Chapters 11 and 12

Warnings: The Keynesian Cross/IS/LM model is a model that is perfect for creating extensions and then asking students to incorporate their extensions in the model. A perfect example is to ask what happens when we assume taxes are income based rather than lump-sum based (see problem #5). A second type of question involves determining the difference between a shift of the IS (or LM) curve and a movement along the IS or LM curve. My advice is that you change every possible exogenous variable, and then show what happens in the Keynesian cross, IS/LM, and Money Supply/Demand curves (see problem #4).

B Level Questions

1. Imagine an economy that can be described with the following equations:

C = 500 + .8(Y-T)
I = 200 – 5r
G = 100
T = 100

a. Assuming r= 10, what is this economy's equilibrium level of income?
AE = 500 + .8(Y – 100) + 200 – 5(10) + 100 = Y so Y = 3350.

b. The spending multiplier describes how much more GDP (income) is created when spending increases by one unit. In the example above, what is the spending multiplier? What does the spending multiplier depend upon?
The spending multiplier is 5—it depends on any non-autonomous factors that change when Y changes (like the MPC).

c. Choose different levels of r and plot the IS curve. What is the equation for the IS curve (Hint: You should come up with a mathematical function that r is a function of Y).
The IS curve is given by the equation r = 144 - .04Y. This is found by equating AE with Y: 500 + .8(Y – 100) + 200 – 5r + 100 = Y.

d. Now imagine that government spending rises from 100 to 200. What has happened to the IS curve?
The new IS curve is given by the equation r = 164 - .04Y. Thus, an increase in government spending does not change the slope of the IS curve but does increase the intercept—the IS curve shifts up given a higher amount of government spending.

e. How does the IS curve depend upon the spending multiplier?
Let me re-write the problem as:
C = a + b(Y – T)
I = d - er
G = G
T = T

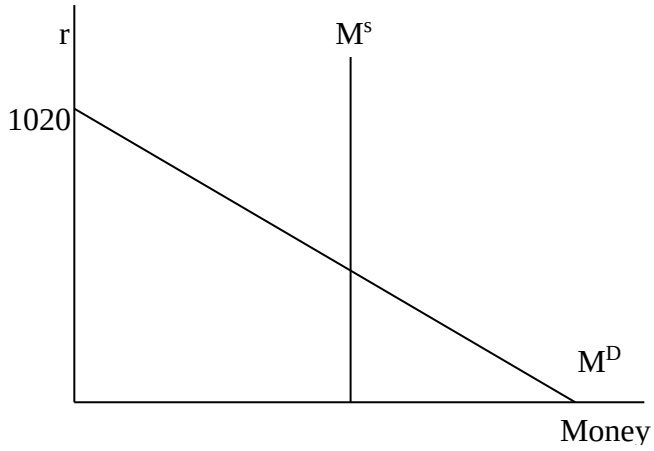
Equilibrium occurs when a + b(Y – T) + d –er + G = Y. Solving for r gives $r = \frac{a + (b-1)Y - bT + d + G}{e}$. As b gets bigger (closer to 1) the IS curve gets flatter.

2. Suppose an economy can be described by the following functions:

Money Demand = $M^D = 1000 - 100r + .5Y$

Money Supply = $M^S = \frac{1000}{P}$

a. Graph the money supply/money demand diagram. Assume that Y = 100 and P = 1. What is the equilibrium interest rate?



The equilibrium interest rate occurs when money supply equals money demand or when 1000 = 1000 – 100r + 50. In this case r = .5.

b. Now choose different levels of Y. Graph the LM curve in this economy. What is the equation for the LM curve (Hint: It should be a function of r and Y similar to part b of #1).

We know the LM curve is determined by the intersection of the money supply and money demand curves. In this case that occurs when 1000 = 1000 – 100r + .5Y. Simplifying this gives the LM curve relationship: r = .005Y. Note that the LM curve represents a positive relationship between interest rates and income.

c. Assume that the Federal Reserve raises the money supply to 1250. How does the LM curve change? How much does it shift? What determines the size of this shift?

If the money supply rises from 1000 to 1250, then the LM curve is given by 1250 = 1000 – 100r + .5Y. In this case, 100r = .5Y – 250 or r = .005Y – 2.5. If Y = 100 then r = -2. In this case, with higher money supply, the LM curve has shifted to the right. This is displayed by the lower intercept (-2.5) relative to the original intercept (0).

3. Combine the LM and IS curves of part c of problem #1 and part b of problem #2.

a. What is the economy's equilibrium level of interest rate and income?

