6. List and discuss the macroeconomic variables that affect the aggregate demand for money.

7. Define velocity. Discuss the role of velocity in the quantity theory of money.

8. Why is equilibrium in the asset market described by the condition that real money supply equal real money demand? What aggregation assumption is needed to allow ignoring the markets for other assets?

9. What is the relationship between the price level and the nominal money supply? What is the relationship between inflation and the growth rate of the nominal money supply?

10. Give an example of a factor that would increase the public's expected rate of inflation. All else being equal, how would this increase in the expected inflation rate affect interest rates?

**NUMERICAL PROBLEMS**

Questions marked with a brown circle are available in MyEconLab at www.myeconlab.com.

1. Suppose the interest rate on a one-year bond today is 6% per year, the interest rate on a one-year bond one year from now is expected to be 4% per year, and the interest rate on a one-year bond two years from now is expected to be 3% per year. The risk premium on a two-year bond is 0.5% per year and the risk premium on a three-year bond is 1.0% per year. In equilibrium, what is the interest rate today on a two-year bond? On a three-year bond? What is the shape of the yield curve?

2. Money demand in an economy in which no interest is paid on money is

\[ M_d = \frac{500}{P} + 0.2Y - 1000i. \]

   a. Suppose that \( P = 100, Y = 1000, \) and \( i = 0.10. \) Find real money demand, nominal money demand, and velocity.

   b. The price level doubles from \( P = 100 \) to \( P = 200. \) Find real money demand, nominal money demand, and velocity.

   c. Starting from the values of the variables given in Part (a) and assuming that the money demand function as written holds, determine how velocity is affected by an increase in real income, by an increase in the nominal interest rate, and by an increase in the price level.

3. Mr. Midas has wealth of $100,000 that he invests entirely in money (a checking account) and government bonds. Mr. Midas instructs his broker to invest $50,000 in bonds, plus $5000 more in bonds for every percentage point that the interest rate on bonds exceeds the interest rate on his checking account.

   a. Write an algebraic formula that gives Mr. Midas's demand for money as a function of bond and checking account interest rates.

   b. Write an algebraic formula that gives Mr. Midas's demand for bonds. What is the sum of his demand for money and his demand for bonds?

   c. Suppose that all holders of wealth in the economy are identical to Mr. Midas. Fixed asset supplies per person are $80,000 of bonds and $20,000 of checking accounts. Checking accounts pay no interest. What is the interest rate on bonds in asset market equilibrium?

4. Assume that the quantity theory of money holds and that velocity is constant at 5. Output is fixed at its full-employment value of 10,000, and the price level is 2.

   a. Determine the real demand for money and the nominal demand for money.

   b. In this same economy the government fixes the nominal money supply at 5000. With output fixed at its full-employment level and with the assumption that prices are flexible, what will be the new price level? What happens to the price level if the nominal money supply rises to 6000?

5. Consider an economy with a constant nominal money supply, a constant level of real output \( Y = 100, \) and a constant real interest rate \( r = 0.10. \) Suppose that the income elasticity of money demand is 0.5 and the interest elasticity of money demand is -0.1

   a. By what percentage does the equilibrium price level differ from its initial value if output increases to \( Y = 106 (\text{and } r \text{ remains at } 0.10)? \) (Hint: Use Eq. 7.11.)
b. By what percentage does the equilibrium price level differ from its initial value if the real interest increases to \( r = 0.11 \) (and \( Y \) remains at 100)?

c. Suppose that the real interest rate increases to \( r = 0.11 \). What would real output have to be for the equilibrium price level to remain at its initial value?

d. Suppose that the real money demand function is

\[
L(Y, r + \pi') = \frac{0.01Y}{r + \pi'}
\]

where \( Y \) is real output, \( r \) is the real interest rate, and \( \pi' \) is the expected rate of inflation. Real output is constant over time at \( Y = 150 \). The real interest rate is fixed in the goods market at \( r = 0.05 \) per year.

a. Suppose that the nominal money supply is growing at the rate of 10% per year and that this growth rate is expected to persist forever. Currently, the nominal money supply is \( M = 300 \). What are the values of the real money supply and the current price level? (Hint: What is the value of the expected inflation rate that enters the money demand function?)

b. Suppose that the nominal money supply is \( M = 300 \). The central bank announces that from now on the nominal money supply will grow at the rate of 5% per year. If everyone believes this announcement, and if all markets are in equilibrium, what are the values of the real money supply and the current price level? Explain the effects on the real money supply and the current price level of a slowdown in the rate of money growth.

