Problem Set # 9
Solutions

Chapter 12 #2

a. The invention of the new high-speed chip increases investment demand, which shifts the IS curve out. That is, at every interest rate, firms want to invest more. The increase in the demand for investment goods shifts the IS curve out, raising income and employment.

The increase in income from the higher investment demand also raises interest rates. This happens because the higher income raises demand for money; since the supply of money does not change, the interest rate must rise in order to restore equilibrium in the money market. The rise in interest rates partially offsets the increase in investment demand, so that output does not rise by the full amount of the rightward shift in the IS curve.

Overall, income, interest rates, consumption, and investment all rise.

b. The increased demand for cash shifts the LM curve up. This happens because at any given level of income and money supply, the interest rate necessary to equilibrate the money market is higher.
The upward shift in the LM curve lowers income and raises the interest rate. Consumption falls because income falls, and investment falls because the interest rate rises.

c. At any given level of income, consumers now wish to save more and consume less. Because of this downward shift in the consumption function, the IS curve shifts inward.

Income, interest rates, and consumption all fall, while investment rises. Income falls because at every level of the interest rate, planned expenditure falls. The interest rate falls, because the fall in income reduces demand for money; since the supply of money is unchanged, the interest rate must fall to restore money-market equilibrium. Consumption falls both because of the shift in the consumption function and because income falls. Investment rises because of the lower interest rates and partially offsets the effect of the fall in consumption.

d. Expected inflation rises, so if the nominal interest rate remains the same, the real interest rate has fallen. (Ordinarily we think of both inflation and expected inflation (and indeed often prices) as fixed in the short run.) If the central bank maintains the same nominal interest rate, the real interest rate fall shows up as the LM curve shifts down and to the right (it drops by the increment to expected inflation); this provides the equivalent of a monetary stimulus, raising output through the usual channels … until inflation rises as the short run ends and we enter the long run.
Chapter 12 #5

a. False; the relationship between interest rates and investment is through the IS curve.

b. 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

\[ Y = C(Y - T) + I(r) + G. \]

If investment does not depend on the interest rate, then nothing in the IS equation depends on the interest rate; income must adjust to ensure that the quantity of goods produced, \( Y \), equals the quantity of goods demanded, \( C + I + G \). Thus, the IS curve is vertical at this level, as shown in the Figure. Monetary policy has no effect on output, because the IS curve determines \( Y \). Monetary policy can affect only the interest rate. In contrast, fiscal policy is effective: output increases by the full amount that the IS curve shifts.

c. False: money demand affects LM, not the IS curve.

d. The LM curve represents the combinations of income and the interest rate at which the money market is in equilibrium. If money demand does not depend on the interest rate, then we can write the LM equation as

\[ M/P = L(Y). \]

For any given level of real balances \( M/P \), there is only one level of income at which the money market is in equilibrium. Thus, the LM curve is vertical, as shown in the Figure. Fiscal policy now has no effect on output; it can affect only the interest rate. Monetary policy is effective: a shift in the LM curve increases output by the full amount of the shift.

e. If money demand does not depend on income, then we can write the LM equation as \( M/P = L(r) \). For any given level of real balances \( M/P \), there is only one level of the interest rate at which the money market is in equilibrium. Hence, the LM curve is horizontal, as shown in Figure 11–18. Fiscal policy is very effective: output increases by the full amount that the IS curve shifts. Monetary policy is also effective: an increase in the money supply causes the interest rate to fall, so the LM curve shifts down, as shown in Figure 11–18.
f. The *LM* curve gives the combinations of income and the interest rate at which the supply and demand for real balances are equal, so that the money market is in equilibrium. The general form of the *LM* equation is \( M/P = L(r, Y) \).

Suppose income \( Y \) increases by $1. How much must the interest rate change to keep the money market in equilibrium? The increase in \( Y \) increases money demand. If money demand is extremely sensitive to the interest rate, then it takes a very small increase in the interest rate to reduce money demand and restore equilibrium in the money market. Hence, the *LM* curve is (nearly) horizontal, as shown in Figure 11–19.

An example may make this clearer. Consider a linear version of the *LM* equation:

\[
\frac{M}{P} = eY - fr.
\]

Note that as \( f \) gets larger, money demand becomes increasingly sensitive to the interest rate. Rearranging this equation to solve for \( r \), we find

\[
r = \left(\frac{e}{f}\right)Y - \frac{1}{f} \left(\frac{M}{P}\right).
\]

We want to focus on how changes in each of the variables are related to changes in the other variables. Hence, it is convenient to write this equation in terms of changes:

\[
\Delta r = \left(\frac{e}{f}\right)\Delta Y - \frac{1}{f} \Delta \left(\frac{M}{P}\right).
\]

The slope of the *LM* equation tells us how much \( r \) changes when \( Y \) changes, holding \( M \) fixed. If \( \Delta \left(\frac{M}{P}\right) = 0 \), then the slope is \( \Delta r / \Delta Y = (e/f) \). As \( f \) gets very large, this slope gets closer and closer to zero. If money demand is very sensitive to the interest rate, then fiscal policy is very effective: with a horizontal *LM* curve, output increases by the full amount that the *IS* curve shifts. Monetary policy is now completely ineffective: an increase in the money supply does not shift the *LM* curve at all. We see this in our example by considering what happens if \( M \) increases. For any given \( Y \) (so that we set \( \Delta Y = 0 \)), \( \Delta r / \Delta \left(\frac{M}{P}\right) = (-1/f) \); this tells us how much the *LM* curve shifts down. As \( f \) gets larger, this shift gets smaller and approaches zero. (This is in contrast to the horizontal *LM* curve in part (c), which does shift down.)
Chapter 12 #6

To raise investment while keeping output constant, the government should adopt a loose monetary policy and a tight fiscal policy, as shown in Figure 11–20. In the new equilibrium at point B, the interest rate is lower, so that investment is higher. The tight fiscal policy—reducing government purchases, for example—offsets the effect of this increase in investment on output.

![Figure 11–20: IS-LM Model](image)

The policy mix in the early 1980s did exactly the opposite. Fiscal policy was expansionary, while monetary policy was contractionary. Such a policy mix shifts the IS curve to the right and the LM curve to the left, as in Figure 11–21. The real interest rate rises and investment falls.

Chapter 12 #8

The figure to the left shows what the IS-LM model looks like for the case in which the Fed holds the money supply constant. The figure to the right 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.

![Holding the Money Supply Constant](image)

![Holding the Interest Rate Constant](image)

a. If all shocks to the economy arise from the 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\(_2\). The figures below 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.
supply constant. Thus, if all shocks are to the IS curve, then the Fed should follow a policy of keeping the money supply constant.

Holding the Money Supply Constant

Holding the Interest Rate 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. It is clear that output fluctuates less 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.

Holding the Money Supply Constant

Holding the Interest Rate Constant