

Answers to Preparation Questions for Exam #3

1. *Forward-Looking Theory of Consumption: Suppose the government unexpectedly decides to temporarily raise taxes for this year only. If taxpayers base their consumption decisions on their permanent income, how much will they change their level of consumption (relative to the tax increase)? Briefly explain. Next, discuss how your answer would change for those taxpayers that are liquidity constrained?*

A temporary increase in taxes causes a one-period decrease in disposable income. That one-period decline causes a small decrease in permanent income which causes a small drop in consumption. The fall in consumption is much smaller than the one-period rise in taxes. If consumers are liquidity constrained, they cannot borrow as easily as the forward-looking theory suggests to keep their consumption elevated so consumers must reduce their consumption more.

2. *Consumption and the Interest Rate: Let the following equations describe a simple economy without a foreign sector:*

$$Y = C + I + G$$

$$C = 40 + 0.95 \times (1 - t) \times Y - 2,000 \times R$$

$$I = 740 - 8,000 \times R$$

$$M^S = (Y - 20,000 \times R) \times P$$

where Y is output, C is consumption, I is investment, G is government spending, t is the proportional income tax rate, R is the interest rate, M^S is the money supply, and P is the price level. Furthermore, money supply is 8,100, government spending is 460, the proportional income tax rate is 20%, and the price level is 3.

- a. *Briefly describe the substitution and income effects from an increase in the interest rate on consumption. Which effect dominates in this problem? Briefly explain. You may assume that the expected inflation rate equals zero.*

The substitution effect says that a rise in the real interest rate increases the opportunity cost of current consumption so consumers will consume less now and more in the future [$(R - \pi^e) \uparrow \rightarrow$ opportunity cost of current $C \uparrow \rightarrow C \downarrow$]. The income effect asserts that a rise in the real interest rate increases consumers' return on their assets, i.e. their income rises, so their consumption increases [$(R - \pi^e) \uparrow \rightarrow Y \uparrow \rightarrow C \uparrow$]. In this problem, the substitution effect dominates the income effect because a rise in the interest rate causes consumption to fall (i.e., there is a negative sign on the interest rate in the consumption function).

- b. *Calculate the equilibrium values of output and the interest rate.*

The equation for the IS curve is

$$Y = C + I + G$$

$$Y = 40 + 0.95 \times (1 - 0.2) \times Y - 2,000 \times R + 740 - 8,000 \times R + 460$$

$$Y = 1,240 + 0.95 \times 0.8 \times Y - 10,000 \times R$$

$$Y = 1,240 + 0.76 \times Y - 10,000 \times R$$

$$10,000 \times R = 1,240 - 0.24 \times Y$$

The equation for the LM curve is

$$M^S = (Y - 20,000 \times R) \times P$$

$$8,100 = (Y - 20,000 \times R) \times 3$$

$$2,700 = Y - 20,000 \times R$$

$$20,000 \times R = Y - 2,700$$

Multiply the IS curve equation by two and then combine with the LM curve equation by eliminating $20,000 \times R$

$$2 \times (1,240 - 0.24 \times Y) = Y - 2,700$$

$$2,480 - 0.48 \times Y = Y - 2,700$$

$$1.48 \times Y = 5,180$$

$$Y = 5,180 / 1.48$$

$$Y = 3,500$$

Substituting $Y = 3,500$ into the LM curve (or IS curve), we get the value for R

$$R = (3,500 - 2,700) / 20,000$$

$$R = 0.04 = 4\%$$

3. *The Optimal Capital Stock: Suppose the nominal interest rate is 5%, the depreciation rate is 10%, the relative price of capital is 60, and the marginal product capital is given by the equation $MP_K = 200 - 4 \times K$ where K is the capital stock. If rental income is taxed at the rate of 25% and there are no subsidies for the production of capital, what is the rental price of capital and the optimal level of the capital stock (K^*)? Use an optimal capital demand/supply graph to support your answer.*

The rental price of capital:

$$\begin{aligned}R_k &= (R + \delta) \times P_K / (1 - u) \\R_k &= (0.05 + 0.10) \times 60 / (1 - 0.25) \\R_k &= 0.15 \times 60 / (0.75) \\R_k &= 12\end{aligned}$$

