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×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

$$R = (3{,}500 - 2{,}700)/20{,}000$$
$$R = 0.04 = 4\%$$

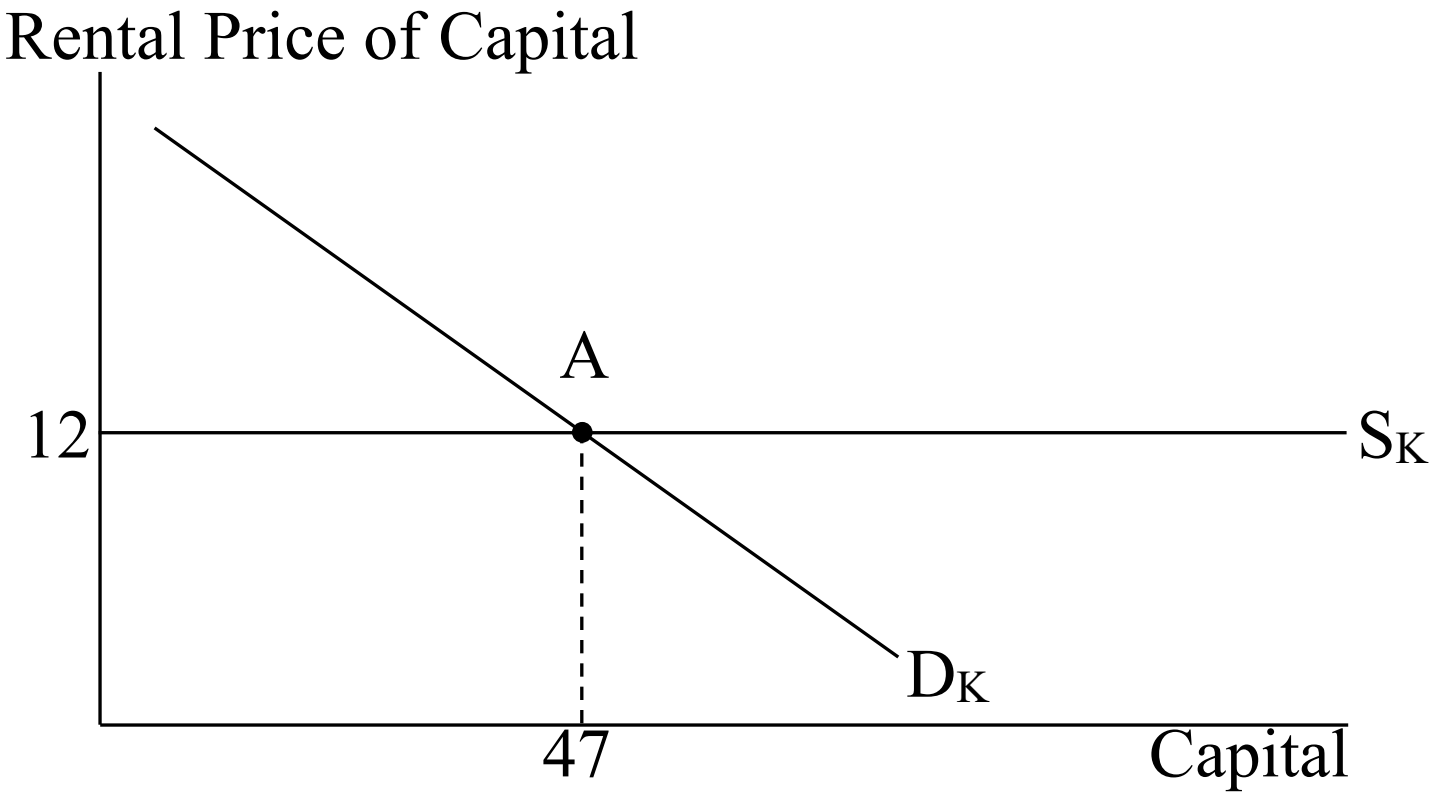
3. *The Optimal Capital Stock*: *Suppose the nominal interest rate is 5%, the depreciation rate is 10%, the relative price of capital is 60, and the marginal product capital is given by the equation* $MP_K = 200 - 4 \times K$ *where K is the capital stock. If rental income is taxed at the rate of 25% 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:

$$R_k = (R + \delta) \times P_K / (1 - u)$$
$$R_k = (0.05 + 0.10) \times 60 / (1 - 0.25)$$
$$R_k = 0.15 \times 60 / (0.75)$$
$$R_k = 12$$