Setting IS equal to LM gives Y = 3200 and r = 16.

b. What is the equation for the aggregate demand curve implied by these equations? (Hint: this is not a linear equation)

To answer this, I start be remembering that the AD curve plots the relationship between P and Y. Since neither the IS nor the LM curves that we found in problems 1 and 2 incorporates P, I need to start at the beginning. Actually, P should be in the LM curve, but in problem 2 we assumed P = 1 so we don't "see" P in the current LM curve. To get a new LM curve, I set money demand equal to money supply:

$$1000 - 100r + .5Y = \frac{1000}{P} \Rightarrow r = 10 + .005Y - \frac{10}{P}$$

You see immediately the LM curve found in part 7 when P = 1.

Setting this LM curve equal to the IS curve of r = 144 – .04Y gives an expression for P that is equal to:

$$P = \frac{10}{.045Y - 134} = \frac{1}{.0045Y - 13.4}.$$

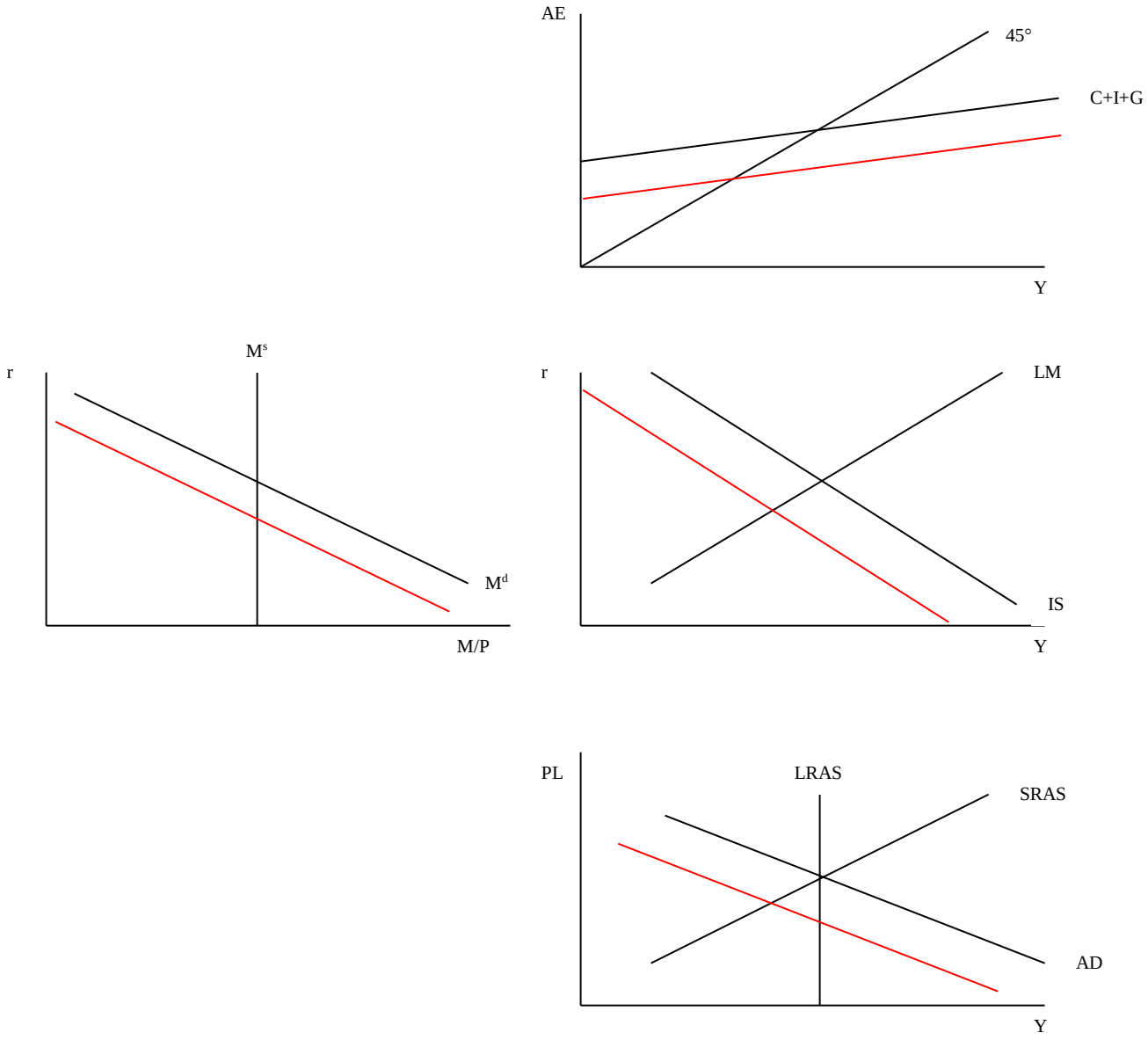
c. What happens to the aggregated demand curve if government spending rises from 100 to 200? Find the new equation and verify that the equation matches what you believe happens to the AD curve.

