Answer to Hw4

1. **Answer to Question 3 of Chapter 10.**

a. Consumption is a function of disposable income, C=C(Y-T). Now $T = \bar{T} + tY$. Thus $C = C(Y - T) = C((1 - t)Y - \bar{T})$. So $\Delta C = (1 - t)MPC\Delta Y$. Comparing with the response of consumption to GDP change in the text, $\Delta C = MPC\Delta Y$, the response of consumption under the new tax system becomes smaller. The reason is that the disposable income changes by less than total income.

b. Under the new tax system, $Y = C(Y - T) + I + G$ becomes $Y = C\big((1 - t)Y - \bar{T}\big) + I + G$. We have $\Delta Y = \Delta C + \Delta G = (1 - t)MPC\Delta Y + \Delta G$. Thus the new government purchase multiplier is $\frac{\Delta Y}{\Delta G} = \frac{1}{1-(1-t)MPC}$. The new multiplier is smaller than the old multiplier which is $\frac{1}{1-MPC}$. After the introduction of the new tax system, the response of consumption to GDP change decreases. Then the government purchase multiplier decreases.

c. First we will derive the slope of IS curve, $\frac{\Delta r}{\Delta Y}$. From $Y = C(Y - T) + I + G$, we have $Y = C\big((1 - t)Y - \bar{T}\big) + I(r) + G$. Thus $\Delta Y = \Delta C + \Delta I$. Let us denote the magnitude of response of I to r as MPI, i.e. $MPI = \frac{\Delta I}{\Delta r}$. Thus we have $\Delta Y = \Delta C + \Delta I = (1 - t)MPC\Delta Y + MPI\Delta r$. We can solve for $\frac{\Delta Y}{\Delta r} = \frac{MPI}{1-(1-t)MPC}$. Note that the slope of IS curve is just the reciprocal of $\frac{\Delta Y}{\Delta r}$. Let t=0, we have the reciprocal of slope of IS curve under the old tax

system, $\frac{\Delta Y}{\Delta r} = \frac{MPI}{1-MPC}$. The absolute value of $\frac{MPI}{1-(1-t)MPC}$ is smaller than the absolute value of $\frac{MPI}{1-MPC}$. This means that when there is one unit change of r, the reaction of Y under the new tax system is smaller than that under the old tax system. So the IS curve becomes steeper (Remember that Y is on the horizontal axis in the graph of IS curve).

tion and because income falls. Investment rises because of the lower interest rates and partially offsets the effect on output of the fall in consumption. If the Federal Reserve wants to keep output constant, then they must increase the money supply in order to reduce the interest rate and increase output back to its original level. The increase in the money supply will shift the *LM* curve down and to the right. Output will remain at its original level, consumption will be lower, investment will be higher, and interest rates will be lower.

3. a. The *IS* curve is given by:

$$Y = C(Y - T) + I(r) + G.$$

We can plug in the consumption and investment functions and values for G and T as given in the question and then rearrange to solve for the *IS* curve for this economy:

$$\begin{aligned} Y &= 200 + 0.75(Y - 100) + 200 - 25r + 100 \\ Y - 0.75Y &= 425 - 25r \\ (1 - 0.75)Y &= 425 - 25r \\ Y &= (1/0.25)\,(425 - 25r) \\ Y &= 1{,}700 - 100r. \end{aligned}$$

This *IS* equation is graphed in Figure 11–11 for r ranging from 0 to 8.

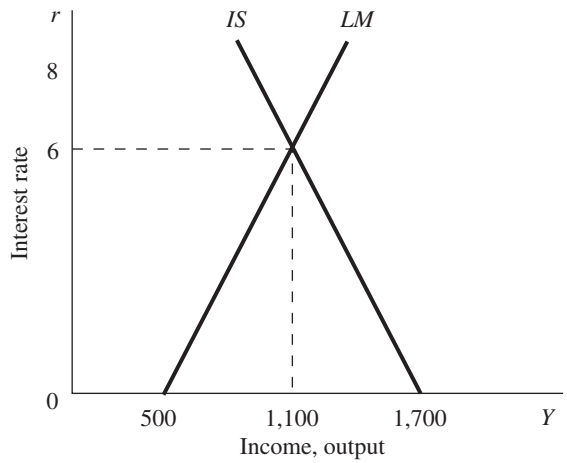


Figure 11–11

b. The *LM* curve is determined by equating the demand for and supply of real money balances. The supply of real balances is 1,000/2 = 500. Setting this equal to money demand, we find:

$$\begin{aligned} 500 &= Y - 100r. \\ Y &= 500 + 100r. \end{aligned}$$

This *LM* curve is graphed in Figure 11–11 for r ranging from 0 to 8.