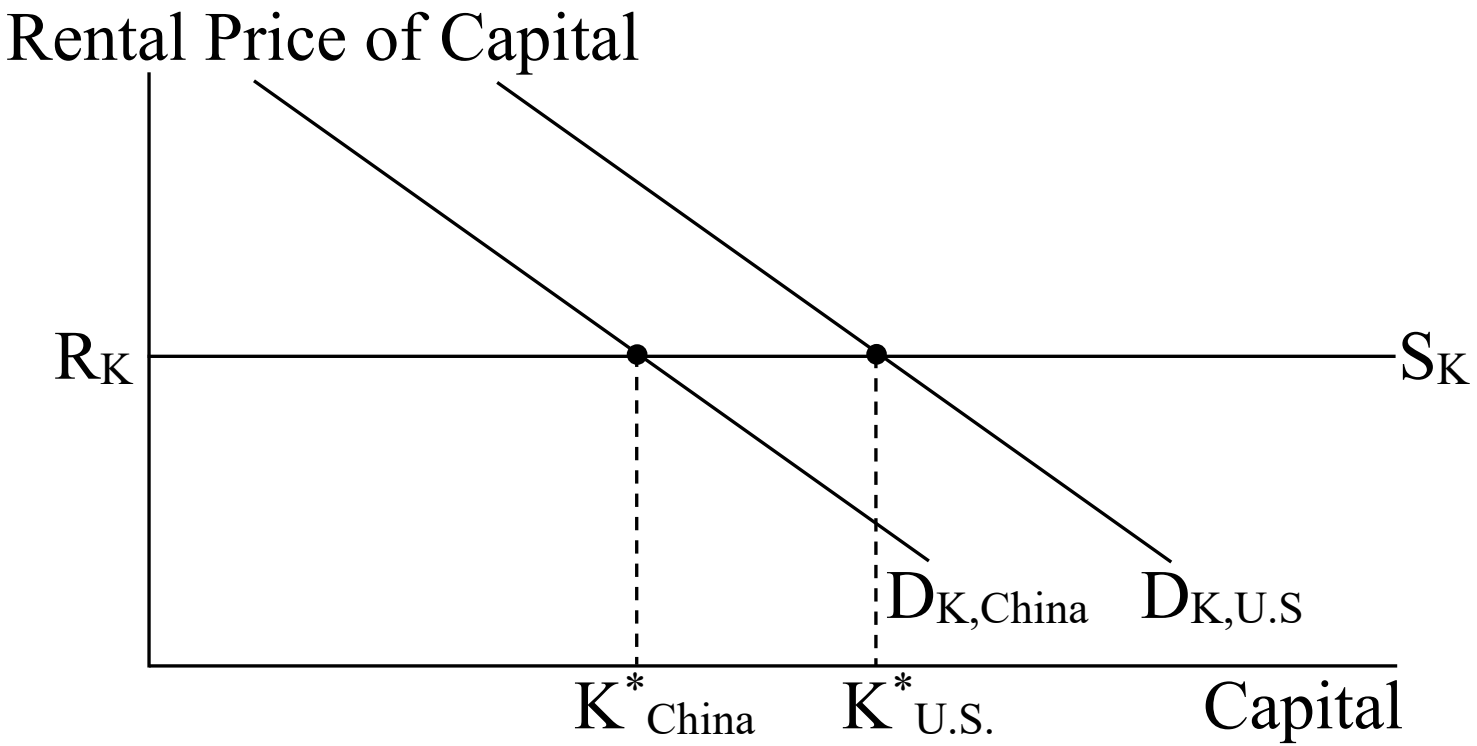
The optimal capital stock is then determined by setting the marginal product of capital to the rental price of capital:

$$200 - 4 \times K = 12$$
$$4 \times K = 188$$
$$K = 47$$



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}).

