The *IS-LM-PC* Model

GRADUATE MACRO – LAB SESSION 9

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Class Outline

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9-2	Dynamics and the Medium Run Equilibrium
9-3	Fiscal Consolidation Revisited
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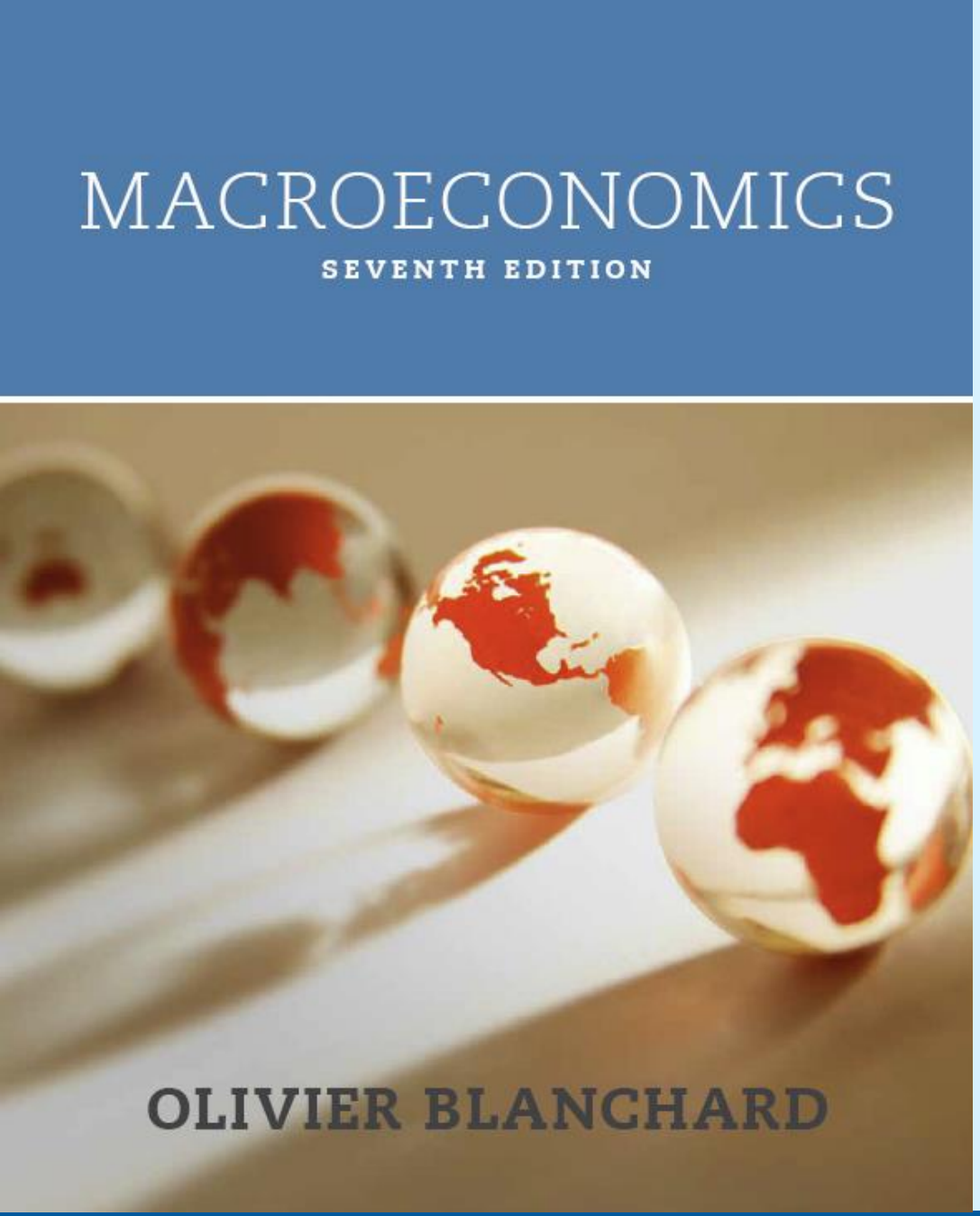


From the Short to the Medium Run: The *IS-LM-PC* Model

Chapter 9

From the Short to the Medium Run: The *IS-LM-PC* Model

- In Chapters 3 through 6, we looked at equilibrium in the goods and financial markets, and how output is determined in the short run.
- In Chapters 7 and 8, we looked at equilibrium in the labor market.
- We now put the two parts together and use this IS-LM-PC (PC for Phillips curve) model to characterize the behavior of output both in the short run and the medium runs.