c. If we take the price level as given, then the *IS* and the *LM* equations give us two equations in two unknowns, Y and r. We found the following equations in parts (a) and (b):

$$\begin{aligned} IS&: Y = 1{,}700 - 100r. \\ LM&: Y = 500 + 100r. \end{aligned}$$

Equating these, we can solve for r:

$$1{,}700 - 100r = 500 + 100r$$
$$1{,}200 = 200r$$
$$r = 6.$$

Now that we know r, we can solve for Y by substituting it into either the *IS* or the *LM* equation. We find

$$Y = 1{,}100.$$

Therefore, the equilibrium interest rate is 6 percent and the equilibrium level of output is 1,100, as depicted in Figure 11–11.

d. If government purchases increase from 100 to 150, then the *IS* equation becomes:

$$Y = 200 + 0.75(Y - 100) + 200 - 25r + 150.$$

Simplifying, we find:

$$Y = 1{,}900 - 100r.$$

This *IS* curve is graphed as IS_2 in Figure 11–12. We see that the *IS* curve shifts to the right by 200.

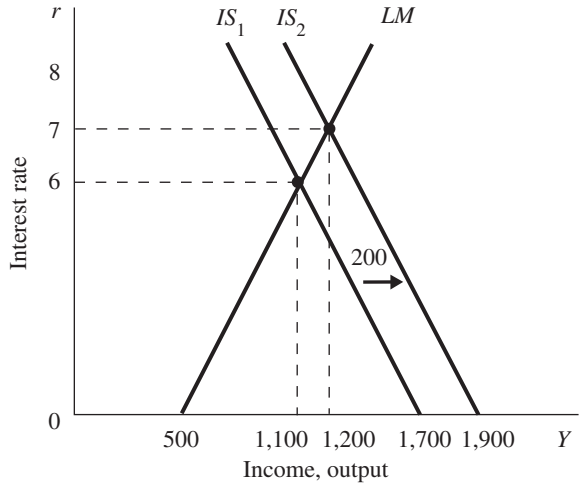


Figure 11–12

By equating the new *IS* curve with the *LM* curve derived in part (b), we can solve for the new equilibrium interest rate:

$$1{,}900 - 100r = 500 + 100r$$
$$1{,}400 = 200r$$
$$7 = r.$$

We can now substitute r into either the *IS* or the *LM* equation to find the new level of output. We find

$$Y = 1{,}200.$$

Therefore, the increase in government purchases causes the equilibrium interest rate to rise from 6 percent to 7 percent, while output increases from 1,100 to 1,200. This is depicted in Figure 11–12.

e. If the money supply increases from 1,000 to 1,200, then the *LM* equation becomes:

$$(1{,}200/2) = Y - 100r,$$

or

$$Y = 600 + 100r.$$

This *LM* curve is graphed as LM_2 in Figure 11–13. We see that the *LM* curve shifts to the right by 100 because of the increase in real money balances.

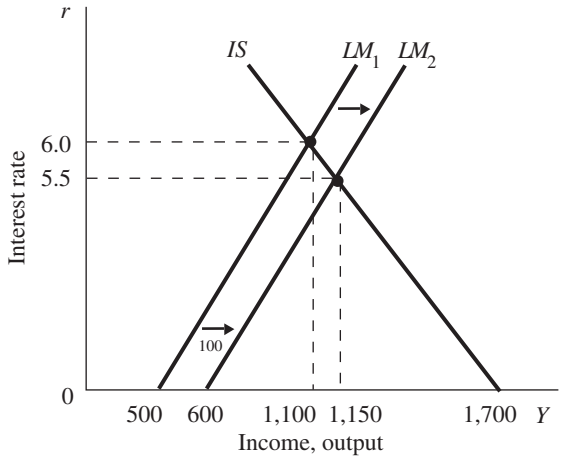


Figure 11–13

To determine the new equilibrium interest rate and level of output, equate the *IS* curve from part (a) with the new *LM* curve derived above:

$$1{,}700 - 100r = 600 + 100r$$
$$1{,}100 = 200r$$
$$5.5 = r.$$

Substituting this into either the *IS* or the *LM* equation, we find

$$Y = 1{,}150.$$

Therefore, the increase in the money supply causes the interest rate to fall from 6 percent to 5.5 percent, while output increases from 1,100 to 1,150. This is depicted in Figure 11–13.

f. If the price level rises from 2 to 4, then real money balances fall from 500 to 1,000/4 = 250. The *LM* equation becomes:

$$Y = 250 + 100r.$$

As shown in Figure 11–14, the *LM* curve shifts to the left by 250 because the increase in the price level reduces real money balances.

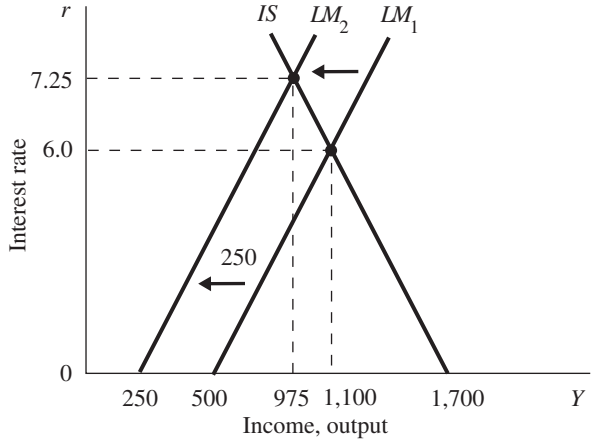


Figure 11–14

To determine the new equilibrium interest rate, equate the *IS* curve from part (a) with the new *LM* curve from above:

$$1{,}700 - 100r = 250 + 100r$$
$$1{,}450 = 200r$$
$$7.25 = r.$$

Substituting this interest rate into either the *IS* or the *LM* equation, we find

$$Y = 975.$$

Therefore, the new equilibrium interest rate is 7.25, and the new equilibrium level of output is 975, as depicted in Figure 11–14.

g. The aggregate demand curve is a relationship between the price level and the level of income. To derive the aggregate demand curve, we want to solve the *IS* and the *LM* equations for *Y* as a function of *P*. That is, we want to substitute out for the interest rate. We can do this by solving the *IS* and the *LM* equations for the interest rate:

$$IS: \quad Y = 1{,}700 - 100r$$
$$100r = 1{,}700 - Y.$$
$$LM: \quad (M/P) = Y - 100r$$
$$100r = Y - (M/P).$$

Combining these two equations, we find

$$1{,}700 - Y = Y - (M/P)$$
$$2Y = 1{,}700 + M/P$$
$$Y = 850 + M/2P.$$

Since the nominal money supply *M* equals 1,000, this becomes

$$Y = 850 + 500/P.$$

This aggregate demand equation is graphed in Figure 11–15.

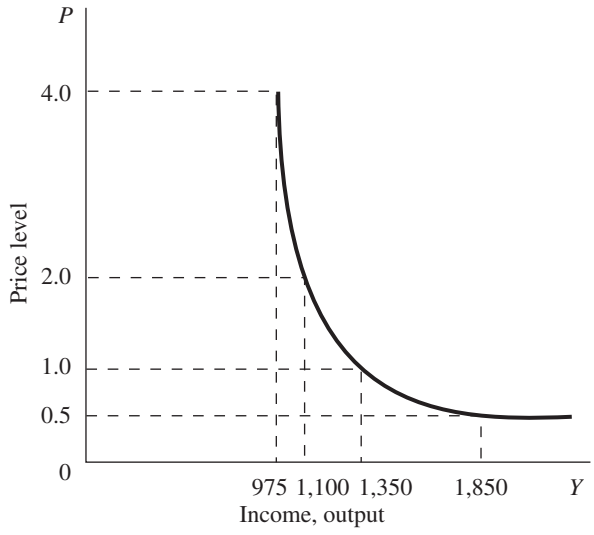


Figure 11–15

How does the increase in fiscal policy of part (d) affect the aggregate demand curve? We can see this by deriving the aggregate demand curve using the *IS* equation from part (d) and the *LM* curve from part (b):