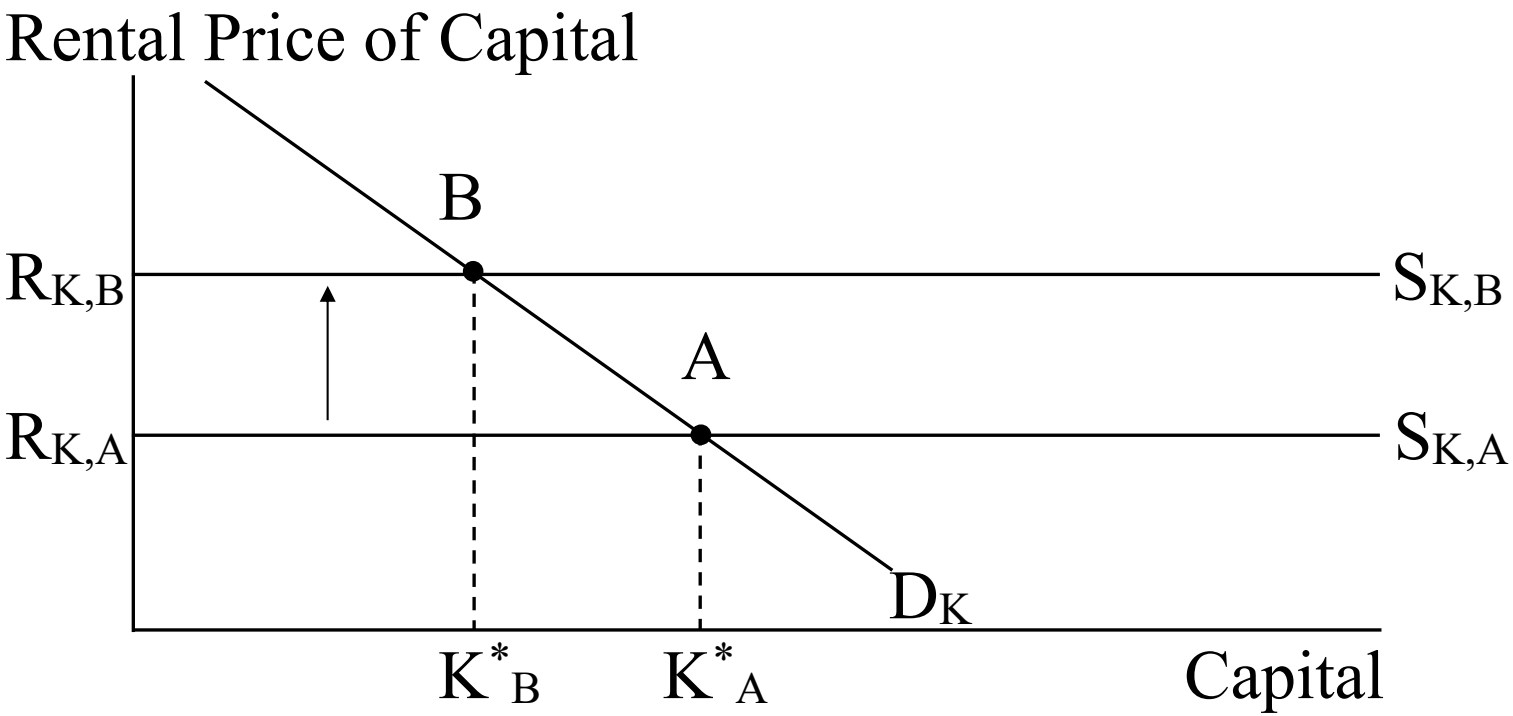


5. *Anticipated Tax Changes*: *Suppose firms expect the government to institute investment subsidies next period. How will that change impact the expected price of capital goods next period, the rental rate of capital this period, and the optimal capital stock this period? Briefly explain. Use an optimal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

