level of capital per worker.
   (b) An increase in the saving rate.
   (c) A rise in the rate of population growth.
   (d) A decrease in productivity.
   Answer: B  
   Level of difficulty: 1  
   Section: 6.2

42. An increase in the saving rate in a steady-state economy would cause
   (a) a rightward movement along the saving-per-worker curve and an increase in the capital-labor ratio.
   (b) an upward shift in the saving-per-worker curve and an increase in the capital-labor ratio.
   (c) a downward shift in the saving-per-worker curve and a decrease in the capital-labor ratio.
   (d) a leftward movement along the saving-per-worker curve and a decrease in the capital-labor ratio.
   Answer: B  
   Level of difficulty: 1  
   Section: 6.2

43. In the long run, an increase in the saving rate in a steady-state economy will cause
   (a) an increase in the capital-labor ratio and an increase in consumption per worker.
   (b) an increase in the capital-labor ratio and a decrease in consumption per worker.
   (c) a decrease in the capital-labor ratio and a decrease in consumption per worker.
   (d) a decrease in the capital-labor ratio and an increase in consumption per worker.
   Answer: A  
   Level of difficulty: 2  
   Section: 6.2

44. All else being equal, a permanent decrease in the saving rate in a steady-state economy would cause
   (a) an increase in the capital-labor ratio and an increase in consumption per worker.
   (b) an increase in the capital-labor ratio and a decrease in consumption per worker.
   (c) a decrease in the capital-labor ratio and a decrease in consumption per worker.
   (d) a decrease in the capital-labor ratio and an increase in consumption per worker.
   Answer: C  
   Level of difficulty: 2  
   Section: 6.2

45. An increase in the growth rate of population in a steady-state economy would cause
   (a) a parallel shift upward in the investment line.
   (b) a pivot up and to the left in the investment line.
   (c) a pivot down and to the right in the investment line.
   (d) a parallel shift downward in the investment line.
   Answer: B  
   Level of difficulty: 1  
   Section: 6.2
46. An increase in population growth will lead to a __________ in the steady-state capital-labor ratio and a __________ in output per worker.
   (a) fall; fall  
   (b) fall; rise  
   (c) rise; rise  
   (d) rise; fall  
   Answer: A  
   Level of difficulty: 2  
   Section: 6.2

47. A productivity improvement will cause
   (a) a rightward movement along the saving-per-worker curve and an increase in the capital-labor ratio.  
   (b) an upward shift in the saving-per-worker curve and an increase in the capital-labor ratio.  
   (c) a downward shift in the saving-per-worker curve and a decrease in the capital-labor ratio.  
   (d) a leftward movement along the saving-per-worker curve and a decrease in the capital-labor ratio.  
   Answer: B  
   Level of difficulty: 1  
   Section: 6.2

48. In the long run, a reduction in productivity will cause
   (a) an increase in the capital-labor ratio and an increase in consumption per worker.  
   (b) an increase in the capital-labor ratio and a decrease in consumption per worker.  
   (c) a decrease in the capital-labor ratio and a decrease in consumption per worker.  
   (d) a decrease in the capital-labor ratio and an increase in consumption per worker.  
   Answer: C  
   Level of difficulty: 2  
   Section: 6.2

49. In the very long run, the level of consumption per worker can grow continually if
   (a) the saving rate continually falls.  
   (b) the population growth rate continually rises.  
   (c) productivity continually improves.  
   (d) the depreciation rate continually rises.  
   Answer: C  
   Level of difficulty: 1  
   Section: 6.2

50. Unconditional convergence means that in the long run,
   (a) living standards converge only within groups of countries having similar characteristics.  
   (b) living standards converge only for countries that have the same initial capital-labor ratio.  
   (c) living standards around the world become the same.  
   (d) differences persist in living standards around the world.  
   Answer: C  
   Level of difficulty: 1  
   Section: 6.2
51. Conditional convergence means that in the long run,
   (a) living standards converge only within groups of countries having similar characteristics.
   (b) living standards converge only for countries that have the same initial capital-labor ratio.
   (c) living standards around the world become the same.
   (d) living standards converge even if countries have different population growth rates.
   Answer: A
   Level of difficulty: 1
   Section: 6.2

52. How does the possibility of international trade and finance affect the convergence conclusions of the
    Solow model?
   (a) Capital should flow from rich to poor countries.
   (b) Capital should flow from poor to rich countries.
   (c) Labor should flow from rich to poor countries.
   (d) Capital will flow to countries with low tariffs.
   Answer: A
   Level of difficulty: 1
   Section: 6.2

