

Homework 3

Intermediate Macroeconomics

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10 Classical Business Cycle Analysis: Market-Clearing Macroeconomics

10.1 Review Questions

1. What main feature of the classical IS-LM model distinguishes it from the Keynesian IS-LM model? Why is the distinction of practical importance?
2. What are the two main components of any theory of the business cycle? Describe these two components for the real business cycle theory.
3. Define real shock and nominal shock. What type of real shock do real business cycle economists consider the most important source of cyclical fluctuations?
4. What major business cycle facts does the RBC theory explain successfully? Does it explain any business cycle facts less well?

5. What is the Solow residual and how does it behave over the business cycle? What factors cause the Solow residual to change?
6. What effects does an increase in government purchases have on the labor market, according to the classical theory? What effects does it have on output, the real interest rate, and the price level? According to classical economists, should fiscal policy be used to smooth out the business cycle? Why or why not?
7. In the context of the relationship between the money supply and real economic activity, what is meant by reverse causation? Explain how reverse causation could occur. What business cycle fact is it intended to explain?
8. According to the misperceptions theory, what effect does an increase in the price level have on the amount of output supplied by producers? Explain. Does it matter whether the increase in the price level was expected?

9. What conclusion does the basic classical model (with no misperceptions of the price level) allow about the neutrality or nonneutrality of money? In what ways is this conclusion modified by the extended classical model based on the misperceptions theory?
10. Define rational expectations. According to the classical model, what implications do rational expectations have for the ability of the central bank to use monetary policy to smooth business cycles?

10.2 Numerical Problems

1. In a certain economy the production function is

$$Y = A(100N - 0.5N^2),$$

where Y is output, A is productivity, and N is total hours worked. The marginal product of labor associated with this production function is

$$MPN = A(100 - N).$$

Initially, $A = 1.0$, but a beneficial productivity shock raises A to 1.1.

- a. The supply of labor is

$$NS = 45 + 0.1w,$$

where w is the real wage. Find the equilibrium levels of output, hours worked, and the real wage before and after the productivity shock. Recall (Chapter 3) that the MPN curve is the same as the labor demand curve, with the real wage replacing the MPN .

- b. Repeat Part (a) if the labor supply is

$$NS = 10 + 0.8w.$$

- c. Some studies show that the real wage is only slightly procyclical. Assume for the sake of argument that this finding is correct. Would a calibrated RBC model fit the facts better if the labor supply is relatively insensitive to the real wage, or if it is relatively sensitive? Justify your answer diagrammatically and relate it to your answers to Parts (a) and (b).

2. An economy is described as follows.

Desired consumption	$C^d = 600 + 0.5(Y - T) - 50r,$
Desired investment	$I^d = 450 - 50r,$
Real money demand	$L = 0.5Y - 100i,$
Full-employment output	$\bar{Y} = 2210,$
Expected inflation	$\pi^e = 0.05.$

In this economy the government always has a balanced budget, so $T = G$, where T is total taxes collected.

a. Suppose that $M = 4320$ and $G = 150$. Use the classical IS-LM model to find the equilibrium values of output, the real interest rate, the price level, consumption, and investment. (Hint: In the classical model, output always equals its full-employment level.)

b. The money supply rises to 4752. Repeat Part (a). Is money neutral?

c. With the money supply back at 4320, government purchases and taxes rise to 190. Repeat Part (a). Assume for simplicity that $\bar{Y}$ is fixed (unaffected by G). Is fiscal policy neutral in this case? Explain.

3. Consider the following economy.

$$C^d = 250 + 0.5(Y - T) - 500r,$$

$$I^d = 250 - 500r,$$

$$L = 0.5Y - 500i,$$

$$\bar{Y} = 1000,$$

$$\pi^e = 0.$$

- a. Suppose that $T = G = 200$ and that $M = 7650$. Find an equation describing the IS curve. Find an equation describing the LM curve. Finally, find an equation for the aggregate demand curve. What are the equilibrium values of output, consumption, investment, the real interest rate, and the price level? Assume that there are no misperceptions about the price level.

- b. Suppose that $T = G = 200$ and that $M = 9000$. What is the equation for the aggregate demand curve now? What are the equilibrium values of output, consumption, investment, the real interest rate, and the price level? Assume that full-employment output, $\bar{Y}$, is fixed.

c. Repeat Part (b) for $T = G = 300$ and $M = 7650$.