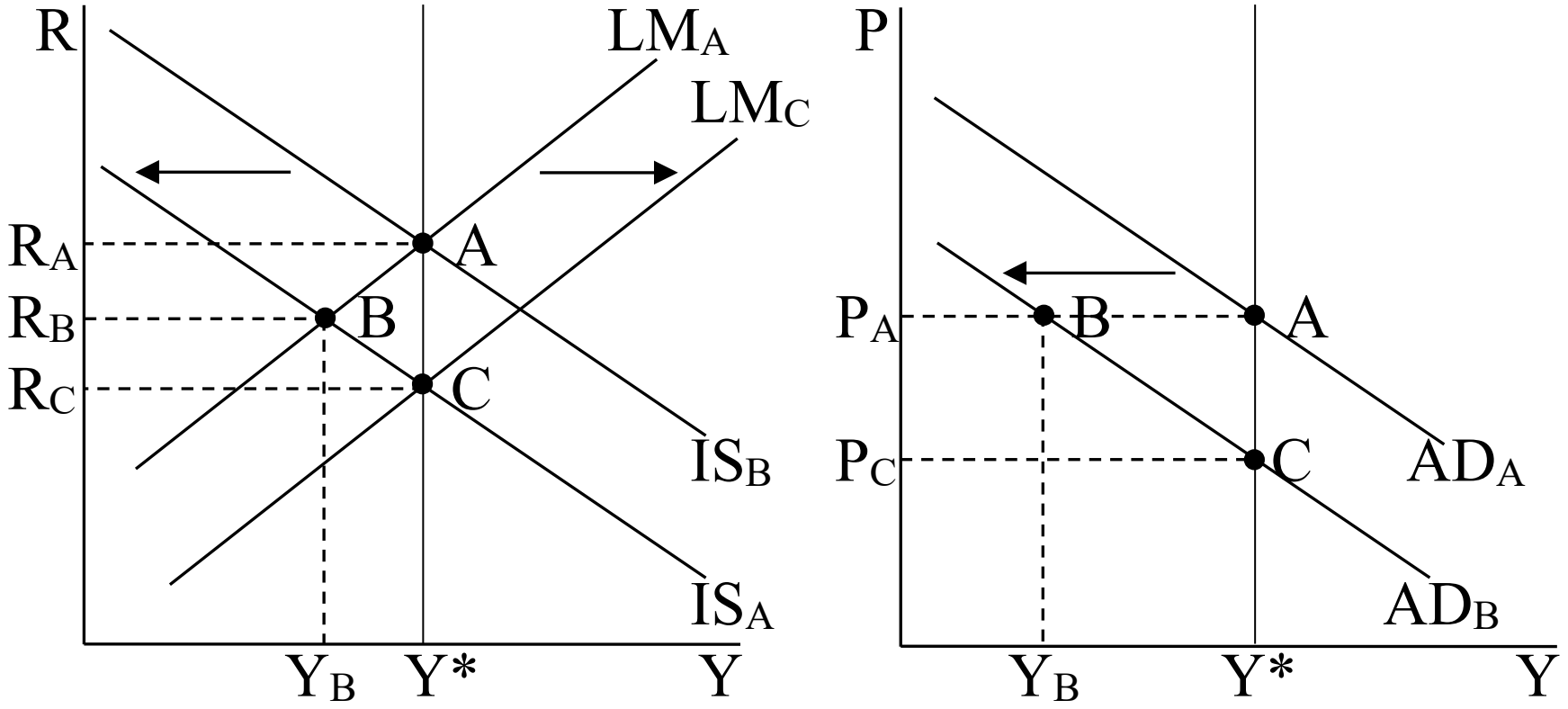
c. *Suppose there is an unplanned increase in buffer stock inventories, what does this indicate about future output? Briefly explain.*

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. *Autonomous Imports*: *Suppose the economy is initially at potential output. What are the short-run and long-run impacts of an increase in autonomous imports on output, the interest rate, the price level, the nominal exchange rate, and the real exchange rate? Briefly explain your answer. Use an IS/LM graph and an aggregate demand graph to support that answer.*