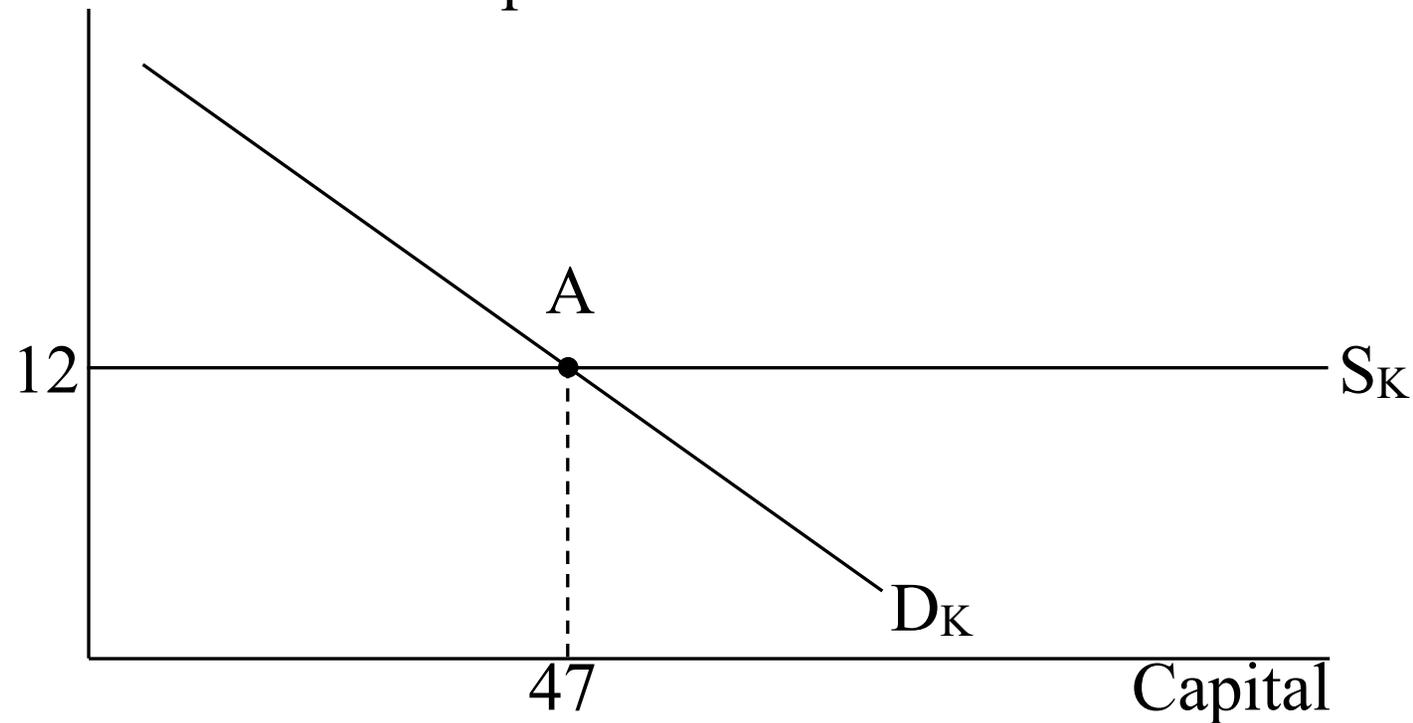
The optimal capital stock is then determined by setting the marginal product of capital to the rental price of capital:

$$200 - 4 \times K = 12$$

$$4 \times K = 188$$

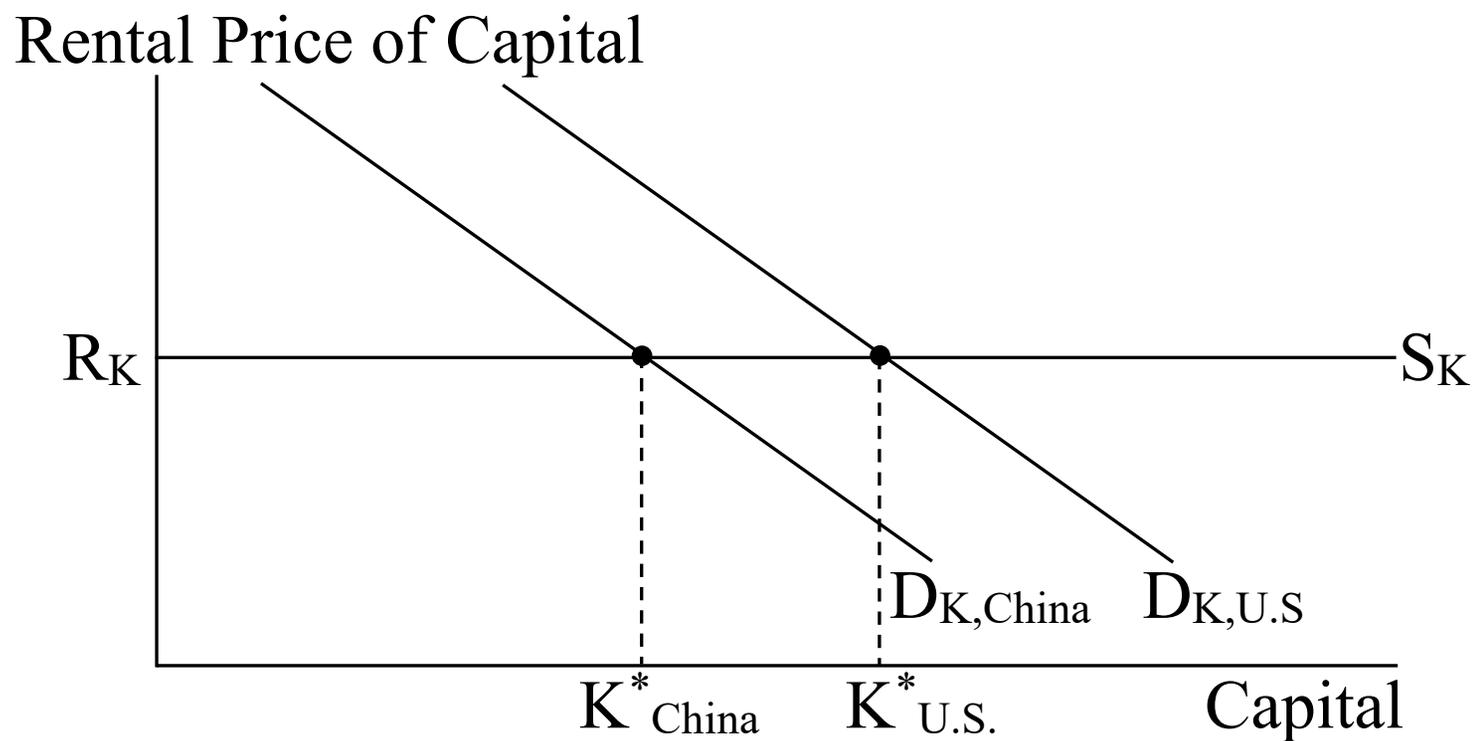
$$K = 47$$

Rental Price of Capital



4. *The Optimal Capital Stock: The real wage rate in the United States is much higher than in China. How does this difference impact the size of the optimal capital stock in the United States to that in China? For simplicity, assume the level of GDP and the rental rate of capital are identical in both countries. Use an optimal capital demand/supply graph to support your answer.*

A higher real wage (w) increases the demand for capital (D_K). If the real wage in the U.S. ($w_{U.S.}$) is greater than the real wage in China (w_{China}) then the demand for capital in the U.S. ($D_{K,U.S.}$) is greater than the demand for capital in China ($D_{K,China}$). As a result, the optimal capital stock is greater in the U.S. ($K^*_{U.S.}$) than China (K^*_{China}).

