

Practice Problems Chapter 4, 6, 7 with solutions

- 1) Suppose the nominal interest rate is 6%, the tax rate on interest income is 30%, and expected inflation is 3%.
  - (a) Calculate the expected real after-tax interest rate.
  - (b) Calculate the expected real after-tax interest rate if the nominal interest rate falls to 4%.
  - (c) Calculate the expected real after-tax interest rate if the tax rate increases to 50% (with the nominal interest rate at its original value of 6%).
  - (d) Calculate the expected real after-tax interest rate if expected inflation increases to 5% (with the nominal interest rate at its original value of 6% and the tax rate at its original value of 30%).
- 2) Draw a diagram showing the determination of a firm's optimal capital stock, showing the relationship between the user cost of capital and the future marginal product of capital. Suppose the real interest rate declines. Show what happens to the firm's optimal capital stock. What happens to the firm's desired investment?
- 3) Use a saving—investment diagram to explain what happens to saving, investment, and the real interest rate in each of the following scenarios in a closed economy.
  - (a) Current output rises due to a temporary productivity increase.
  - (b) The tax code changes so that business firms face higher tax rates on their revenue (offset by other lump-sum tax changes so there's no overall change in tax revenue).
  - (c) The government increases spending temporarily for a one-year project to turn mercury into gold.
  - (d) The average educational level rises, inducing an increase in the future marginal productivity of capital.
- 4) How would each of the following affect Cheryl Shirker's current consumption and saving? Cheryl is a forward-looking consumer with no borrowing constraints.
  - (a) Cheryl's firm announces a reorganization plan, increasing Cheryl's future income dramatically.
  - (b) Cheryl's father, who had planned to leave her a large bequest, must spend all his wealth on medical bills after a prolonged illness.
  - (c) The real interest rate rises from its original level. Cheryl originally planned to have no assets for the future; that is, she planned to spend all her original assets and all her income when she was young, and planned to consume an amount equal to her future income when she was old.
- 5) From one year to the next, 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  $\alpha_K = 0.3$  and  $\alpha_N = 0.7$ .
  - (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?
- 6) Use the growth accounting equation to calculate productivity growth, given output growth of 3.5%, capital stock growth of 5%, labor employment growth of 2%, the output elasticity of capital of 0.3, and the output elasticity of labor of 0.7.

- 7) 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?

- 8) Briefly explain the shape of the per-worker production curve in the Solow model. If investment per worker initially exceeds saving per worker, how is the steady-state capital—labor ratio achieved?
- 9) What happens to M1 and M2 due to each of the following changes?
- (a) You take \$500 out of your checking account and put it into a passbook savings account.
  - (b) You take \$1000 out of your checking account and buy traveler's checks.
  - (c) You take \$1500 out of your money—market mutual fund and deposit into your checking account.
  - (d) You cash in \$2000 in savings bonds and invest the money in a certificate of deposit.
- 10) Calculate the change in the price level for each of the following events, taken one at a time, with other variables unchanged.
- (a) Money supply increases 10%.
  - (b) Money demand increases 5%.
  - (c) Money supply decreases 5% while money demand increases 5%.
  - (d) Money supply increases 15% while money demand increases 5%.
- 11) What happens to real money demand (rise, fall, no change) due to a change in each of the following factors?
- (a) A tax on stock market transactions is introduced.
  - (b) Computerized bond trading reduces transactions costs.
  - (c) People's average level of wealth rises.
  - (d) The threat of a recession increases the riskiness of stocks and bonds.
  - (e) The interest rate paid on checking account balances declines.
  - (f) The price level falls in a one-time jump.