9-1 The IS-LM-PC Model

- In Chapter 6, output in the short run is determined by demand (IS curve):

$$Y = C(Y - T) + I(Y, r + x) + G \tag{9.1}$$

- In Chapter 8, the relation between inflation and unemployment is called the Phillips curve:

$$\pi - \pi^e = -\alpha(u - u_n) \tag{9.2}$$

- When $u = u_n$, natural employment is $Nn = L(1 - u_n)$
- When $u = u_n$, **potential output** is $Y_n = L(1 - u_n)$
- **Output gap**: $Y - Y_n = L((1 - u) - (1 - u_n) = -L(u - u_n)$

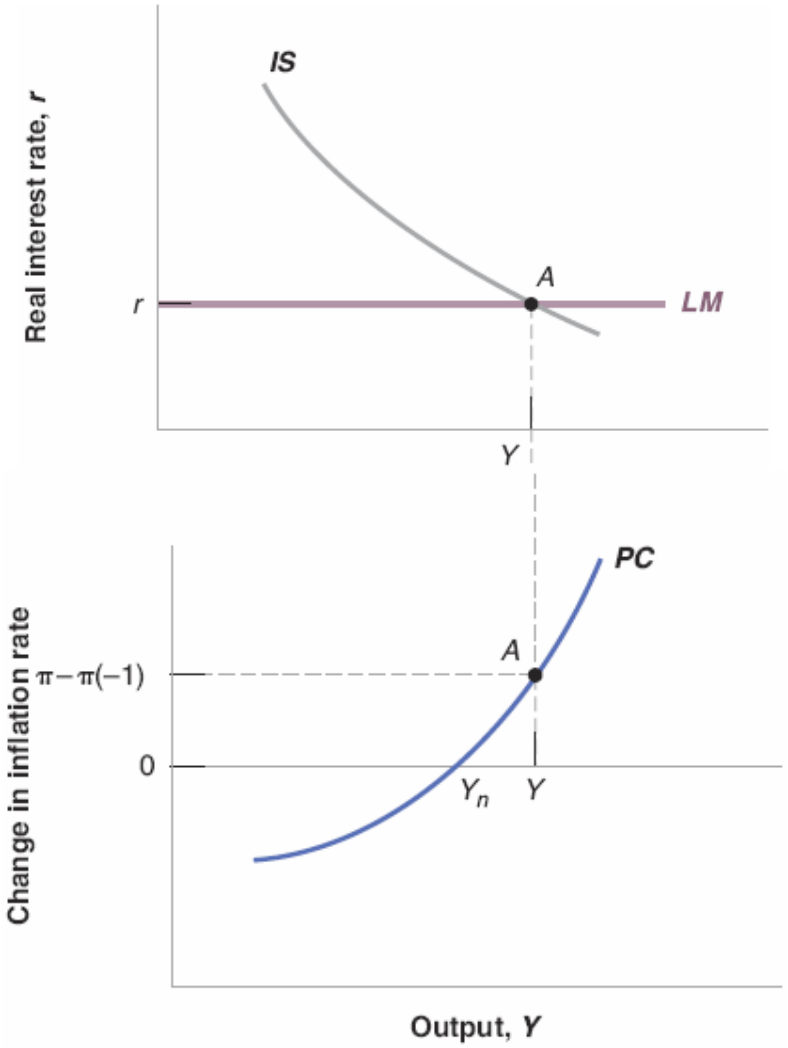
9-1 The IS-LM-PC Model

Figure 9-1 The IS-LM-PC Model

Short-run equilibrium

Top graph: A low policy rate leads to higher output.