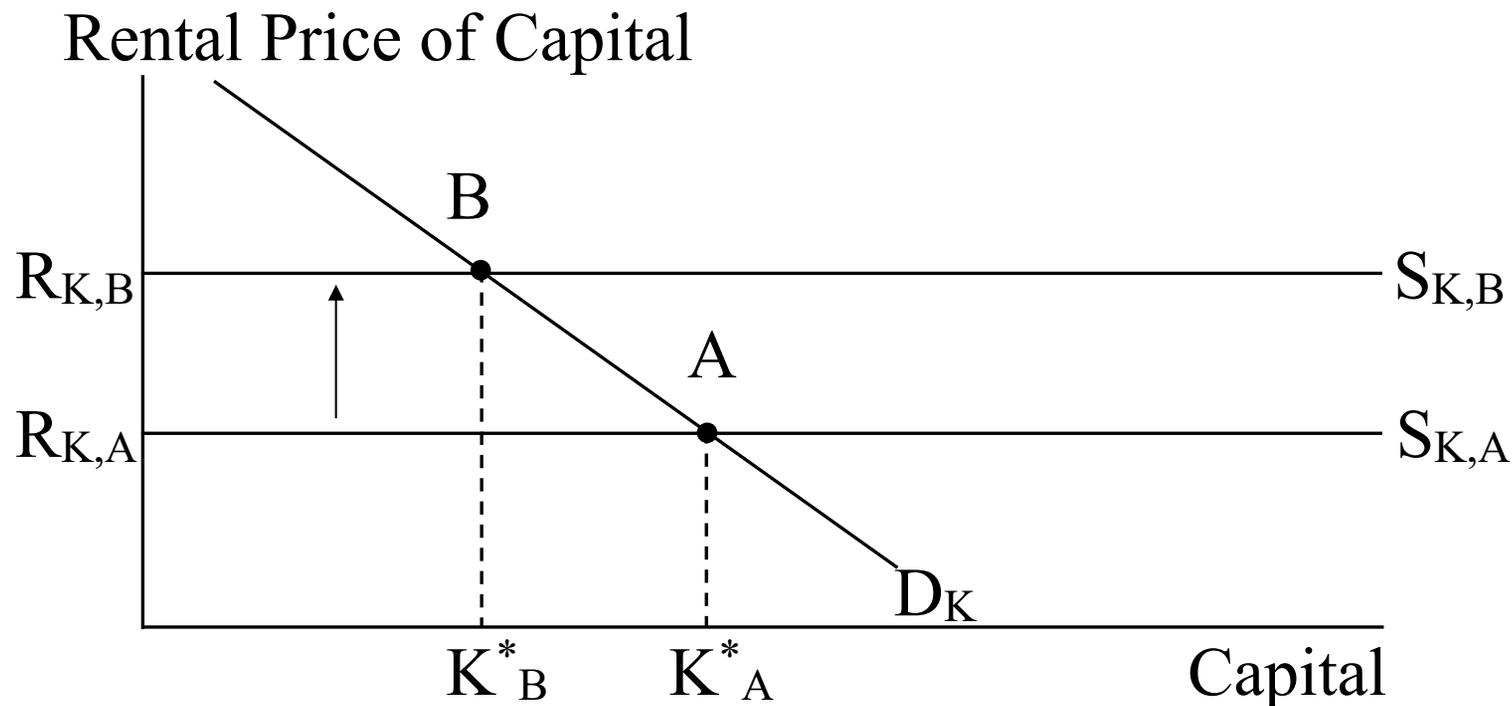


5. *Anticipated Tax Changes: Suppose firms expect the government to institute investment subsidies next period. How will that change impact the expected price of capital goods next period, the rental rate of capital this period, and the optimal capital stock this period? Briefly explain. Use an optimal capital demand/supply graph to support your answer.*

If the government is expected to institute a subsidy on new capital next period, then the price of existing capital is expected to fall next period ($P_{K(+1)}$). Thus, the rental price of capital (R_K) equals

$$R_K = (R + \delta) \times P_K - (P_{K(+1)} - P_K).$$

The expected decline in $P_{K(+1)}$ raises R_K this period which shifts up the capital supply curve (S_K) resulting in a smaller optimal capital stock (K^*) this period. [$P_{K(+1)} \downarrow \rightarrow R_K \uparrow \rightarrow K^* \downarrow$]



6. *Inventories: Answer parts a – c below*

- a. *Briefly describe the two types of inventories. What fraction of total inventories does each type comprise?*

The pipeline function of inventories are inventories that are held as an intrinsic part of the production process. The buffer stock inventories are inventories held by firms to maintain a buffer stock against unplanned changes in demand.

- b. *Suppose there is a planned increase in pipeline inventories, what does this indicate about future output? Briefly explain.*

A planned increase in pipeline inventories means firms feel optimistic that output will rise in the future.

c. *Suppose there is an unplanned increase in buffer stock inventories, what does this indicate about future output? Briefly explain.*

An unplanned increase in buffer stock inventories means firms are not selling as many goods as planned. To reduce their inventories, firms will reduce their production in the future output.

