Macroeconomics Homework: Chap 3, 4, 5

Intermediate Macroeconomics, 2026 Spring, JCER

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Chapter 3: Productivity, Output and Employment

Review Questions

2. The production function slopes upward, but its slope declines from left to right. Give an economic interpretation of each of these properties of the production function.

4. Explain why the profit-maximizing level of employment for a firm occurs when the marginal revenue product of labor equals the nominal wage. How can this profit-maximizing condition be expressed in real terms?

12. What is frictional unemployment? Why is a certain amount of frictional unemployment probably necessary in a well-functioning economy?

Numerical Problems

2. Suppose the production function is $Y = AK^{0.3}N^{0.7}$ and that in 2000, $K = 1000$, $N = 100$, and $Y = 199.5$. In 2010, capital, labor, and output have doubled, so $K = 2000$, $N = 200$, and $Y = 399$.

a. By what percentage did productivity grow from 2000 to 2010?

b. If output had risen to 798 instead of 399 and capital and labor had doubled, by what percentage would productivity have grown from 2000 to 2010?

3. Acme Widget, Inc. has the following production function.

Number of Workers	Number of Widgets Produced
0	0
1	8
2	15
3	21
4	26
5	30
6	33

a. Find the MPN for each level of employment.

b. Acme can get \$5 for each widget it produces. How many workers will it hire if the nominal wage is \$38? If it is \$27? If it is \$22?

c. Graph the relationship between Acme's labor demand and the nominal wage. How does this graph differ from a labor demand curve? Graph Acme's labor demand curve.

d. With the nominal wage fixed at $38, the price of widgets doubles from $5 each to $10 each. What happens to Acme's labor demand and production?

e. With the nominal wage fixed at $38 and the price of widgets fixed at $5, the introduction of a new automatic widget maker doubles the number of widgets that the same number of workers can produce. What happens to labor demand and production?

f. What is the relationship between your answers to part (d) and part (e)? Explain.

7. Consider an economy with 500 people in the labor force. At the beginning of every month, 5 people lose their jobs and remain unemployed for exactly one month; one month later, they find new jobs and become employed. In addition, on January 1 of each year, 20 people lose their jobs and remain unemployed for six months before finding new jobs. Finally, on July 1 of each year, 20 people lose their jobs and remain unemployed for six months before finding new jobs.

a. What is the unemployment rate in this economy in a typical month?

b. What fraction of unemployment spells last for one month? What fraction last for six months?

c. What is the average duration of a completed spell of unemployment?

d. On any particular date, what fraction of the unemployed are suffering a long spell (six months) of unemployment?

Analytical Problems

1.

a. A technological breakthrough raises a country's total factor productivity A by 10%. Show how this change affects the graphs of both the production function relating output to capital and the production function relating output to labor.

b. Show that a 10% increase in A also increases the MPK and the MPN by 10% at any level of capital and labor. (*Hint:* What happens to ΔY for any increase in capital, ΔK, or for any increase in labor, ΔN?)

c. Can a beneficial supply shock leave the MPK and MPN unaffected? Show your answer graphically.

3. During the 1980s and 1990s the average rate of unemployment in Europe was high. Some economists claimed that this rate was in part the result of "real-wage rigidity," a situation in which unions kept real wages above their market-clearing levels.

a. Accepting for the sake of argument that real wages were too high in Europe in the 1980s and 1990s, show how this situation would lead to unemployment (a situation where people who would like to work at the going wage cannot find jobs).

b. What is the effect of real-wage rigidity on the output actually supplied by firms, relative to the output they would supply if there were no real-wage rigidity?

5. Suppose that under a new law all businesses must pay a tax equal to 6% of their sales revenue. Assume that this tax is not passed on to consumers. Instead, consumers pay the same prices after the tax is imposed as they did before. What is the effect of this tax on labor demand? If the labor supply curve is unchanged, what will be the effect of the tax on employment and the real wage?

Chapter 4: Consumption, Saving, and Investment

Review Questions

3. Use the concepts of income effect and substitution effect to explain why the effect on desired saving of an increase in the expected real interest rate is potentially ambiguous.

5. What effect does a temporary increase in government purchases—for example, to fight a war—have on desired consumption and desired national saving, for a constant level of output? What is the effect on desired national saving of a lump-sum tax increase? Why is the effect of a lump-sum tax increase controversial?