Bottom graph: A higher output leads to a larger change in inflation.



9-1 The IS-LM-PC Model

- Output gap: $Y - Y_n = L((1-u) - (1-u_n) = -L(u - u_n)$
- Replacing $u - u_n$ in equation (9.2) gives:

$$\pi - \pi^e = (\alpha/L)(Y - Y_n) \tag{9.3}$$

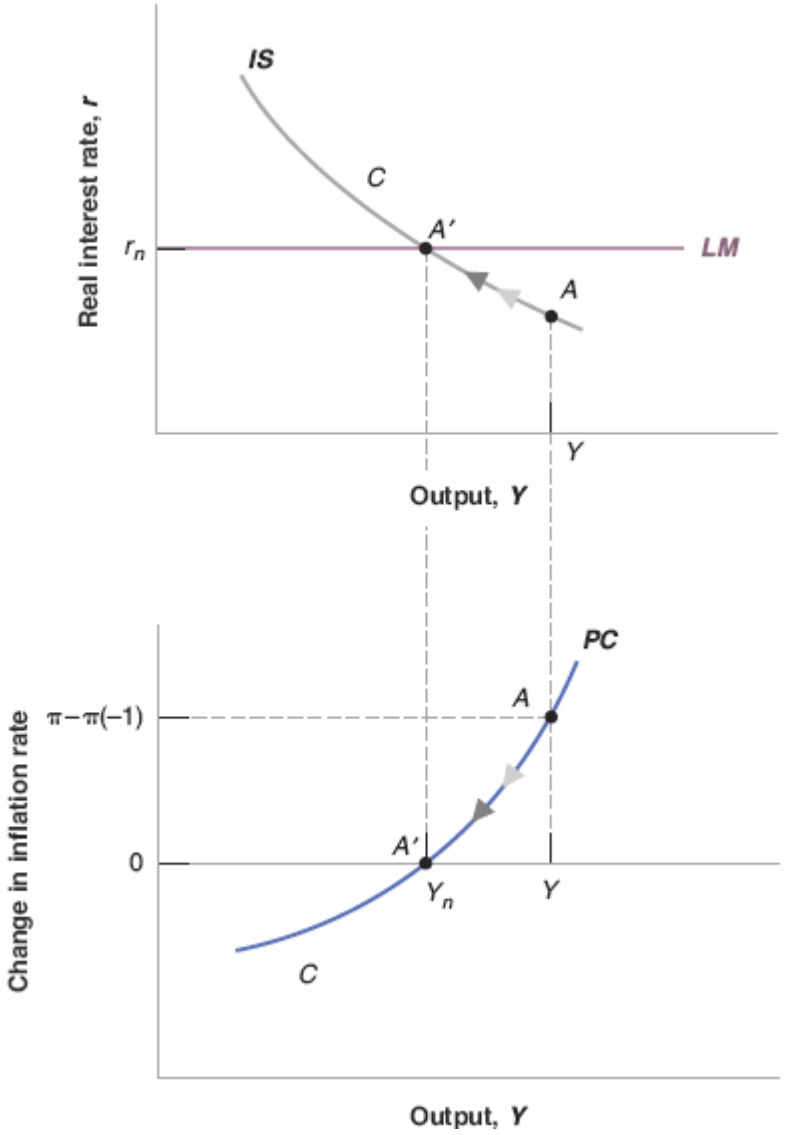
- Assume wage setters expect inflation this year to be the same last year:

$$\pi - \pi(-1) = (\alpha/L)(Y - Y_n) \tag{9.4}$$

- When output is above potential (positive output gap), inflation increases, and vice versa.

9-2 Dynamics and the Medium Run Equilibrium

Figure 9-2 Medium-Run Output and Inflation



Over the medium run, the economy converges to the natural level of output and stable inflation.

At the medium-run equilibrium (point *A'*), r_n is called the **natural**, **neutral**, or **Wicksellian rate of interest**.

If the central bank wants to achieve a constant level of inflation, then the initial boom must be followed by a recession.