$$IS: \quad Y = 1{,}900 - 100r$$
$$100r = 1{,}900 - Y.$$
$$LM: \quad (1{,}000/P) = Y - 100r$$
$$100r = Y - (1{,}000/P).$$

Combining and solving for Y:

$$1{,}900 - Y = Y - (1{,}000/P),$$

or

$$Y = 950 + 500/P.$$

By comparing this new aggregate demand equation to the one previously derived, we can see that the increase in government purchases by 50 shifts the aggregate demand curve to the right by 100.

How does the increase in the money supply of part (e) affect the aggregate demand curve? Because the *AD* curve is $Y = 850 + M/2P$, the increase in the money supply from 1,000 to 1,200 causes it to become

$$Y = 850 + 600/P.$$

By comparing this new aggregate demand curve to the one originally derived, we see that the increase in the money supply shifts the aggregate demand curve to the right.

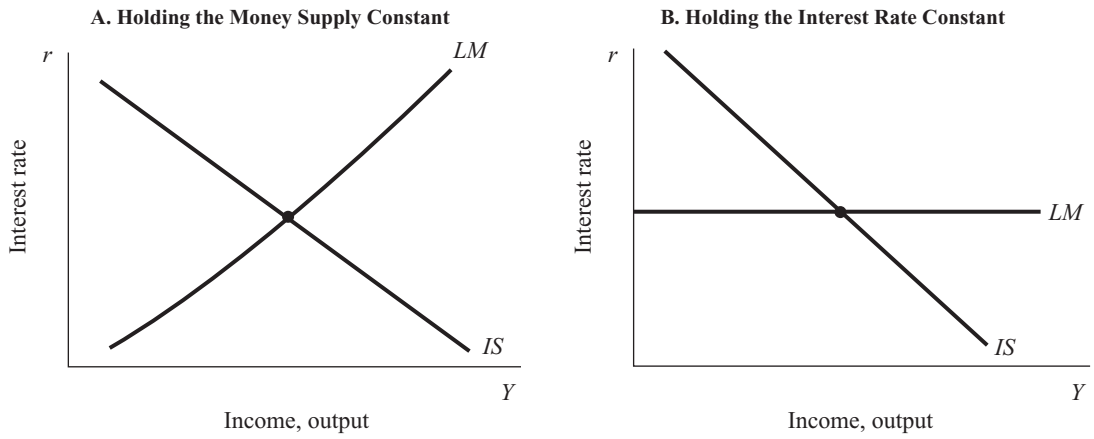
4. a. The *IS* curve represents the relationship between the interest rate and the level of income that arises from equilibrium in the market for goods and services. That is, it describes the combinations of income and the interest rate that satisfy the equation

$$Y = C(Y - T) + I(r) + G.$$

Initially, the *LM* curve is not affected. In the longer run, prices begin to decline because output is below its long-run equilibrium level, and the *LM* curve then shifts to the right because of the increase in real money balances. Interest rates fall even further to r_3 and, thus, further stimulate investment and increase income. In the long run, the economy moves to point C. Output returns to *Y*, the price level and the interest rate are lower, and the decrease in consumption has been offset by an equal increase in investment.