10. Explain why the saving curve slopes upward and the investment curve slopes downward in the saving–investment diagram. Give two examples of changes that would shift the saving curve to the right, and two examples of changes that would shift the investment curve to the right.

Numerical Problems

6. An economy has full-employment output of 6000. Government purchases, G, are 1200. Desired consumption and desired investment are

$$C^d = 3600 - 2000r + 0.10Y, \text{ and}$$
$$I^d = 1200 - 4000r,$$

where Y is output and r is the real interest rate.

a. Find an equation relating desired national saving, S^d, to r and Y.

b. Using both versions of the goods market equilibrium condition, Eqs. (4.7) and (4.8), find the real interest rate that clears the goods market. Assume that output equals full-employment output.

c. Government purchases rise to 1440. How does this increase change the equation describing desired national saving? Show the change graphically. What happens to the market-clearing real interest rate?

d. Repeat part (c) for the case in which government purchases fall to 1000. Assume that the amount people desire to consume at each real interest rate is unchanged.

7. Suppose that the economywide expected future marginal product of capital is $MPK^f = 20 - 0.02K$, where K is the future capital stock. The depreciation rate of capital, d, is 20% per period. The current capital stock is 900 units of capital. The price of a unit of capital is 1 unit of output. Firms pay taxes equal to 15% of their output. The consumption function in the economy is $C = 100 + 0.5Y - 200r$, where C is consumption, Y is output, and r is the real interest rate. Government purchases equal 200, and full-employment output is 1000.

a. Suppose that the real interest rate is 10% per period. What are the values of the tax-adjusted user cost of capital, the desired future capital stock, and the desired level of investment?

b. Now consider the real interest rate determined by goods market equilibrium. This part of the problem will guide you to this interest rate.

   i. Write the tax-adjusted user cost of capital as a function of the real interest rate r. Also write the desired future capital stock and desired investment as functions of r.

   ii. Use the investment function derived in part (i) along with the consumption function and government purchases, to calculate the real interest rate that clears the goods market. What are the goods market-clearing values of consumption, saving, and investment? What are the tax-adjusted user cost of capital and the desired capital stock in this equilibrium?

9. (Appendix 4.A) A consumer lives three periods, called the learning period, the working period, and the retirement period. Her income is 200 during the learning period, 800 during the working period, and 200 again during the retirement period. The consumer's initial assets are 300. The real interest rate is zero. The consumer desires perfectly smooth consumption over her lifetime.

a. What are consumption and saving in each period, assuming no borrowing constraints? What happens if the consumer faces a borrowing constraint that prevents her from borrowing?

b. Assume that the consumer's initial wealth is zero instead of 300. Repeat part (a). Does being borrowing-constrained mean that consumption is lower in all three periods of the consumer's life than it would be if no borrowing constraints applied?

Analytical Problems

1. Use the saving–investment diagram to analyze the effects of the following on national saving, investment, and the real interest rate. Explain your reasoning.

a. Consumers become more future-oriented and thus decide to save more.

b. The government announces a large, one-time bonus payment to veterans returning from a war. The bonus will be financed by additional taxes levied on the general population over the next five years.

c. The government introduces an investment tax credit (offset by other types of taxes, so total tax collections remain unchanged).

d. A large number of accessible oil deposits are discovered, which increases the expected future marginal product of oil rigs and pipelines. It also causes an increase in expected future income.

2. A country loses much of its capital stock to a war.

a. What effects should this event have on the country's current employment, output, and real wage?

b. What effect will the loss of capital have on desired investment?

c. Assume that the desired saving function doesn't change. What effect does the loss of capital have on the country's real interest rate and the quantity of investment?

6. (Appendix 4.A) Draw a budget line and indifference curves for a consumer who initially is a borrower. Be sure to indicate the no-borrowing, no-lending point and the optimal consumption point. Then show the effect on the budget line and the consumer's optimal consumption of an increase in the real interest rate. Using an intermediate budget line, show the income effect and the substitution effect. Do they work in the same direction or in opposite directions? Explain your answer.

Chapter 5: Saving and Investment in the Open Economy

Review Questions

4. How do a country's current account and financial account balances affect its net foreign assets? If country A has greater net foreign assets per citizen than does country B, is country A necessarily better off than country B?

5. Explain why, in a small open economy, (a) national saving does not have to equal investment, and (b) output does not have to equal absorption.