53. If there is international trade and finance, output per worker will converge in rich and poor
    countries. Will consumption per worker converge?
   (a) Yes, with the same output, consumption must be the same.
   (b) Yes, in equilibrium, consumption per worker must be the same around the world.
   (c) No, because total output is different.
   (d) No, because part of the output must be used to repay foreign investors.
   Answer: D
   Level of difficulty: 2
   Section: 6.2

54. The empirical evidence on convergence suggests that
   (a) there is support for conditional convergence.
   (b) there is support for unconditional convergence.
   (c) there is no support for any type of convergence.
   (d) there is support for unconditional convergence among all English-speaking countries.
   Answer: A
   Level of difficulty: 2
   Section: 6.2

55. Endogenous growth theory attempts to
   (a) replace the Solow model with a model in which money growth plays a key role.
   (b) explain how societies can more easily reach the “Golden Rule.”
   (c) show how population growth reduces capital and output.
   (d) explain why productivity changes.
   Answer: D
   Level of difficulty: 2
   Section: 6.2
56. In the textbook model of endogenous growth, in equilibrium, output grows at the rate of
(a) $sA - d$.
(b) $n + d$.
(c) $K$.
(d) $A$.
Answer: A
Level of difficulty: 1
Section: 6.2

57. In the textbook model of endogenous growth, long-run output growth would decline if there were either a _____ in the saving rate or a _____ in the depreciation rate.
(a) rise; rise
(b) rise; fall
(c) fall; rise
(d) fall; fall
Answer: C
Level of difficulty: 2
Section: 6.2

58. Government policies to raise the rate of productivity growth include all of the following EXCEPT
(a) improving infrastructure.
(b) encouraging research and development.
(c) reducing the government budget surplus.
(d) improving human capital development.
Answer: C
Level of difficulty: 1
Section: 6.3
### Essay Questions

1. From 2003 to 2004 a country’s output rose from 4000 to 4500, its capital stock rose from 10,000 to 12,000, and its labor force declined from 2000 to 1750. Suppose $a_k = 0.3$ and $a_n = 0.7$.
   (a) How much did capital contribute to economic growth over the year?
   (b) How much did labor contribute to economic growth over the year?
   (c) How much did productivity contribute to economic growth over the year?

   **Answers:**
   (a) $a_k \Delta K/K = 0.3(2000 / 10,000) = 6\%$.
   (b) $a_n \Delta N/N = 0.7 (–250 / 2000) = –8.75\%$.
   (c) $\Delta Y/Y = 500/4000 = 12.5\%$.
   
   $\Delta A/A = \Delta Y/Y - a_k \Delta K/K - a_n \Delta N/N$
   
   $= 12.5\% - 6\% - (–8.75\%)$
   
   $= 15.25\%$.

   Level of difficulty: 3
   Section: 6.1

2. Describe the miracle of the East Asian “tigers.” What explains their growth, according to Alwyn Young’s research? What does his research imply about their chances for future growth?

   **Answers:** The miracle is that they’ve all had growth rates averaging 7% or more for over 25 years. According to Young, the rapid growth occurred because of increases in capital and labor, not increases in total factor productivity. This bodes ill for their chances of continued growth because diminishing marginal productivity makes it unlikely that continued increases in inputs will lead to continuing growth at such a rapid pace.

   Level of difficulty: 1
   Section: 6.1

3. A country has the per-worker production function
   
   $y_t = 5k_t^{0.5}$,

   where $y_t$ is output per worker and $k_t$ is the capital-labor ratio. The depreciation rate is 0.2 and the population growth rate is 0.05. The saving function is
   
   $S_t = 0.2Y_t$,

   where $S_t$ is total national saving and $Y_t$ is total output.
   (a) What is the steady-state value of the capital-labor ratio?
   (b) What is the steady-state value of output per worker?
   (c) What is the steady-state value of consumption per worker?

   **Answers:**
   (a) $s(k) = (n + d)k$, so $0.2 \times 5k^{0.5} = 0.25k$; or $k^{0.5} = 4$, so $k = 16$.
   (b) $y = 5k^{0.5} = 20$.
   (c) $c = (1 - s)y = 0.8y = 16$.