9-2 Dynamics and the Medium Run Equilibrium

- Assume instead that the expected inflation rate is a constant, then equation (9.3) becomes:

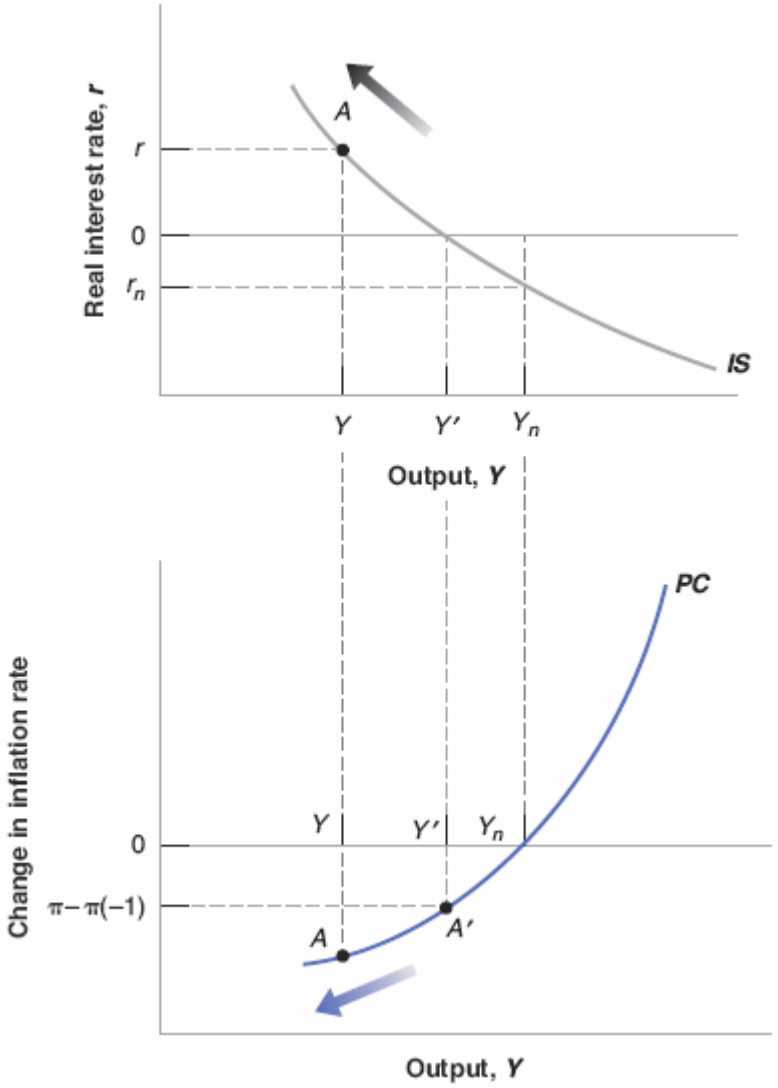
$$\pi - \bar{\pi} = (\alpha/L)(Y - Y_n) \qquad (9.5)$$

- A positive output gap generates *a higher level of inflation*, rather than *an increase in inflation*.
- So long as inflation **expectations** remain **anchored**, the central bank does not need to compensate for the initial boom by a recession later.

9-2 Dynamics and the Medium Run Equilibrium

Figure 9-3 The Deflation Spiral

If the zero lower bound prevents monetary policy from increasing output back to potential, the result may be a deflation spiral. More deflation leads to a higher real policy rate, and the higher policy rate in turn leads to lower output and more deflation.