7. *A Bank's Balance Sheet: Show how each of the following would initially affect the assets and liabilities of a bank. Indicate the particular type of assets or liabilities that change.*

a. *The Federal Reserve sells \$100,000 in bonds to a bank.*

Assets	Liabilities
Bonds + \$100,000	
Reserves -\$100,000	

b. *A bank makes a \$20,000 loan to a business.*

Assets	Liabilities
Loans + \$20,000	
Reserves - \$20,000	

c. *A consumer withdraws \$100 from his/her checking account.*

Assets	Liabilities
Reserves - \$100	Checking Deposits - \$100

8. *Reserves/Money: Use the information below to calculate the answers to parts a – e.*

<i>Borrowed reserves</i>	<i>\$25</i>
<i>Currency-to-deposit ratio</i>	<i>0.25</i>
<i>Excess reserves</i>	<i>\$70</i>
<i>Nonborrowed reserves</i>	<i>\$1,445</i>
<i>Required reserves ratio</i>	<i>0.10</i>

a. *Total reserves*

Total reserves = Borrowed reserves + Nonborrowed reserves

$$\text{Total reserves} = \$25 + \$1,445$$

$$\text{Total reserves} = \$1,470$$

b. *Required reserves*

Total reserves = Required reserves + Excess reserves

$$\$1,470 = \text{Required reserves} + \$70$$

$$\text{Required reserves} = \$1,400$$

c. *Checking deposits*

Required reserves = Required reserves ratio × Checking deposits

$$\$1,400 = 0.10 \times \text{Checking deposits}$$

$$\text{Checking deposits} = \$14,000$$

d. *Currency*

Currency = Currency-to-deposit ratio × Checking deposits

$$\text{Currency} = 0.25 \times \$14,000$$

$$\text{Currency} = \$3,500$$

e. *M1*

M1 = Currency + Checking deposits

$$M1 = 3,500 + \$14,000$$

$$M1 = \$17,500$$

9. *The Money Multiplier: Suppose the currency-to-deposit ratio is 0.20, the excess reserves-to-deposit ratio is 0.10, and the required reserves ratio is 0.10.*

a. *If the Federal Reserve buys \$6 million in bonds, how much does the money supply change?*

$$\Delta M^B = \$6 \text{ million}, c = 0.20, e = 0.10, \text{ and } rr = 0.10$$

$$\Delta M^S = [(1+c)/(c+rr+e)] \times \Delta M^B$$

$$\Delta M^S = [(1+0.20)/(0.20+0.10+0.10)] \times \$6 \text{ million}$$

$$\Delta M^S = [1.20/0.40] \times \$6 \text{ million}$$

$$\Delta M^S = \$18 \text{ million}$$

b. *If the Federal Reserve wants the money supply to decline by \$27 million, how much should it decrease the monetary base?*

$$\Delta M^S = -\$27 \text{ million}, c = 0.20, e = 0.10, \text{ and } rr = 0.10$$

$$\Delta M^S = [(1+c)/(c+rr+e)] \times \Delta M^B$$

$$-\$27 \text{ million} = [(1+0.20)/(0.20+0.10+0.10)] \times \Delta M^B$$

$$- \$27 \text{ million} = [1.20/0.40] \times \Delta M^B$$
$$\Delta M^B = - \$9 \text{ million}$$

10. *Federal Funds Rate/Discount Rate: Briefly describe what the Federal Funds Rate and the Discount Rate are. Does the Federal Reserve directly set or just simply target these rates?*

The Federal Funds Rate is the interest rate one bank charges another bank for borrowing reserves. This interest rate is targeted by the Federal Reserve. The Discount Rate is the interest rate the Federal Reserve charges banks for borrowing reserves at the discount window. This interest rate is set by the Federal Reserve.

11. *The Fed's Policy Tools: Name and briefly describe the four main policy tools of the Federal Reserve.*

1. Open-market operations are purchase or sale of bonds by the Federal Reserve to increase or decrease monetary base.
2. The Discount Rate is the interest rate the Federal Reserve charges banks for borrowing reserves at the discount window.
3. Interest rate on reserves is the interest rate the Federal Reserve pays banks for holding reserves.
4. Required reserve ratio is the percentage of reserves a bank must hold against checking deposits.

12. *The Taylor Rule: Suppose the Federal Reserve targets the unemployment rate gap as opposed to the output gap. Use Okun's Law and the Taylor Rule to derive the relationship between the nominal interest rate and the unemployment rate. Does the nominal interest rate target rise or fall when the unemployment rate increases?*

Taylor rule: $R = \pi + \beta_{\pi} \times (\pi - \pi^*) + \beta_Y \times [(Y - Y^*)/Y^*] + r^{e*}$

Okun's law: $(Y - Y^*)/Y^* = -2 \times (U - U^*)$

Substitute Okun's law into the Taylor rule and get

$$R = \pi + \beta_{\pi} \times (\pi - \pi^*) - 2 \times \beta_Y \times (U - U^*) + r^{e*}$$

Thus, when unemployment (U) increase, the Federal Reserve lowers its nominal interest rate (R) target.