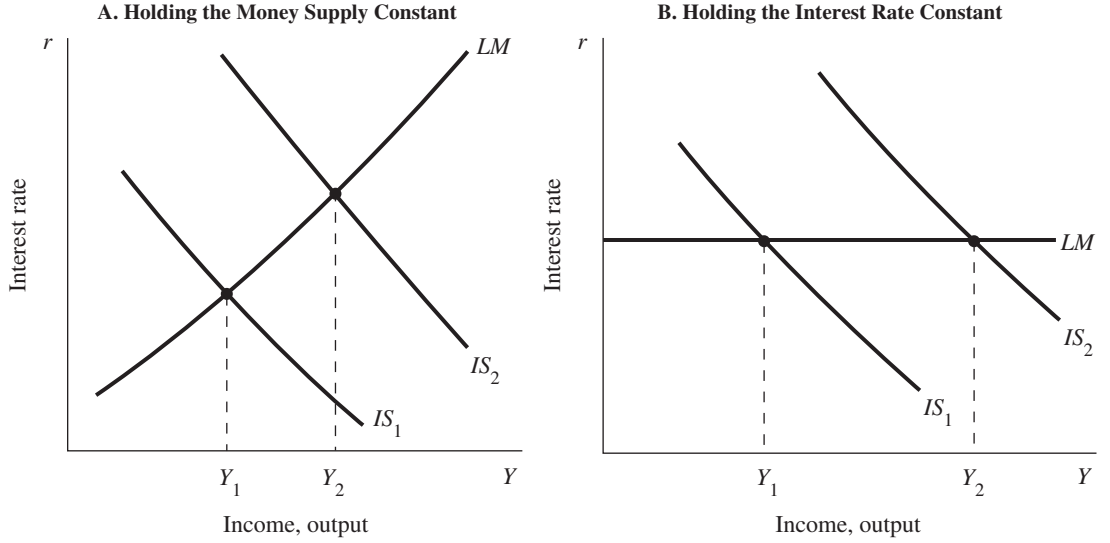
7. Figure 11–25(A) shows what the *IS*–*LM* model looks like for the case in which the Fed holds the money supply constant. Figure 11–25(B) shows what the model looks like if the Fed adjusts the money supply to hold the interest rate constant; this policy makes the effective *LM* curve horizontal.

Figure 11–25



a. If all shocks to the economy arise from exogenous changes in the demand for goods and services, this means that all shocks are to the *IS* curve. Suppose a shock causes the *IS* curve to shift from IS_1 to IS_2. Figures 11–26(A) and (B) show what effect this has on output under the two policies. It is clear that output fluctuates less if the Fed follows a policy of keeping the money supply constant. Thus, if all shocks are to the *IS* curve, then the Fed should follow a policy of keeping the money sup-

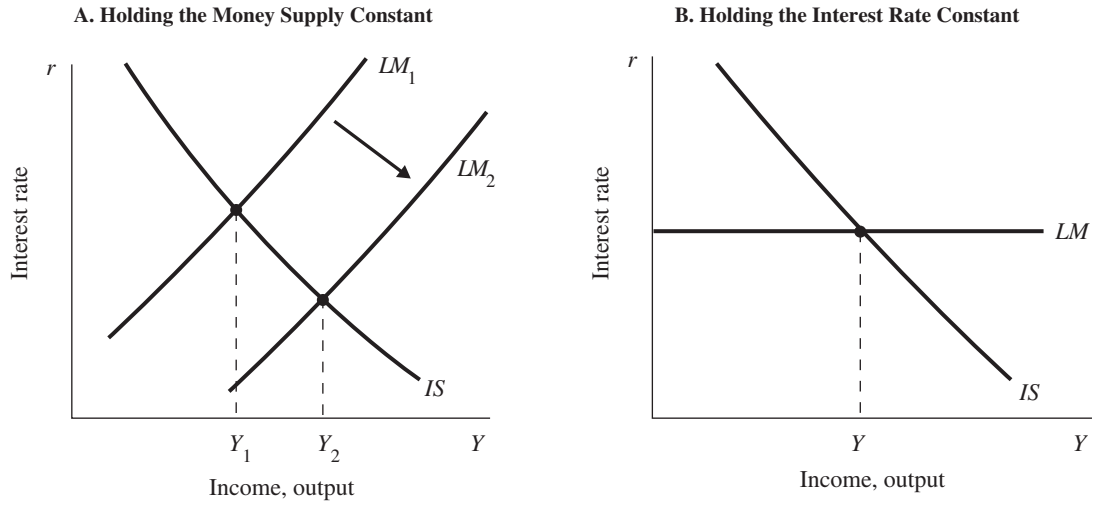
Figure 11–26



ply constant.