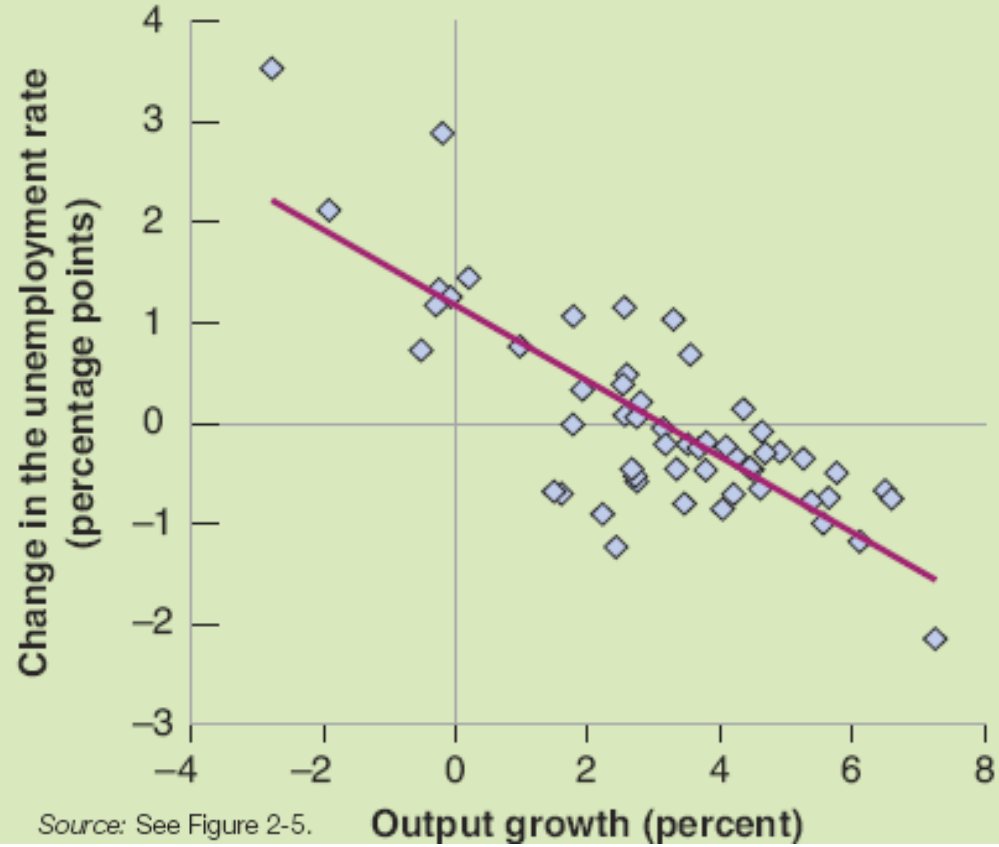
9-2 Dynamics and the Medium Run Equilibrium

- The zero lower bound constraint may make it impossible to achieve a negative real policy rate.
- **Deflation spiral** or **deflation trap** occurs at Y' (Figure 9-3) when output is still below potential, and thus inflation is still decreasing.
- Lower output leads to more deflation, and more deflation leads to a higher real interest rate and lower output.

FOCUS: Okun's Law across Time and Countries

Figure 1 Changes in the Unemployment Rate versus Output Growth in the United States, 1960–2014

High output growth is associated with a reduction in the unemployment rate; low growth is associated with an increase in the unemployment rate.



FOCUS: Okun's Law across Time and Countries

- Okun's law can be written as the change in the unemployment that is approximately equal to the negative of the growth rate of output:

$$u - u(-1) \approx -g_x \qquad (9B.1)$$

- The regression that fits the points in Figure 1 is:

$$u - u(-1) = -0.4(g_x - 3\%) \qquad (9B.2)$$

- Annual output growth has to be at least 3% to prevent the unemployment rate from rising.
- Output growth 1% above normal leads only to a 0.4% reduction in the unemployment rate due to such factors as labor hoarding and discouraged workers.
- The coefficient (0.4) is called the **Okun coefficient**.