7. In a world with two large open economies, what determines the world real interest rate? What relationship between the current accounts of the two countries is satisfied when the world real interest rate is at its equilibrium value?

Numerical Problems

1. Here are some balance of payments data:

Exports of goods	100
Imports of goods	125
Exports of services	90
Imports of services	80
Income receipts from abroad	110
Income payments to foreigners	150
Increase in home country's ownership of assets abroad	160
Increase in foreign ownership of assets in home country	200
Increase in home reserve assets	30
Increase in foreign reserve assets	35

Assuming that unilateral transfers equal zero, find net exports, the current account balance, the financial account balance, the balance of payments, and the statistical discrepancy. (*Note:* The increase in home reserve assets of 30 is included in the increase in the home country's ownership of assets abroad of 160, and the increase in foreign reserve assets of 35 is included in the increase in foreign ownership of assets in the home country of 200.)

4. Consider two large open economies, the home economy and the foreign economy. In the home country the following relationships hold:

$$\begin{aligned}
\text{desired consumption, } C^d &= 320 + 0.4(Y - T) - 200r^w; \\
\text{desired investment, } I^d &= 150 - 200r^w; \\
\text{output, } Y &= 1000; \\
\text{taxes, } T &= 200; \\
\text{government purchases, } G &= 275.
\end{aligned}$$

In the foreign country the following relationships hold:

$$\begin{aligned}
\text{desired consumption, } C^d_{For} &= 480 + 0.4(Y_{For} - T_{For}) - 300r^w; \\
\text{desired investment, } I^d_{For} &= 225 - 300r^w; \\
\text{output, } Y_{For} &= 1500; \\
\text{taxes, } T_{For} &= 300; \\
\text{government purchases, } G_{For} &= 300.
\end{aligned}$$

a. What is the equilibrium interest rate in the international capital market? What are the equilibrium values of consumption, national saving, investment, and the current account balance in each country?

b. Suppose that in the home country government purchases increase by 50 to 325. Taxes also increase by 50 to keep the deficit from increasing. What is the new equilibrium interest rate in the international capital market? What are the new equilibrium values of consumption, national saving, investment, and the current account balance in each country?

5. Consider a world with only two countries, which are designated the home country (H) and the foreign country (F). Output equals its full-employment level in each country. You are given the following information about each country:

Home Country	
Consumption:	$C_H = 100 + 0.5Y_H - 500r^w$
Investment:	$I_H = 300 - 500r^w$
Government Purchases:	$G_H = 155$
Full-employment Output:	$\overline{Y}_H = 1000$
Foreign Country	
Consumption:	$C_F = 225 + 0.7Y_F - 600r^w$
Investment:	$I_F = 250 - 200r^w$
Government Purchases:	$G_F = 190$
Full-employment Output:	$\overline{Y}_F = 1200$

a. Write national saving in the home country and in the foreign country as functions of the world real interest rate r^w.

b. What is the equilibrium value of the world real interest rate?

c. What are the equilibrium values of consumption, national saving, investment, the current account balance, and absorption in each country?

Analytical Problems

1. Explain how each of the following transactions would enter the U.S. balance of payments accounts. Discuss only the transactions described. Do not be concerned with possible offsetting transactions.

a. The U.S. government sells F-16 fighter planes to a foreign government.

b. A London bank sells yen to and buys dollars from a Swiss bank.

c. The Federal Reserve sells yen to and buys dollars from a Swiss bank.

d. A New York bank receives the interest on its loans to Brazil.

e. A U.S. collector buys some ancient artifacts from a collection in Egypt.

f. A U.S. oil company buys insurance from a Canadian insurance company to insure its oil rigs in the Gulf of Mexico.

g. A U.S. company borrows from a British bank.

5. How would each of the following affect national saving, investment, the current account balance, and the real interest rate in a large open economy?

a. An increase in the domestic willingness to save (which raises desired national saving at any given real interest rate).

b. An increase in the willingness of foreigners to save.

c. A temporary increase in foreign government purchases.

d. An increase in foreign taxes (consider both the case in which Ricardian equivalence holds and the case in which it doesn't hold).

6. Analyze the effects on a large open economy of a temporary adverse supply shock that hits only the foreign economy. Discuss the impact on the home country's national saving, investment, and current account balance—and on the world real interest rate. How does your answer differ if the adverse supply shock is worldwide?