The income elasticity of money demand is 2/3 and the interest elasticity of money demand is \(-0.1\). Real income is expected to grow by 4.5% over the next year, and the real interest rate is expected to remain constant over the next year. The rate of inflation has been zero for several years.

a. If the central bank wants zero inflation over the next year, what growth rate of the nominal money supply should it choose?

b. By how much will velocity change over the next year if the central bank follows the policy that achieves zero inflation?

### Analytical Problems

Questions marked with a brown circle are available in MyEconLab at [www.myeconlab.com](http://www.myeconlab.com).

1. All else being equal, how would each of the following affect the demand for M? The demand for M? Explain.
   a. The maximum number of checks per month that can be written on money market mutual funds and money market deposit accounts is raised from 30 to 300.
   b. Banks introduce overdraft protection, under which funds are automatically transferred from savings to checking as needed to cover checks.
   c. Home equity lines of credit that allow homeowners to write checks against the value of their homes are introduced.
   d. The stock market crashes, and further sharp declines in the market are widely feared.
   e. Home equity lines of credit that allow homeowners to write checks against the value of their homes are introduced.
   f. The income elasticity of money demand is 2/3 and the interest elasticity of money demand is \(-0.1\). Real income is expected to grow by 4.5% over the next year, and the real interest rate is expected to remain constant over the next year. The rate of inflation has been zero for several years.

a. If the central bank wants zero inflation over the next year, what growth rate of the nominal money supply should it choose?

b. By how much will velocity change over the next year if the central bank follows the policy that achieves zero inflation?

3. The prisoner-of-war camp described by Radford (Box 7.1) periodically received large shipments of cigarettes from the Red Cross or other sources.

a. How did cigarette shipments affect the price level (the prices of goods in terms of cigarettes) in the POW camp?

b. (More difficult) On some occasions the prisoners knew in advance when the cigarette shipments were to arrive. What happened to the demand for cigarette money and the price level in the camp in the days just before an anticipated shipment?

Assume that prices and wages adjust rapidly so that the markets for labor, goods, and assets are always in equilibrium. What are the effects of each of the following on output, the real interest rate, and the current price level?

a. A temporary increase in government purchases.

b. A reduction in expected inflation.

c. A temporary increase in labor supply.

d. An increase in the interest rate paid on money.
5. Define general equilibrium and show the general equilibrium point in the IS–LM diagram. If the economy isn’t in general equilibrium, what determines output and the real interest rate? What economic forces act to bring the economy back to general equilibrium?

6. Define monetary neutrality. Show that, after prices adjust completely, money is neutral in the IS–LM model. What are the classical and Keynesian views about whether money is neutral in the short run? In the long run?

7. What two variables are related by the aggregate demand (AD) curve? Why does the AD curve slope downward? Give two examples of changes in the economy that shift the AD curve up and to the right and explain why the shifts occur.

8. Describe the short-run aggregate supply (SRAS) curve and the long-run aggregate supply (LRAS) curve. Why is one of these curves horizontal and the other vertical?

9. Use the IS–AD–AS framework to analyze whether money is neutral in the short run and whether it is neutral in the long run.

NUMERICAL PROBLEMS

Questions marked with a brown circle are available in MyEconLab at www.myeconlab.com.

Desired consumption and investment are

\[ C^d = 4000 - 4000r + 0.20Y; \]
\[ I^d = 2400 - 4000r. \]

As usual, \( Y \) is output and \( r \) is the real interest rate. Government purchases, \( G \), are 2000.

a. Find an equation relating desired national saving, \( S^d \), to \( r \) and \( Y \).

b. What value of the real interest rate clears the goods market when \( Y = 10,000 \)? Use both forms of the goods market equilibrium condition. What value of the real interest rate clears the goods market when \( Y = 10,200 \)? Graph the IS curve.

c. Government purchases rise to 2400. How does this increase change the equation for national saving in Part (a)? What value of the real interest rate clears the goods market when \( Y = 10,000 \)? Use both forms of the goods market equilibrium condition. How is the IS curve affected by the increase in \( G \)?