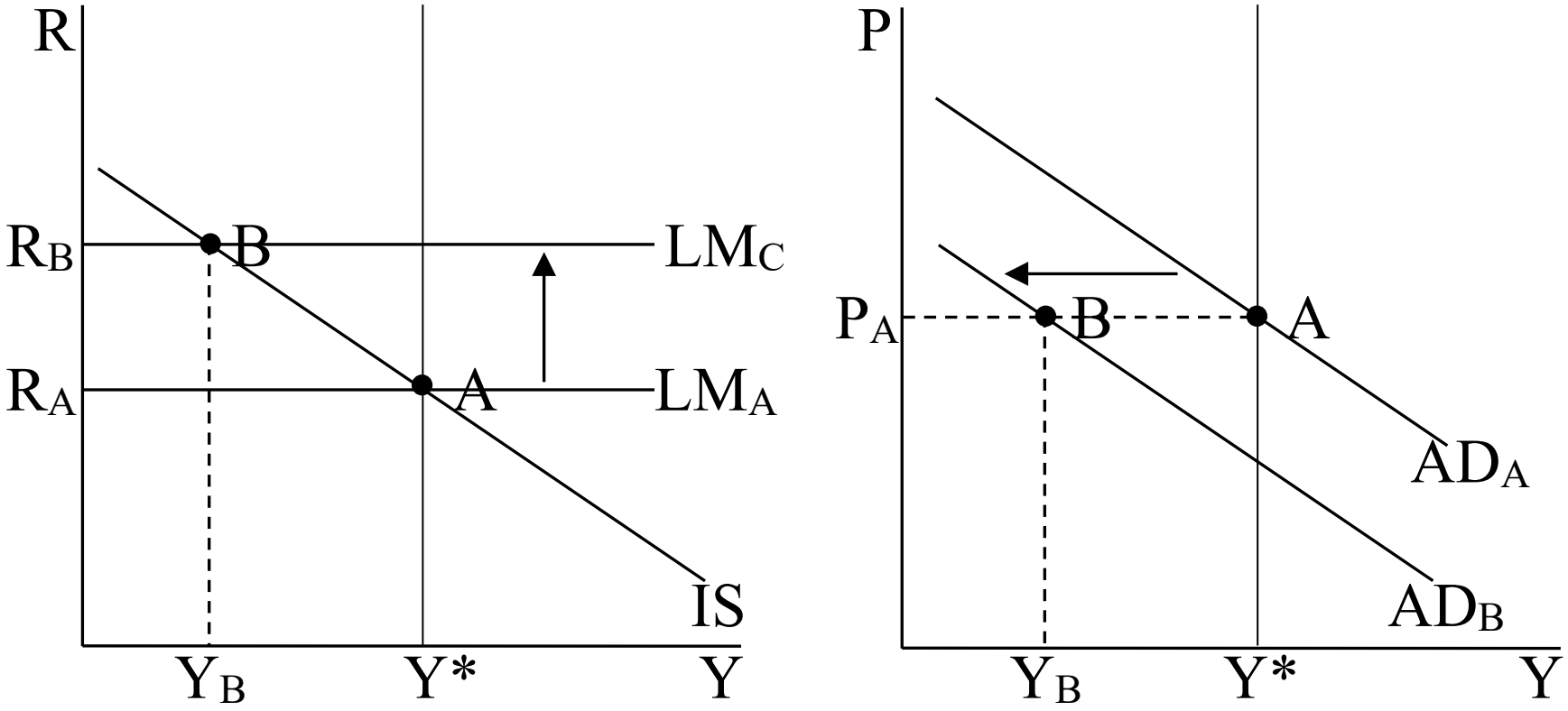
   In the short run, a rise in g_{IM} (i.e., X – IM falls) means consumers are buying more foreign goods, which causes Y to decline to Y_B and the IS to shift to the left. That lower level of output reduces money demand which causes R to fall. The lower R decreases demand for U.S. assets, which leads to a decline in E_R. Since P and P_W remain unchanged, E declines and the AD curve shifts leftward [$g_{IM}\uparrow \rightarrow Y\downarrow \rightarrow M_D\downarrow \rightarrow R\downarrow \rightarrow E_R\downarrow \rightarrow E\downarrow$]. In the long run, P falls from P_A to P_C, which causes M_D and R to fall. The lower R further decreases demand for U.S. assets, which leads to a further decline in E_R. A lower R and E_R combined to push up I and moderate the decline in (X – IM), which causes Y to return

to Y*. Since both P and E_R decline, we cannot determine if E rises or falls. Therefore, in the long run, a rise in g_{IM} leads to a decline in R, E_R, and P, no change in Y, and an uncertain change in E. [$Y < Y^* \rightarrow P\downarrow \rightarrow M_D\downarrow \rightarrow R\downarrow \rightarrow I\uparrow$ & $(X–IM)\uparrow \rightarrow Y\uparrow$] & [$R\downarrow \rightarrow E_R\downarrow$]



8. *Monetary Policy and a Real Exchange Rate Target*: *Suppose the central bank's objective is to target the real exchange rate. What is the short-run impact of an increase in the world interest rate on output, the domestic interest rate, the price level, the nominal exchange rate, and the real exchange rate? Briefly explain your answer. You can assume that economy is initially at potential output. Use an IS/LM graph and an aggregate demand graph to support that answer.*

An increase in the R_W causes the central bank to raise R by decreasing M^S in order to keep E_R constant. The higher R causes I and (X – IM) to decline which pushes down Y. Since this change occurs in the short run, P is unchanged and so is E because E_R does not change.



9. *Nominal and Real Exchange Rates*: *Let the following equations describe an open economy:*

$$Y = C + I + G + (X - IM)$$
$$C = 26 + 0.92 \times (1 - t) \times Y$$
$$I = 760 - 2{,}000 \times R$$
$$(X - IM) = 2{,}050 - 2{,}000 \times E_R - 0.07 \times (1 - t) \times Y$$
$$E_R = 0.8 + 4 \times R$$
$$M^S = (Y - 20{,}000 \times R) \times P$$

where Y is actual output, C is consumption, I is investment, G is government spending, (X – IM) is net exports, t is the proportional income tax rate, R is the interest rate, E_R *is the real exchange rate,* M^S *is the money supply, and P is the domestic price level. Furthermore, government spending is 800, the money supply is 15,200, the proportional income tax rate is 20%, the domestic price level is 4, and the rest-of-the-world price level is 8.*