FOCUS: Deflation in the Great Depression

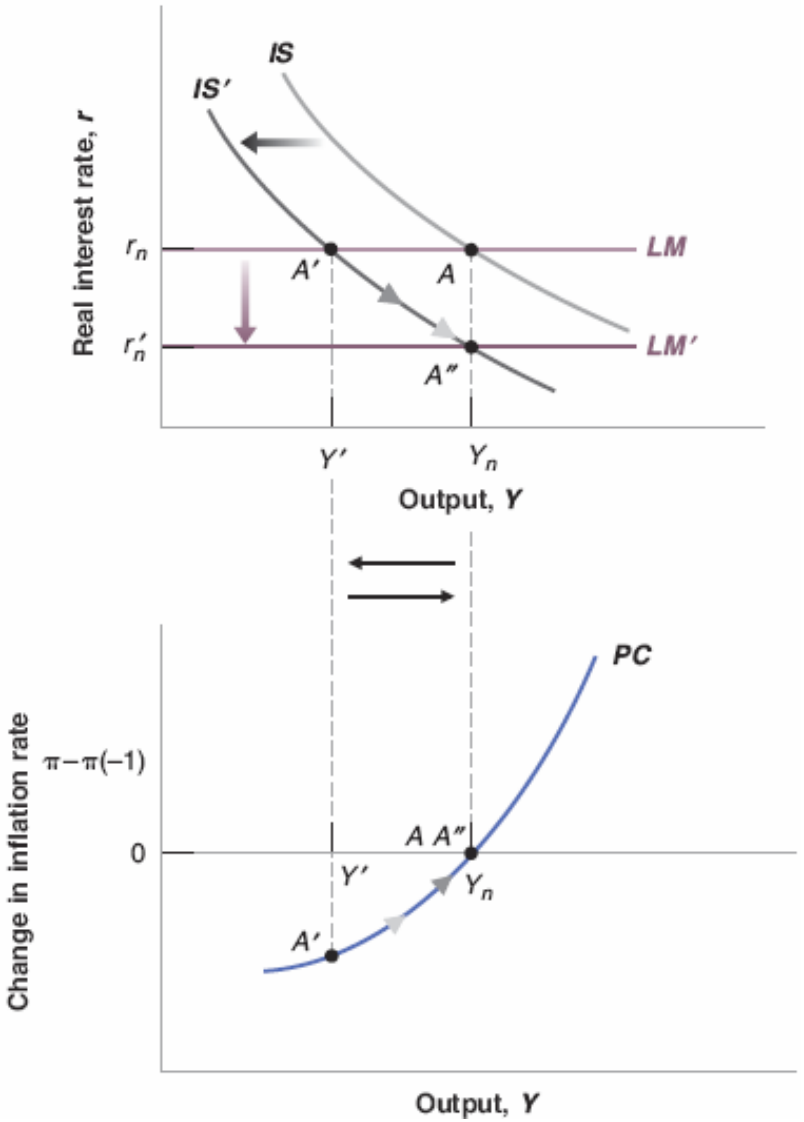
- The economy seemed to be in a deflation trap between 1929 and 1933.
- Monetary policy decreased the nominal interest rate from 5.3% to 2.3% in 1933, but with negative inflation rates, the real rate reached 12.3% in 1931 and 7.8% in 1933.

Table 1 The Nominal Interest Rate, Inflation, and the Real Interest Rate, 1929–2033

Year	Unemployment Rate (%)	Output Growth Rate (%)	One-Year Nominal Interest Rate (%), i	Inflation Rate (%), π	One-Year Real Interest Rate (%), r
1929	3.2	−9.8	5.3	0.0	5.3
1930	8.7	−7.6	4.4	−2.5	6.9
1931	15.9	−14.7	3.1	−9.2	12.3
1932	23.6	−1.8	4.0	−10.8	14.8
1933	24.9	9.1	2.6	−5.2	7.8

9-3 Fiscal Consolidation Revisited

Figure 9-4 Fiscal Consolidation in the Short Run and the Medium Run



Fiscal consolidation leads to a decrease in output in the short run.

In the medium run, output returns to potential, and the interest rate is lower.