4. An economy has the following AD and AS curves.

$$\text{AD curve} \quad Y = 300 + 30(M/P),$$

$$\text{AS curve} \quad Y = \bar{Y} + 10(P - P^e).$$

Here, $\bar{Y} = 500$ and $M = 400$.

a. Suppose that $P^e = 60$. What are the equilibrium values of the price level, P , and output, Y ? (Hint: The solutions for P in this Part and in Part (b) are multiples of 10.)

b. An unanticipated increase raises the money supply to $M = 700$. Because the increase is unanticipated, P^e remains at 60. What are the equilibrium values of the price level, P , and output, Y ?

c. The Fed announces that the money supply will be increased to $M = 700$, which the public believes. Now what are the equilibrium values of the price level, P , the expected price level, P^e , and output, Y ?

5. Output in an economy is given by the production function $Y = AK^{0.3}N^{0.7}$, where Y is output, A measures productivity, the capital stock K is fixed at 30, and employment N is fixed at 100. Output equals 100 in the year 2006 and equals 105 in 2007.
- a. Find the Solow residual in the years 2006 and 2007, and its growth rate between those two years.
 - b. What is the relationship between the growth in the Solow residual between 2006 and 2007 and the growth in productivity (as measured by the parameter A) in the same years? Assume that the rates of utilization of capital and labor remain unchanged.
 - c. Repeat Part (b) under the assumption that utilization of labor increases by 3% between 2006 and 2007. You will have to modify the production function along the lines of Eq. (10.2).
 - d. Repeat Part (b) under the assumption that the utilization rates of both

labor and capital increase by 3% between 2006 and 2007.

6. Try the following experiment: Flip a coin fifty times, keeping track of the results. Think of each “heads” as a small positive shock that increases output by one unit; similarly, think of each “tails” as a small negative shock that reduces output by one unit. Let the initial value of output, Y , be 50, and graph the level of output over time as it is hit by the “positive” and “negative” shocks (coin flips). For example, if your first four flips are three heads and a tail, output takes the values 51, 52, 53, 52. After fifty flips, have your small shocks produced any large cycles in output?

7. In a particular economy the labor force (the sum of employed and unemployed workers) is fixed at 100 million. In this economy, each month 1% of the workers who were employed at the beginning of the month lose their jobs, and 19% of the workers who were unemployed at the beginning of the month find new jobs.
 - a. The January unemployment rate is 5%. For the rates of job loss and job finding given, what will the unemployment rate be in February? In March?

- b.** In April an adverse productivity shock raises the job loss rate to 3% of those employed. The job loss rate returns to 1% in May, while the job finding rate remains unchanged at 19% throughout. Find the unemployment rate for April, May, June, and July.

8. (Appendix 10.B) Consider the following economy.

$$\begin{array}{ll} \text{IS curve} & r = 2.47 - 0.0004Y, \\ \text{Real money demand} & L = 0.5Y - 500(r + \pi^e), \\ \text{Short-run aggregate supply} & Y = \bar{Y} + 100(P - P^e). \end{array}$$

Here, r is the real interest rate, Y is output, and P is the price level. Assume that expected inflation, π^e , is 0, nominal money supply, M , is 88,950, and full-employment output, $\bar{Y}$, is 6000.

- a.** Use the notation of Appendixes 9.B and 10.B. What are the values of the parameters α_{IS} , β_{IS} , α_{LM} , β_{LM} , $\bar{Y}$, and b ? (Hint: Solve for asset market equilibrium to obtain the coefficients of the LM equation.)

- b.** What is the equation of the aggregate demand curve?

c. Suppose that the expected price level, P^e , is 29.15. What are the short-run equilibrium values of the price level, P , and output, Y ?

d. What are the long-run equilibrium values of the price level, P , and output, Y ?

10.3 Analytical Problems

1. The discovery of a new technology increases the expected future marginal product of capital.
 - a. Use the classical IS-LM model to determine the effect of the increase in the expected future MPK on current output, the real interest rate, employment, real wages, consumption, investment, and the price level. Assume that expected future real wages and future incomes are unaffected by the new technology. Assume also that current productivity is unaffected.
 - b. Find the effects of the increase in the expected future MPK on current output and prices from the AD-AS diagram based on the misperceptions theory. What accounts for the difference with Part (a)?