a. *Calculate the equilibrium values of output and the interest rate.*

The equation for the IS curve is

$$Y = C + I + G + (X - IM)$$

$$Y = 26+0.92\times(1-0.2)\times Y+760-2{,}000\times R+800+2{,}050-2{,}000\times(0.8+4\times R)-0.07\times(1-0.2)\times Y$$

$$Y = 3{,}636 + 0.85\times0.8\times Y - 2{,}000\times R - 1{,}600 - 8{,}000\times R$$

$$Y = 2{,}036 + 0.68Y - 10{,}000\times R$$

$$10{,}000\times R = 2{,}036 - 0.32\times Y$$

The equation for the LM curve is

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

$$15{,}200 = (Y - 20{,}000\times R)\times 4$$

$$3{,}800 = Y - 20{,}000\times R$$

$$20{,}000\times R = Y - 3{,}800$$

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

$$4{,}072 - 0.64 \times Y = Y - 3{,}800$$
$$1.64 \times Y = 7{,}872$$
$$Y = 7{,}872/1.64$$
$$Y = 4{,}800$$

Substituting Y =4,800 into the LM curve (or IS curve), we get the value for R

$$R = (4{,}800 - 3{,}800)/20{,}000$$
$$R = 0.05 = 5\%$$

b. *Determine the equilibrium nominal and real exchange rates.*

The real exchange rate is determined by using the fact that R = 0.05 and the equation

$$E_R = 0.8 + 4 \times R$$
$$E_R = 0.8 + 4 \times 0.05$$
$$E_R = 0.8 + 0.2$$
$$E_R = 1$$

The nominal exchange rate is determined by using the fact that $E_R = 1$, $P = 4$, $P_W = 8$ and the equation

$$E_R = E \times P / P_W$$
$$1 = E \times 4 / 8$$
$$E = 2$$

10. *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

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

Borrowed reserves	*$25*
Currency-to-deposits ratio	*0.25*
Nonborrowed reserves	*$1,445*
Reserves-to-deposits ratio	*0.10*

a. *Total reserves*

$$\text{Total reserves} = \text{Borrowed reserves} + \text{Nonborrowed reserves}$$
$$\text{Total reserves} = \$25 + \$1{,}445$$
$$\text{Total reserves} = \$1{,}470$$

b. *Checking deposits*

$$\text{Total reserves} = \text{Reserves-to-deposits ratio} \times \text{Checking deposits}$$
$$\$1{,}470 = 0.10 \times \text{Checking deposits}$$
$$\text{Checking deposits} = \$14{,}700$$

c. *Currency*

$$\text{Currency} = \text{Currency-to-deposits ratio} \times \text{Checking deposits}$$
$$\text{Currency} = 0.25 \times \$14{,}700$$
$$\text{Currency} = \$3{,}675$$

d. *Money supply (M1 – savings accounts)*

$$M^S = \text{Currency} + \text{Checking deposits}$$
$$M^S = \$3{,}675 + \$14{,}700$$
$$M^S = \$18{,}375$$

12. *The Money Multiplier*: *Suppose the currency-to-deposits ratio is 0.20 and the excess reserves-to-deposits ratio is 0.20.*

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

    ΔM^B = \$6 million, c = 0.20, and rr = 0.20

$$\Delta M^S = [(1+c)/(c+rr)] \times \Delta M^B$$
$$\Delta M^S = [(1+0.20)/(0.20+0.20)] \times \$6 \text{ million}$$
$$\Delta M^S = [1.20/0.40] \times \$6 \text{ million}$$
$$\Delta M^S = \$18 \text{ million}$$

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

$\Delta M^S = -\$27$ million, c = 0.20, and rr = 0.20

$$\Delta M^S = [(1+c)/(c+rr)] \times \Delta M^B$$
$$-\$27 \text{ million} = [(1+0.20)/(0.20+0.20)] \times \Delta M^B$$
$$-\$27 \text{ million} = [1.20/0.40] \times \Delta M^B$$
$$\Delta M^B = -\$9 \text{ million}$$

13. *Federal Funds Rate/Discount Rate*: *Briefly describe what the Federal Funds Rate and the Discount Rate are. Does the Federal Reserve direct 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.

14. *The Fed's Policy Tools*: *Name and briefly describe the three 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.

15. *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.