   Level of difficulty: 3
   Section: 6.2
4. A country has the per-worker production function
\[ y_t = 6k_t^{2/3}, \]
where \( y_t \) is output per worker and \( k_t \) is the capital-labor ratio. The depreciation rate is 0.1 and the population growth rate is 0.1. The saving function is
\[ S_t = 0.1Y_t, \]
where \( S_t \) is total national saving and \( Y_t \) is total output.

(a) What is the steady-state value of capital-labor ratio?
(b) What is the steady-state value of output per worker?
(c) What is the steady-state value of consumption per worker?

Answers:
(a) \( sf(k) = (n + d)k \), so \( 0.1 \times 6k^{2/3} = 0.2k \); or \( k^{1/3} = 3 \), so \( k = 27 \).
(b) \( y = 6k^{2/3} = 54 \).
(c) \( c = (1 - s)y = 0.9y = 48.6 \).
Level of difficulty: 3
Section: 6.2

5. What happens in the steady state to the capital-labor ratio, output per worker, and consumption per worker when each of the following events occur? You should assume that the steady-state capital-labor ratio is below the Golden Rule level.
(a) Productivity falls.
(b) Population growth falls.
(c) The saving rate falls.
(d) The depreciation rate falls.

Answers:
(a) \( k, y, \) and \( c \) all fall.
(b) \( k, y, \) and \( c \) all rise.
(c) \( k, y, \) and \( c \) all fall.
(d) \( k, y, \) and \( c \) all rise.
Level of difficulty: 2
Section: 6.2
6. Country A has a capital-labor ratio that is initially twice as big as that of country B, but neither is yet in a steady state. Both countries have the same production function, \( f(k) = 6k^{1/2} \). Country A has a 10% saving rate, 10% population growth rate, and 5% depreciation rate, while country B has a 20% saving rate, 10% population growth rate, and 20% depreciation rate.

(a) Calculate the steady-state capital-labor ratio for each country. Does the initial capital-labor ratio affect your results?
(b) Calculate output per worker and consumption per worker for each country. Which country has the highest output per worker? The highest consumption per worker?
(c) In general, do all the fundamental characteristics of different countries need to be identical for convergence of output per worker?

**Answers:**
(a) Using the formula \( sf(k) = (n + d)k \), country A: \( 0.1 \times 6k^{1/2} = 0.15k \), or \( k^{1/2} = 4 \), so \( k = 16 \); country B: \( 0.2 \times 6k^{1/2} = 0.3k \), or \( k^{1/2} = 4 \), so \( k = 16 \) also. The initial capital-labor ratios have no effect on the steady-state capital-labor ratios.
(b) \( y = 6k^{1/2} = 24 \) for both countries. \( c = (1 - s)y \), so country A has \( c = 0.9y = 21.6 \), while country B has \( c = 0.8y = 19.2 \). The two countries have the same capital-labor ratio and output per worker, but different consumption per worker.
(c) Convergence can arise even if the fundamental characteristics of different countries are different.

Level of difficulty: 3
Section: 6.2

7. How would each of the following changes affect the steady-state values of the capital-labor ratio, output per worker, and consumption per worker?
(a) A change in the composition of the capital stock raises the depreciation rate.
(b) A change in social mores lowers the population growth rate.
(c) Government tax policies change to encourage a higher saving rate.
(d) A supply shock reduces productivity sharply.

**Answers:**
(a) The rise in \( d \) reduces the capital-labor ratio, as well as output per worker and consumption per worker.
(b) The decline in \( n \) raises the capital-labor ratio, as well as output per worker and consumption per worker.
(c) The rise in \( s \) raises the capital-labor ratio, as well as output per worker and consumption per worker.
(d) The decline in productivity shifts the production function down, reducing the capital-labor ratio, as well as output per worker and consumption per worker.

Level of difficulty: 2
Section: 6.2

8. What is the empirical evidence on whether or not rich and poor countries converge?

**Answer:** There is little evidence for unconditional convergence; indeed, in many cases, rich countries get richer and poor countries get poorer. But there is some evidence supporting the idea of conditional convergence, as countries with similar fundamentals seem to end up with about the same level of output per worker.

Level of difficulty: 1
Section: 6.2
9. What types of government policies can increase long-run living standards?

Answer: If, for some reason, the national saving rate were too low, the government could increase national saving by reducing its budget deficit. Government policies could also raise the level of productivity and/or the rate of productivity growth by improving infrastructure, building human capital, and encouraging research and development.

Level of difficulty: 1
Section: 6.3