2. Use the classical IS-LM model to analyze the effects of a permanent increase in government purchases of 100 per year (in real terms). The increase in purchases is financed by a permanent increase in lump-sum taxes of 100 per year.
 - a. Begin by finding the effects of the fiscal change on the labor market. How does the effect of the permanent increase in government purchases of 100 compare with the effect of a temporary increase in purchases of 100?
 - b. Because the tax increase is permanent, assume that at any constant levels of output and the real interest rate, consumers respond by reducing their consumption each period by the full amount of the tax increase. Under this assumption, how does the permanent increase in government purchases affect desired national saving and the IS curve?
 - c. Use the classical IS-LM model to find the effects of the permanent increase in government purchases and taxes on output, the real interest rate, and the price level in the current period. What happens if consumers reduce their current consumption by less than 100 at any level of output and the real interest rate?

3. Consider a business cycle theory that combines the classical IS-LM model with the assumption that temporary changes in government purchases are the main source of cyclical fluctuations. How well would this theory explain the observed cyclical behavior of each of the following variables? Give reasons for your answers.

a. Employment

b. The real wage

c. Average labor productivity

d. Investment

e. The price level

4. This problem asks you to work out in more detail the example of reverse causation described in the text. Suppose that firms that expect to increase production in the future have to increase their current transactions (for example, they may need to purchase more raw materials). For this reason, current real money demand rises when expected future output rises.
- a. Under the assumption that real money demand depends on expected future output, use the classical IS-LM model to find the effects of an increase in expected future output on the current price level. For simplicity, assume that any effects of the increase in expected future output on the labor market or on desired saving and investment are small and can be ignored.
 - b. Suppose that the Fed wants to stabilize the current price level. How will the Fed respond to the increase in expected future output? Explain why the Fed's response is an example of reverse causation.
5. Starting from a situation with no government spending and no taxes, the government introduces a foreign aid program (in which domestically produced goods are shipped abroad) and pays for it with a temporary 10% tax on current wages. Future wages are untaxed.

What effects will the temporary wage tax have on labor supply? Use the classical IS-LM model to find the effects of the fiscal change on output, employment, the (before-tax) real wage, the real interest rate, and the price level.

11 Keynesianism: The Macroeconomics of Wage and Price Rigidity

11.1 Review Questions

1. Define efficiency wage. What assumption about worker behavior underlies the efficiency wage theory? Why does it predict that the real wage will remain rigid even if there is an excess supply of labor?
2. How is full-employment output, $\bar{Y}$, determined in the Keynesian model with efficiency wages? In this model, how is full-employment output affected by changes in productivity (supply shocks)? How is it affected by changes in labor supply?
3. What is price stickiness? Why do Keynesians believe that allowing for price stickiness in macroeconomic analysis is important?
4. Define menu cost. Why might small menu costs lead to price stickiness in monopolistically competitive markets but not in perfectly competitive markets? Why can a monopolistically competitive firm profitably meet demand at its fixed price when actual demand is greater than the firm anticipated?

5. What does the Keynesian model predict about monetary neutrality (both in the short run and in the long run)? Compare the Keynesian predictions about neutrality with those of the basic classical model and the extended classical model with misperceptions.

6. In the Keynesian model, how do increased government purchases affect output and the real interest rate in the short run? In the long run? How do increased government purchases affect the composition of output in the long run?

7. Describe three alternative responses available to policymakers when the economy is in recession. What are the advantages and disadvantages of each strategy? Be sure to discuss the effects on employment, the price level, and the composition of output. What are some of the practical difficulties in using macroeconomic stabilization policies to fight recessions?

8. Use the Keynesian model to explain the procyclical behavior of employment, money, inflation, and investment.

9. What does the Keynesian model predict about the cyclical behavior of average labor productivity? How does the idea of labor hoarding help bring the prediction of the model into conformity with the business cycle facts?

10. According to the Keynesian analysis, in what two ways does an adverse supply shock reduce output? What problems do supply shocks create for Keynesian stabilization policies?

11.2 Numerical Problems

1. A firm identifies the following relationship between the real wage it pays and the effort exerted by its workers:

Real Wage	Effort
8	7
10	10
12	15
14	17
16	19
18	20

The marginal product of labor for this firm is

$$MPN = \frac{E(100 - N)}{15},$$

where E is the effort level and N is the number of workers employed. If the firm can pay only one of the six wage levels shown, which should it choose? How many workers will it employ?