16. *Government Deficit/Debt*: *Suppose the debt (D) is 12,000, the nominal interest rate (R) is 0.04, government spending is 520, actual output (Y) is 4,800, potential output (Y*) is 5,000, transfer payments (F) equal 300 – 0.2×(Y – Y*), and taxes (T) equal 0.25×Y.*

    a. *Find the size of the actual budget deficit.*

Note: T = 0.25×Y, Y = 4,800, Y* = 5,000, G = 520, R = 0.04, D = 12,000, and F = 300 – 0.2×(Y – Y*).

$$\text{Actual BD} = G + F + R \times D - T$$
$$\text{Actual BD} = 520 + 300 - 0.2 \times (Y - Y^*) + 0.04 \times 12{,}000 - 0.25 \times Y$$
$$\text{Actual BD} = 820 - 0.2 \times (4{,}800 - 5{,}000) + 480 - 0.25 \times 4{,}800$$
$$\text{Actual BD} = 1{,}300 - 0.2 \times (-200) - 1{,}200$$
$$\text{Actual BD} = 100 + 40$$
$$\text{Actual BD} = 140$$

b. *Determine the size of the cyclical budget deficit.*

Structural BD is the budget deficit when Y = Y*

$$\text{Structural BD} = G + F + R \times D - T$$
$$\text{Structural BD} = 520+300-0.2\times(Y^*-Y^*)+0.04\times12{,}000-0.25\times Y^*$$
$$\text{Structural BD} = 820 + 480 - 0.25\times5{,}000$$
$$\text{Structural BD} = 1{,}300 - 1{,}250$$
$$\text{Structural BD} = 50$$

$$\text{Actual BD} = \text{Structural BD} + \text{Cyclical BD}$$
$$140 = 50 + \text{Cyclical BD}$$
$$\text{Cyclical BD} = 90$$

c. *Calculate next period's government debt.*

$$D_{+1} = \text{Actual BD} + D$$
$$D_{+1} = 140 + 12{,}000$$
$$D_{+1} = 12{,}140$$

17. *Government Spending and Automatic Stabilizers*: *Let the following equations describe a simple economy without a foreign sector:*

$$Y = C + I + G$$
$$C = 205 + 0.92 \times (1 - t) \times Y$$
$$I = 760 - 8{,}000 \times R$$
$$G = 430 - 0.1 \times (Y - Y^*)$$
$$M^S = (Y - 16{,}000 \times R) \times P$$

where Y is actual output, Y is potential 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, potential output is 4,000, the money supply is 6,950, the proportional income tax rate is 25%, and the price level is 2.5.*

a. *Calculate the equilibrium values of output and the interest rate.*

The equation for the IS curve is

$$Y = C + I + G$$

$$Y = 205 + 0.92\times(1 - 0.25)\times Y + 760 - 8{,}000\times R + 430 - 0.1\times(Y - 4{,}000)$$

$$Y = 1{,}395 + 0.69\times Y - 8{,}000\times R - 0.1\times Y + 400$$

$$Y = 1{,}795 + 0.59Y - 8{,}000\times R$$

$$8{,}000\times R = 1{,}795 - 0.41\times Y$$

The equation for the LM curve is

$$M^S = (Y - 16{,}000\times R)\times P$$

$$6{,}950 = (Y - 16{,}000\times R)\times 2.5$$

$$2{,}780 = Y - 16{,}000\times R$$

$$16{,}000\times R = Y - 2{,}780$$

Multiply the IS curve equation by two and then combine with the LM curve equation by eliminating 16,000×R

$$3{,}590 - 0.82 \times Y = Y - 2{,}780$$
$$1.82 \times Y = 6{,}370$$
$$Y = 6{,}370/1.82$$
$$Y = 3{,}500$$

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

$$R = (3{,}500 - 2{,}780)/16{,}000$$
$$R = 0.045 = 4.5\%$$

b. *Determine the equilibrium level of government spending.*

The level of government spending is determined by using the fact that Y = 3,500 and the equation