Setting the LM curve of b to the IS curve of 1d gives an AD curve of $P = \frac{1}{.0045Y - 15.4}$. The AD curve has shifted up (to the right).

d. Using the original equations, what happens to the aggregate demand curve if the Federal Reserve decreases the money supply from 1000 to 750? Again, find the new equation and verify that the equation matches what you believe happens to the AD curve.

A decrease of the money supply shifts the LM curve to the left. Its new equation is: $r = 10 + .005Y - \frac{7.5}{P}$. Setting this LM curve to the original IS curve gives an AD curve of $P = \frac{7.5}{.0045Y - 134}$. The AD curve has shifted down.

4. Currently the American economy is operating with slow RGDP growth and little inflation. As a matter of fact, a number of professional forecasters have feared the possibility of deflation in the future. Imagine that after a number of interviews given through the New York Times, these forecasters spread the impression that deflation will happen. On the plots below, diagram the impact on the economy of the expectations of future deflation. Label the order of the changes by placing the number 1 next to the first change, the number 2 by the second, etc.



The description for the above graphs is on pp. 321-323 of Mankiw.

A Level Questions

5. Suppose an economy's consumers, investors, and government can be described by:
$C = 100 + .9(Y - T)$ $I = 220 - 10r$ $G = 300$ $T = 300$

a. What is the equation for this economy's IS curve?
AE = C + I + G = 100 + .9(Y – 300) + 220 – 10r + 300 and AE = Y so:

Y = 350 + .9Y – 10r. Solving for Y gives the inverse IS curve of: Y = 3500 – 100r. The IS curve is given by 35 - .01Y = r.

b. If r = 6, what is the equilibrium level of output demanded?
2900

c. What happens to the IS curve if government spending increases by 100 from 300 to 400? What happens to the aggregate demand curve given the same change (assume the LM curve is upward sloping)?
The new (inverse) IS curve is given by Y = 4500 – 100r. The IS curve shifts upward. With an upward sloping LM curve, aggregate demand increases by less than 1000.

d. In the formulation above, taxes are allocated on a "lump-sum" basis. That is, regardless of an economy's income, taxes are always a given number (like 300). Yet in many countries, taxes are income based rather than lump-sum based (for instance, in the U.S. we pay a fraction of our income rather than a lump sum in taxes). Let's imagine that for every dollar earned, consumers pay a fraction of their income τ in taxes where $0<\tau<1$. In other words, the consumption function is now $C = 100 + .9(1 - \tau)Y$ rather than $C = 100 + .9(Y – T)$. If $\tau = .1931$, what is this economy's equilibrium level of output demanded (assume G = 300, r = 6, and investment demand remains as before).
AE = 100 + (1 - .1931)×.9×Y + 220 - 10×6 + 300 = 560 + .72621Y
Setting AE = Y gives 560 + .72621Y = Y and solving for Y gives 2045.36

e. How does the IS curve's slope differ under a lump sum tax versus an income tax? What implications does this have if the Federal Reserve wants to stimulate the economy through monetary policy?
The equation for the IS curve in this case is given by setting AE = Y and letting r vary: Y = 100 + (1 - .1931)×.9×Y + 220 – 10r + 300 = Y. Solving for Y gives the inverse of the IS curve Y = 2264.50 – 36.52r. The IS curve is then 62.00 - .02738Y. Under the lump sum taxes, the slope of the IS curve was -.01, under the income tax the slope gets steeper.

Under lump sum taxes, a decrease in interest rates causes investment to rise which encourages more household spending. The total impact on income of this decrease in interest rates is relatively large.

Under an income tax, the same decrease in interest rates cause the same increase in investment but, upon receiving income, households must spend some of it on taxes so they spend relatively less on consumption leading to less of a multiplier and a smaller increase in income.

f. How does the aggregate demand curve differ under a lump sum tax versus an income tax?
The slope of the AD curve is flatter when the IS curve is flatter—it is steeper when the IS curve is steeper.

Do problems and applications #1-#5 on pp. 279-280.
Do problems and applications #1-#8 on pp. 305-306.
Do problems and applications #1 on p. 311.