There are 200 workers in the town where the firm is located, all willing to work at a real wage of 8. Does this fact change your answer to the first part of this question? If so, how?

2. An economy is described by the following equations:

$$C^d = 130 + 0.5(Y - T) - 500r,$$

$$I^d = 100 - 500r,$$

$$G = 100,$$

$$T = 100,$$

$$L = 0.5Y - 1000r,$$

$$M = 1320,$$

$$\bar{Y} = 500.$$

Assume that expected inflation is zero so that money demand depends directly on the real interest rate.

- a.** Write the equations for the IS and LM curves. (These equations express the relationship between r and Y when the goods and asset markets, respectively, are in equilibrium.)

- b.** Calculate the full-employment values of output, the real interest rate, the price level, consumption, and investment.

- c.** Suppose that, because of investor optimism about the future marginal product of capital, the investment function becomes

$$I^d = 200 - 500r.$$

Assuming that the economy was initially at full employment, what are the new values of output, the real interest rate, the price level, consump-

tion, and investment in the short run? In the long run? Show your results graphically.

3. An economy is described by the following equations:

$$C^d = 600 + 0.8(Y - T) - 500r,$$

$$I^d = 400 - 500r,$$

$$L = 0.5Y - 200i, \quad \text{for } i > 0,$$

Government purchases G and taxes T both equal 1000. The initial price level P equals 2.0, and expected inflation π^e is zero. Full-employment output $\bar{Y}$ is 8000. Notice that the real money demand function above is defined only for positive values of the nominal interest rate. We assume that, when the nominal interest rate equals zero, people are willing to hold as much money as the central bank wishes to supply; this assumption implies that the LM curve becomes horizontal for zero values of the nominal interest rate.

- a. Show that in this economy the requirement that the nominal interest rate must be greater than or equal to zero is not consistent with full employment. That is, the economy is in a “liquidity trap” (refer to the Application “The Zero Bound”, pp. 424–427). Can monetary policy alone restore full employment in this economy? Why or why not?

- b. Find a combination of the money supply M and government purchases G that restores full employment while keeping the nominal interest rate at zero. Discuss the relevance of this policy to the case of Japan in the 1990s. Assume that the price level and inflation expectations are unchanged.

4. An economy is described by the following equations:

$$C^d = 300 + 0.5(Y - T) - 300r,$$

$$I^d = 100 - 100r,$$

$$G = 100,$$

$$T = 100,$$

$$L = 0.5Y - 200r,$$

$$M = 6300,$$

$$\bar{Y} = 700.$$

- a. Write the equation for the aggregate demand curve. (Hint: Find the equations describing the goods market and asset market equilibria. Use these two equations to eliminate the real interest rate. For any given price level, the equation of the aggregate demand curve gives the level of output that satisfies both goods market and asset market equilibria.)
- b. Suppose that $P = 15$. What are the short-run values of output, the real interest rate, consumption, and investment?
- c. What are the long-run equilibrium values of output, the real interest rate, consumption, investment, and the price level?

5. (Appendix 11.A) Consider an economy in which all workers are covered by contracts that specify the nominal wage and give the employer the right to choose the amount of employment. The production function is

$$Y = 20\sqrt{N},$$

and the corresponding marginal product of labor is

$$MPN = \frac{10}{\sqrt{N}}.$$

Suppose that the nominal wage is $W = 20$.

- a. Derive an equation that relates the real wage to the amount of labor demanded by firms (the labor demand curve).

- b. For the nominal wage of 20, what is the relationship between the price level and the amount of labor demanded by firms?

- c. What is the relationship between the price level and the amount of output supplied by firms? Graph this relationship.

Now suppose that the IS and LM curves of the economy (the goods market and asset market equilibrium conditions) are described by the following equations:

$$\begin{aligned}\text{IS curve} \quad Y &= 120 - 500r, \\ \text{LM curve} \quad M/P &= 0.5Y - 500r.\end{aligned}$$

- d.** The money supply M is 300. Use the IS and LM equations to derive a relationship between output, Y , and the price level, P . This relationship is the equation for the aggregate demand curve. Graph it on the same axis as the relationship between the price level and the amount of output supplied by firms (the aggregate supply curve) from Part (c).
- e.** What are the equilibrium values of the price level, output, employment, real wage, and real interest rate?
- f.** Suppose that the money supply, M , is 135. What are the equilibrium values of the price level, output, employment, real wage, and real interest rate?