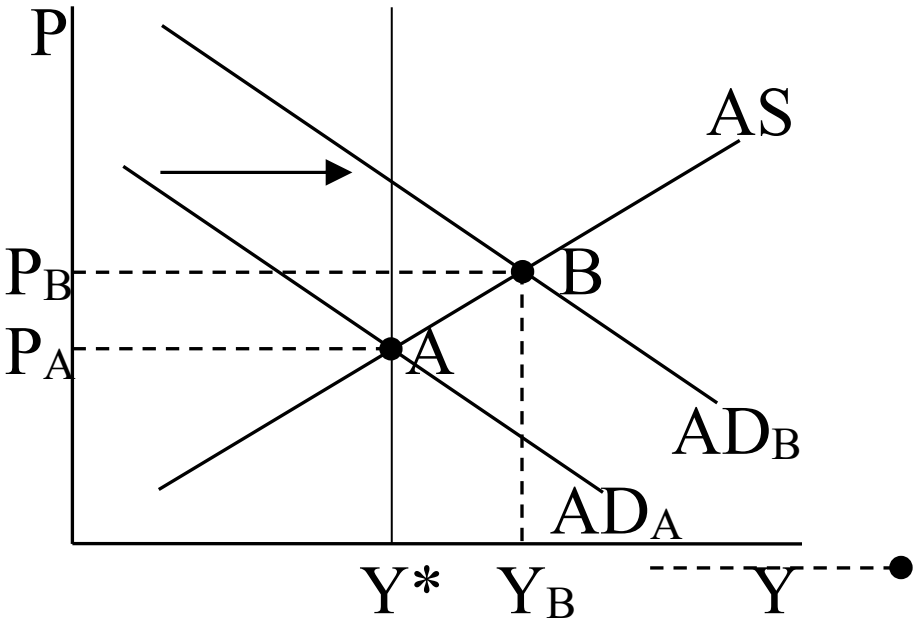
$$G = 430 - 0.1 \times (Y - Y^*)$$
$$G = 430 - 0.1 \times (3{,}500 - 4{,}000)$$
$$G = 430 + 0.1 \times 500$$
$$G = 480$$

c. *Briefly describe how automatic stabilizers (i.e., – 0.1×(Y – Y*)) impact the slope of the IS curve.*

Automatic stabilizers cause government spending to rise when output falls and government spending to fall when output rises. The result is the IS curve becomes steeper with automatic stabilizers.

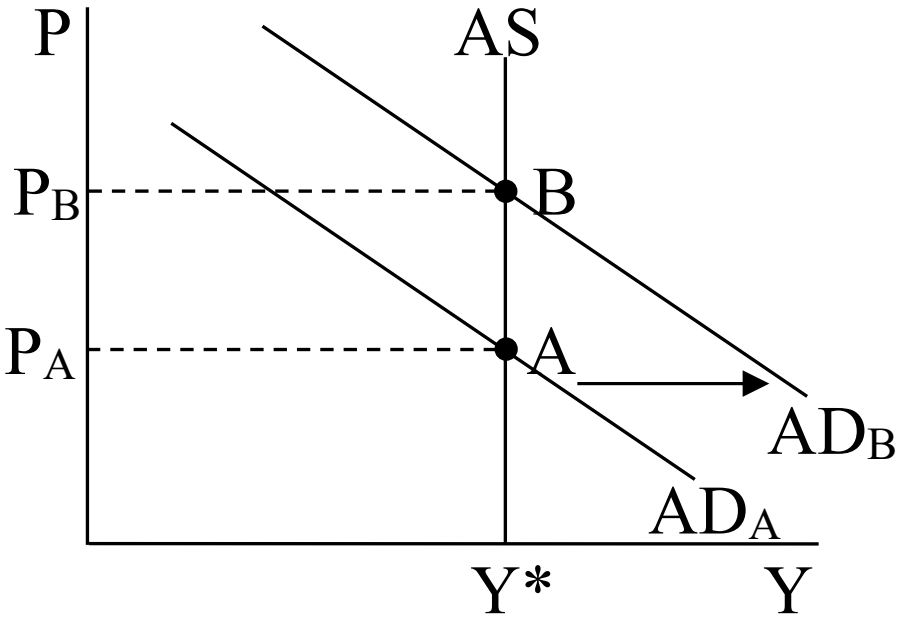
18. *Anticipated vs. Unanticipated Money Supply Increase*: *Suppose prices are flexible but firms have imperfect information on the aggregate price level. If the economy is initially at potential output, what is the short-run impact of an unanticipated money supply increase on aggregate output and the aggregate price level? How does your answer change if the money supply increase is anticipated? Use aggregate demand/aggregate supply graphs to support your answer.*

Unanticipated
Money Supply Increase



Output increases
Price level increases

Anticipated
Money Supply Increase



Output is unchanged
Price level increases

19. *Sticky Wages/Wage Setting*: *Answer parts a – b below.*

a. *Briefly explain how stickiness in wage setting will cause prices to be sticky.*

Wage stickiness causes a firm's marginal cost to be sticky. Since firms set their price to a constant markup over marginal cost, stickiness in the marginal costs leads to prices being sticky.

b. *Which of the following will likely lead to a higher wage rate in contract negotiations: a higher unemployment rate or a higher expected inflation rate? Briefly explain your answer.*

A higher unemployment rate causes employers to have a better negotiating position, which leads to a lower wage. A higher expected inflation rate raises labor demand and reduces labor supply which together push up the wage.