2. In a particular economy the real money demand function is

\[ M/P = 300 + 0.1Y - 1000r. \]

Assume that \( M = 6000 \), \( P = 2.0 \), and \( \pi' = 0.02 \).

a. What is the real interest rate, \( r \), that clears the asset market when \( Y = 8000 \)? When \( Y = 9000 \)? Graph the LM curve.

b. Repeat Part (a) for \( M = 6600 \). How does the LM curve in this case compare with the LM curve in Part (a)?

c. Use \( M = 6000 \) again and repeat Part (a) for \( \pi' = 0.03 \). Compare the LM curve in this case with the one in Part (a).

3. An economy has full-employment output of 1000. Desired consumption and desired investment are

\[ C^d = 200 + 0.8(Y - T) - 500r; \]
\[ I^d = -200 + 100r. \]

Government purchases are 196, and taxes are

\[ T = 20 + 0.25Y \]

Money demand is

\[ M/P = 250(0.5Y + 0.05\pi'), \]

where the expected rate of inflation, \( \pi' \), is 0.10. The nominal supply of money \( M = 9890 \).

a. What are the general equilibrium values of the real interest rate, price level, consumption, and investment?

b. Suppose that government purchases are increased to \( G = 216 \). What are the new general equilibrium values of the real interest rate, the price level, consumption, and investment?

4. The production function in an economy is

\[ Y = A(5N - 0.0025N^2), \]

where \( A \) is productivity. With this production function, the labor demand curve is

\[ W_e = 5A - 0.005AN. \]

Suppose that \( A = 2 \). The labor supply curve is

\[ NS = 55 + 10(1 - r)u; \]
where $NS$ is the amount of labor supplied, $w$ is the real wage, and $t$ is the tax rate on wage income, which is 0.5.

Desired consumption and investment are

\[ C_t = 300 + 0.8(Y - T) - 200r; \]
\[ I_t = 258.5 - 250r. \]

Taxes and government purchases are

\[ T = 20 + 0.5Y; \]
\[ G = 50. \]

Money demand is

\[ \frac{M_d}{P} = 0.5Y - 250(r + \pi^e). \]

The expected rate of inflation, $\pi^e$, is 0.02, and the nominal money supply $M$ is 9150.

a. What are the general equilibrium levels of the real wage, employment, and output?

b. For any level of output, $Y$, find an equation that gives the real interest rate, $r$, that clears the goods market; this equation describes the IS curve. (Hint: Write the goods market equilibrium condition and solve for $r$ in terms of $Y$ and other variables.) What are the general equilibrium values of the real interest rate, consumption, and investment?

c. For any level of output, $Y$, find an equation that gives the real interest rate that clears the asset market; this equation describes the LM curve. (Hint: As in Part (b), write the appropriate equilibrium condition and solve for $r$ in terms of $Y$ and other variables.) What is the general equilibrium value of the price level?

d. Suppose that government purchases increase to $G = 72.5$. Now what are the general equilibrium values of the real wage, employment, output, the real interest rate, consumption, investment, and price level?

Consider the following economy:

Desired consumption

\[ C_t = 1275 + 0.5(Y - T) - 200r; \]

Desired investment

\[ I_t = 900 - 200r. \]

ANALYTICAL PROBLEMS

Questions marked with a brown circle are available in MyEconLab at www.myeconlab.com.

1. Use the IS–LM model to determine the effects of each of the following on the general equilibrium values of the real wage, employment, output, real interest rate, consumption, investment, and price level.

   a. A reduction in the effective tax rate on capital increases desired investment.

   b. The expected rate of inflation rises.

   c. An influx of working-age immigrants increases labor supply (ignore any other possible effects of increased population).

   d. Increased usage of automatic teller machines reduces the demand for money.

2. Use the IS–LM model to analyze the general equilibrium effects of a permanent increase in the price of oil (a permanent adverse supply shock) on current output,