## Answer Key

Testname:

- 1) The expected real after-tax interest rate is  $r_{a-t} = (1 - t)i - \text{expected inflation rate}$ .
  - (a) Given the initial values,  $r_{a-t} = (1 - .30).06 - .03 = 0.012 = 1.2\%$ .
  - (b) When  $i = 4\%$ ,  $r_{a-t} = (1 - .30).04 - .03 = -0.002 = -0.2\%$ .
  - (c) When  $t = 50\%$ ,  $r_{a-t} = (1 - .50).06 - .03 = 0.0 = 0.0\%$ .
  - (d) When expected inflation rate = 5%,  $r_{a-t} = (1 - .30).06 - .05 = -0.008 = -0.8\%$ .
- 2) This is the standard diagram with the user cost of capital as a horizontal line and the future marginal product of capital as a downward sloping line. The decline in the real interest rate reduces the user cost of capital, thus increasing the optimal capital stock. With a higher optimal capital stock, desired investment increases.
- 3) (a) The rise in output raises desired saving, shifting the  $S^d$  curve to the right; in equilibrium, this reduces the real interest rate, increasing investment as well.
  - (b) The rise in taxes reduces desired investment, shifting the  $I^d$  curve to the left; in equilibrium, this reduces the real interest rate, reducing saving as well as investment.
  - (c) The rise in government purchases reduces desired saving, shifting the  $S^d$  curve to the left; in equilibrium, this raises the real interest rate, reducing investment as well as saving.
  - (d) The rise in future marginal productivity of capital raises desired investment, shifting the  $I^d$  curve to the right; in equilibrium, this raises the real interest rate, increasing saving as well as investment.
- 4) (a) The rise in future income raises her current consumption and reduces her saving.
  - (b) The reduction in her wealth reduces her current consumption and raises her saving.
  - (c) The rise in the real interest rate causes Cheryl to reduce current consumption and increase saving to allow her to consume more in the future. There's just a substitution effect and no income effect, since Cheryl was at the no-borrowing, no-lending point initially.
- 5) (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)  $\Delta Y/Y = 500/4000 = 12.5\%$ .  
 $\Delta A/A = \Delta Y/Y - a_K \Delta K/K - a_N \Delta N/N$   
 $= 12.5\% - 6\% - (-8.75\%)$   
 $= 15.25\%$ .
- 6) The growth accounting equation is  $\Delta Y/Y = \Delta A/A + a_K \Delta K/K + a_N \Delta N/N$ .  
Therefore productivity growth is  $\Delta A/A = \Delta Y/Y - a_K \Delta K/K - a_N \Delta N/N$ .  
For the given values, productivity growth =  $3.5\% - (0.3)(5\%) - (0.7)(2\%) = 0.6\%$ .
- 7) (a)  $s_f(k) = (n + d)k$ , so  $0.2 \times 5k^{0.5} = 0.25k$ ; or  $k^{0.5} = 4$ , so  $k = 16$ .
  - (b)  $y = 5k^{0.5} = 20$ .
  - (c)  $c = (1 - s)y = 0.8y = 16$ .
- 8) The per-worker production curve is positively sloped because adding capital to each unit of labor increases output per worker. The curve is concave (i.e., increasing at a decreasing rate) because of diminishing marginal productivity of capital; output increases at a slower rate than capital when capital is added to production.  
The steady-state capital-labor ratio is the capital-labor ratio at which saving per worker [ $s_f(k)$ ] equals investment per worker [ $(n + d)k$ ]. If investment per worker initially exceeds saving per worker, then the initial capital-labor ratio exceeds the steady-state capital-labor ratio. The capital-labor ratio will decline because saving is insufficient to provide enough capital to maintain the initial capital-labor ratio. The capital-labor ratio will continue to decline until it reaches the steady-state capital-labor ratio.
- 9) (a) M1 falls \$500, M2 is unchanged (remember that M1 is part of M2).
  - (b) M1 and M2 are both unchanged.
  - (c) M1 rises \$1500, M2 is unchanged.
  - (d) M1 is unchanged, M2 rises \$2000.

## Answer Key

Testname:

- 10) (a) 10%
- (b) -5%
- (c) -10%
- (d) 10%
- 11) (a) Rises
- (b) Falls
- (c) Rises
- (d) Rises
- (e) Falls
- (f) Is unchanged