6. (Appendix 11.C) Consider the following economy.

$$C^d = 325 + 0.5(Y - T) - 500r,$$

$$I^d = 200 - 500r,$$

$$G = 150,$$

$$T = 150,$$

$$L = 0.5Y - 1000r,$$

$$M = 6000,$$

$$\bar{Y} = 1000.$$

a. Calculate the full-employment values of the real interest rate, the price level, consumption, and investment.

b. What are the values of α_{IS} , β_{IS} , α_{LM} , β_{LM} , and l_r for this economy? (You'll have to refer back to Appendix 9.B for definitions of these coefficients.)

c. Suppose that the price level is fixed at $\bar{P} = 15$. What are the short-run equilibrium values of output and the real interest rate?

- d. With the price level still fixed at $\bar{P} = 15$, suppose that government purchases increase from $G = 150$ to $G = 250$. What are the new values of α_{IS} and the short-run equilibrium level of output?
- e. Use Eq. (11.C.5) to compute the government purchases multiplier. Use your answer to compute the short-run change in Y resulting from an increase in government purchases from $G = 150$ to $G = 250$. How does your answer here compare to your answer in Part (d)?

11.3 Analytical Problems

1. According to the Keynesian IS-LM model, what is the effect of each of the following on output, the real interest rate, employment, and the price level? Distinguish between the short run and the long run.
 - a. Increased tax incentives for investment (the tax breaks for investment are offset by lump-sum tax increases that keep total current tax collections unchanged).
 - b. Increased tax incentives for saving [as in Part (a), lump-sum tax increases offset the effect on total current tax collections].
 - c. A wave of investor pessimism about the future profitability of capital investments.
 - d. An increase in consumer confidence, as consumers expect that their incomes will be higher in the future.

2. According to the Keynesian IS-LM model, what is the effect of each of the following on output, the real interest rate, employment, and the price level? Distinguish between the short run and the long run.
- a.** Financial deregulation allows banks to pay a higher interest rate on checking accounts.
 - b.** The introduction of sophisticated credit cards greatly reduces the amount of money that people need for transactions.
 - c.** A severe water shortage causes sharp declines in agricultural output and increases in food prices.
 - d.** A temporary beneficial supply shock affects most of the economy, but no individual firm is affected sufficiently to change its prices in the short run.

3. Suppose that the Fed has a policy of increasing the money supply when it observes that the economy is in recession. However, suppose that about six months are needed for an increase in the money supply to affect aggregate demand, which is about the same amount of time needed for firms to review and reset their prices. What effects will the Fed's policy have on output and price stability? Does your answer change if (a) the Fed has some ability to forecast recessions or (b) price adjustment takes longer than six months?
4. Classical economists argue that using fiscal policy to fight a recession doesn't make workers better off. Suppose, however, that the Keynesian model is correct. Relative to a policy of doing nothing, does an increase in government purchases that brings the economy to full employment make workers better off? In answering the question, discuss the effects of the fiscal expansion on the real wage, employment, consumption, and current and future taxes. How does your answer depend on (a) the direct benefits of the government spending program and (b) the speed with which prices adjust in the absence of fiscal stimulus?

5. Some labor economists argue that it is useful to think of the labor market as being divided into two sectors: a primary sector, where “good” (high-paying, long-term) jobs are located, and a secondary sector, which has “bad” (low-paying, short-term) jobs. Suppose that the primary sector has a high marginal product of labor and that (because effort is costly for firms to monitor) firms pay an efficiency wage. The secondary sector has a low marginal product of labor and no efficiency wage; instead, the real wage in the secondary sector adjusts so that the quantities of labor demanded and supplied are equal in that sector. Workers are alike, and all would prefer to work in the primary sector. However, workers who can’t find jobs in the primary sector work in the secondary sector.

What are the effects of each of the following on the real wage, employment, and output in both sectors?

- a. Expansionary monetary policy increases the demand for primary sector output.
- b. Immigration increases the labor force.
- c. The effort curve changes so that a higher real wage is needed to elicit the greatest effort per dollar in the primary sector. Effort exerted at the higher real wage is the same as before the change in the effort curve.

d. There is a temporary productivity improvement in the primary sector.

e. There is a temporary productivity improvement in the secondary sector.