b. If all shocks in the economy arise from exogenous changes in the demand for money, this means that all shocks are to the *LM* curve. If the Fed follows a policy of adjusting the money supply to keep the interest rate constant, then the *LM* curve does not shift in response to these shocks—the Fed immediately adjusts the money supply to keep the money market in equilibrium. Figures 11–27(A) and (B) show the effects of the two policies. It is clear that output fluctuates less if the Fed holds the interest rate constant, as in Figure 11–27(B). If the Fed holds the interest rate constant and offsets shocks to money demand by changing the money supply, then all variability in output is eliminated. Thus, if all shocks are to the *LM* curve, then the Fed should adjust the money supply to hold the interest rate constant, thereby stabilizing output.

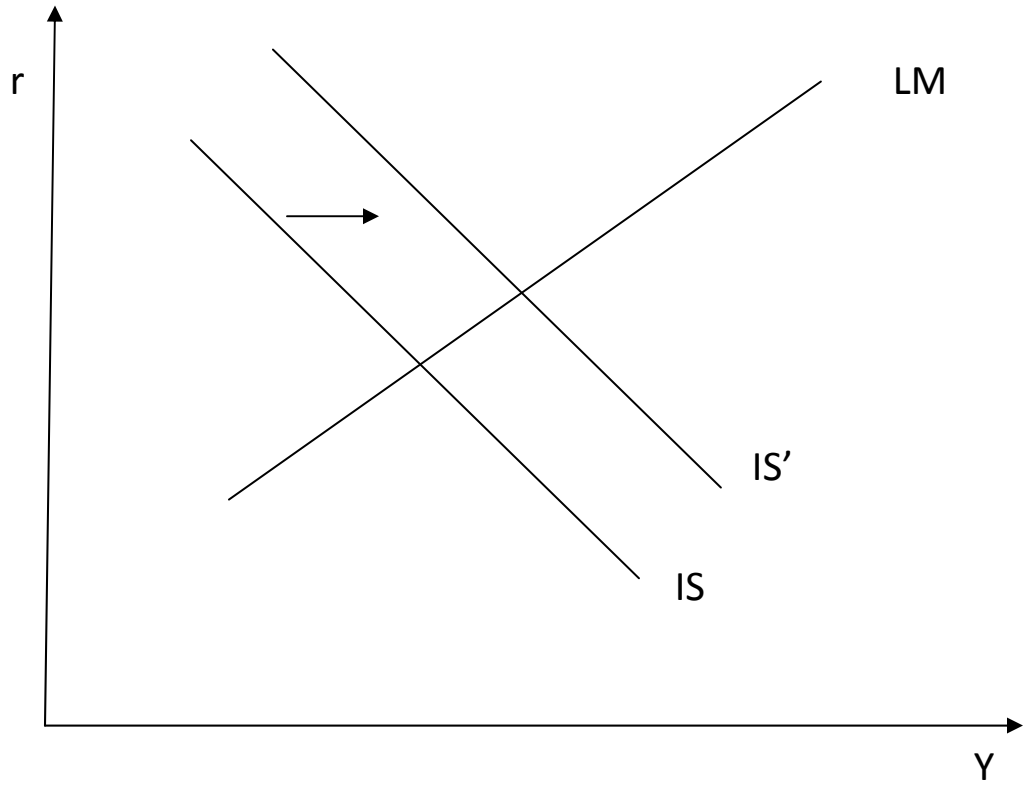
Figure 11–27



8. a. The analysis of changes in government purchases is unaffected by making money demand dependent on disposable income instead of total expenditure. An increase in government purchases shifts the *IS* curve to the right, as in the standard case. The *LM* curve is unaffected by this increase. Thus, the analysis is the same as it was before; this is shown in Figure 11–28.

Answer to Question 10

This event will stimulate the consumption in China. Thus IS curve will shift to the right.



From the graph of IS-LM model, we can see that r↑ and Y↑. Investment I(r) has a negative relationship with r. Thus I↓. For consumption, note that C=Y-I-G. When Y increases, and I decreases, C increases.

Thus, we have

r↑, Y↑, C↑, and I↓.