12 Unemployment and Inflation

12.1 Review Questions

1. What is the Phillips curve? Does the Phillips curve relationship hold for U.S. data? Explain.
2. How does the expectations-augmented Phillips curve differ from the traditional Phillips curve? According to the theory of the expectations-augmented Phillips curve, under what conditions should the traditional Phillips curve relationship appear in the data?
3. How do changes in the expected inflation rate account for the behavior of the Phillips curve in the 1960s, 1970s, and 1980s in the United States? What role do supply shocks play in explaining the behavior of the Phillips curve in the United States?
4. Can policymakers exploit the Phillips curve relationship by trading more inflation for less unemployment in the short run? In the long run? Explain both the classical and Keynesian points of view.

5. Why do policymakers want to keep inflation low? Who suffers when there is unemployment?
6. Why is the natural unemployment rate an important economic variable? What factors explain the changes in the natural rate over time in the United States? What government policies, if any, might be used to reduce the natural unemployment rate?
7. Give two costs of anticipated inflation and two costs of unanticipated inflation. How is the magnitude of each affected if, instead of a moderate inflation, hyperinflation occurs?
8. What is the greatest potential cost associated with disinflation? How does the responsiveness of the public's inflation expectations affect the size of this potential cost?

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12.2 Numerical Problems

1. Consider an economy in long-run equilibrium with an inflation rate, π , of 12% (0.12) per year and a natural unemployment rate, $\bar{u}$, of 6% (0.06). The expectations-augmented Phillips curve is

$$\pi = \pi^e - 2(u - \bar{u}).$$

Assume that Okun's law holds so that a 1 percentage point increase in the unemployment rate maintained for one year reduces GDP by 2% of full-employment output.

- a. Consider a two-year disinflation. In the first year $\pi = 0.04$ and $\pi^e = 0.08$. In the second year $\pi = 0.04$ and $\pi^e = 0.04$. In the first year, what is the unemployment rate?

- b. Now consider a four-year disinflation according to the following table:

Year	1	2	3	4
π	0.08	0.04	0.04	0.04
π^e	0.10	0.08	0.06	0.04

What is the unemployment rate in each of the four years? By what percentage does output fall short of full-employment output each year? What is the sacrifice ratio for this disinflation?

2. Consider the following extended classical economy (in which the misperceptions theory holds):

$$\begin{aligned}
 \text{AD curve} \quad & Y = 300 + 10(M/P), \\
 \text{SRAS curve} \quad & Y = \bar{Y} + P - P^e, \\
 \text{Okun's law} \quad & (Y - \bar{Y})/\bar{Y} = -2(u - \bar{u}), \\
 \text{Full-employment output} \quad & \bar{Y} = 500, \\
 \text{Natural unemployment rate} \quad & \bar{u} = 0.06.
 \end{aligned}$$

- a.** Suppose that the money supply $M = 1000$ and that the expected price level $P^e = 50$. What are the short-run equilibrium values of output, Y , the price level, P , and the unemployment rate, u ? What are the long-run equilibrium values of these three variables?

- b.** Now suppose that an unanticipated increase raises the nominal money supply to $M = 1260$. What are the new short-run equilibrium values of output, Y , the price level, P , and the unemployment rate, u ? What are the new long-run equilibrium values of these three variables? In general, are your results consistent with an expectations-augmented Phillips curve?

3. In a certain economy the expectations-augmented Phillips curve is

$$\pi = \pi^e - 2(u - \bar{u}) \quad \text{and} \quad \bar{u} = 0.06.$$

- a.** Graph the Phillips curve of this economy for an expected inflation rate of 0.10. If the Fed chooses to keep the actual inflation rate at 0.10, what will be the unemployment rate?
- b.** An aggregate demand shock (resulting from increased military spending) raises expected inflation to 0.12 (the natural unemployment rate is unaffected). Graph the new Phillips curve and compare it to the curve you drew in Part (a). What happens to the unemployment rate if the Fed holds actual inflation at 0.10? What happens to the Phillips curve and the unemployment rate if the Fed announces that it will hold inflation at 0.10 after the aggregate demand shock, and this announcement is fully believed by the public?
- c.** Suppose that a supply shock (a drought) raises expected inflation to 0.12 and raises the natural unemployment rate to 0.08. Repeat Part (b).

4. An economy is described by the following equations:

AD $Y = 4000 + 2(M/P),$

$$\text{SRAS} \quad Y = \bar{Y} + 100(P - P^e),$$

Okun's law $(Y - \bar{Y})/\bar{Y} = -2(u - \bar{u})$.

In this economy full-employment output $\bar{Y}$ equals 6000 and the natural unemployment rate $\bar{u}$ equals 0.05.

- a. Suppose that the nominal money supply has long been constant at $M = 4000$ and is expected by the public to remain constant forever. What are the equilibrium values of the price level P , the expected price level P^e , expected inflation π^e , output Y , and the unemployment rate u ?
- b. A totally unexpected increase in the money supply occurs, raising it from 4000 to 4488. What are the short-run equilibrium values of the price level, expected price level, output, and unemployment rate? What are the values of cyclical unemployment and unanticipated inflation?
- c. What is the slope of the expectations-augmented Phillips curve (equal to h in Eq. 12.1) in this economy?

12.3 Analytical Problems

1. Suppose that the government institutes a program to help unemployed workers learn new skills, find new jobs, and relocate as necessary to take the new jobs.
 - a. If this program reduces structural unemployment, what is the effect on the expectations-augmented Phillips curve and the long-run Phillips curve?
 - b. The government program is expensive, and critics argue that a cheaper way to cut unemployment would be by monetary expansion. Comment.
2. Two extended classical economies (in which the misperceptions theory holds) differ only in one respect: In economy A money growth and inflation have been low and stable for many years, but in economy B money growth and inflation have fluctuated erratically between very low and very high levels. When producers in economy B observe changes in the prices of the goods they produce, from past experience they usually attribute these changes to fluctuations in the overall price level rather than to changes in the relative prices of their goods.

Will the slope of the short-run aggregate supply curve for economy B be flatter or steeper than the slope of the curve for economy A? What about the slope of the Phillips curve?

3. In this problem you are asked to show that the expectations-augmented Phillips curve (derived in the text using the extended classical model) can be derived using the Keynesian model.

Consider a Keynesian economy in which full-employment output is constant, and in which the nominal money supply has been growing at 10% per year for some time and is expected to keep growing at that rate in the future. To avoid some technical complications, suppose that, instead of growing continuously over time, the money supply is increased by 10% each December 31 and then held constant until the next December 31. Monopolistically competitive firms reset their prices on December 31 of each year at the level that they expect will allow them to sell the full-employment level of output during the coming year. Inflation is measured as the percentage change in prices between January 1 and December 31 of each year.

- a. Show how the AD curve, SRAS curve, output, the price level, and the expected price level evolve over time in this economy. What are the values of unanticipated inflation and cyclical unemployment?

- b. Now suppose that on June 30, 2007, the money supply is unexpectedly raised by an additional 5%. However, the central bank announces—and firms believe—that this extra increase in the money supply is a one-time-only increase and that next December 31 the central bank will return to its policy of increasing the money supply by 10%. (Thus the total increase in the money supply between January 1, 2007, and December 31, 2007, is 15%.) Firms don't change prices until December 31, as usual, but when they do they respond fully to the new information about money supply growth.

What are the actual and unanticipated inflation rates during 2007? Is cyclical unemployment positive, negative, or zero (on average) during

2007? Relate your results to the expectations-augmented Phillips curve.

4. Some economists have suggested that someday we will live in a “cashless society” in which all businesses (including stores) and banks will be linked to a centralized accounting system. In this system you will be able to pay for purchases directly from your bank account without using cash. What are the costs of anticipated inflation in a cashless society? What are the costs of unanticipated inflation?

5. To fight an ongoing 10% inflation, the government makes raising wages or prices illegal. However, the government continues to increase the money supply (and hence aggregate demand) by 10% per year. The economy starts at full-employment output, which remains constant.
 - a. Using the Keynesian AD-AS framework, show the effects of the government’s policies on the economy. Assume that firms meet the demand at the fixed price level.

- b.** After several years in which the controls have kept prices from rising, the government declares victory over inflation and removes the controls. What happens?

- 6. How would each of the following likely affect the natural unemployment rate?
 - a.** A new law prohibits people from seeking employment before age eighteen.

 - b.** A new Internet service, *Findwork.com*, makes it easy for people to check on the availability of jobs around the country.

 - c.** The length of time that unemployed workers can receive government benefits increases from six months to one year.

 - d.** A shift in the public's buying habits greatly expands the demand for sophisticated consumer electronics while reducing the demand for traditional consumer goods and services, such as clothing and restaurant meals.

- e. Tight monetary policy, introduced to get the inflation rate down, drives the economy into a recession.