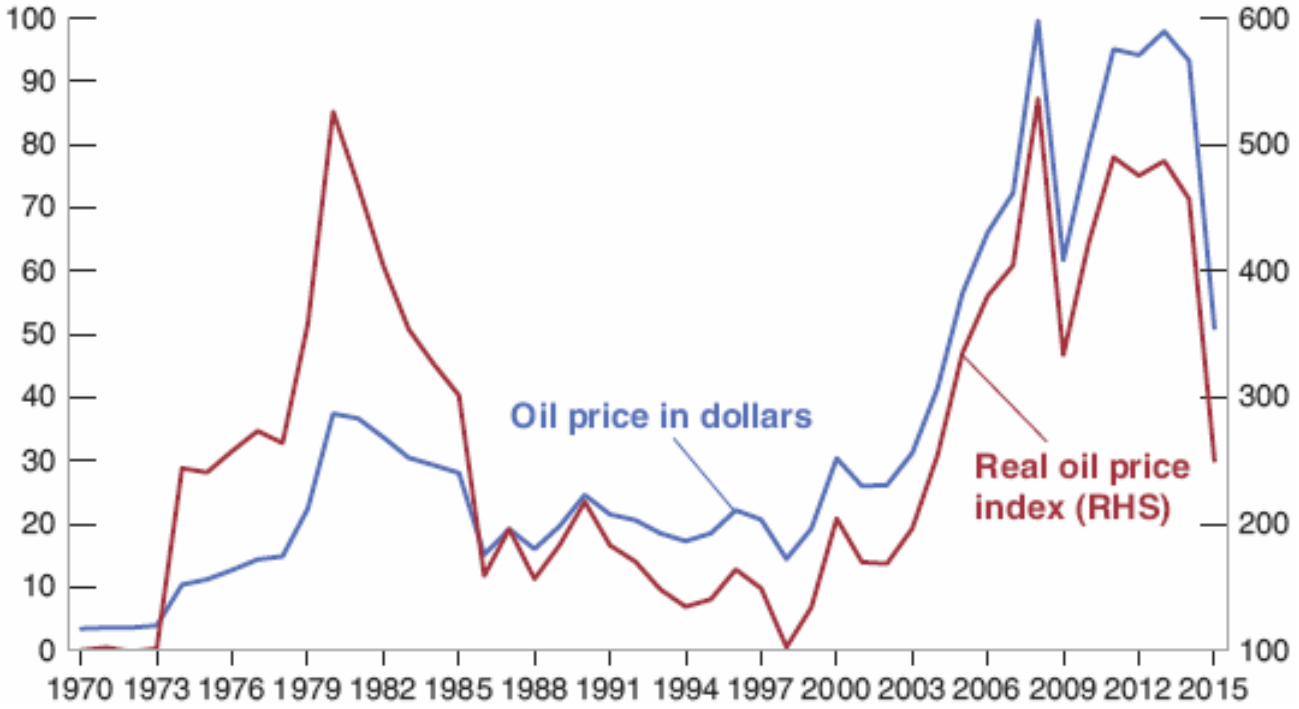
1. Using the information in this chapter, label each of the following statements true, false, or uncertain. Explain briefly.

a. The *IS* curve shifts up with an increase in G, up with an increase in T, and up with an increase in x.
b. If $(u - u_n)$ is greater than zero, then $(Y - Y_n)$ is greater than zero.
c. If $(u - u_n)$ is equal to zero, the output is at potential.
d. If $(u - u_n)$ is less than zero, the output gap is negative.
e. If the output gap is positive, inflation is higher than expected inflation.
f. Okun's law says that if output growth increases by one percentage point, the rate of unemployment drops by one percentage point.
g. At the natural rate of unemployment, inflation is neither rising nor falling.
h. In a medium-run equilibrium, the rate of inflation is stable.
i. The central bank can always act to keep output equal to potential output.
j. It is easier for the central bank to keep output at potential output if expectations of inflation are anchored.
k. A large increase in the price of oil increases the natural rate of unemployment.

9-4 The Effects of an Increase in the Price of Oil

Figure 9-5 The Nominal and the Real Price of Oil, 1970–2015

Over the last 40 years, there have been two sharp increases in the real price of oil, the first in the 1970s and the second in the 2000s.



Source: Series OILPRICE, CPIAUSCL Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/. The value of the index is set equal to 100 in 1970.

9-4 The Effects of an Increase in the Price of Oil

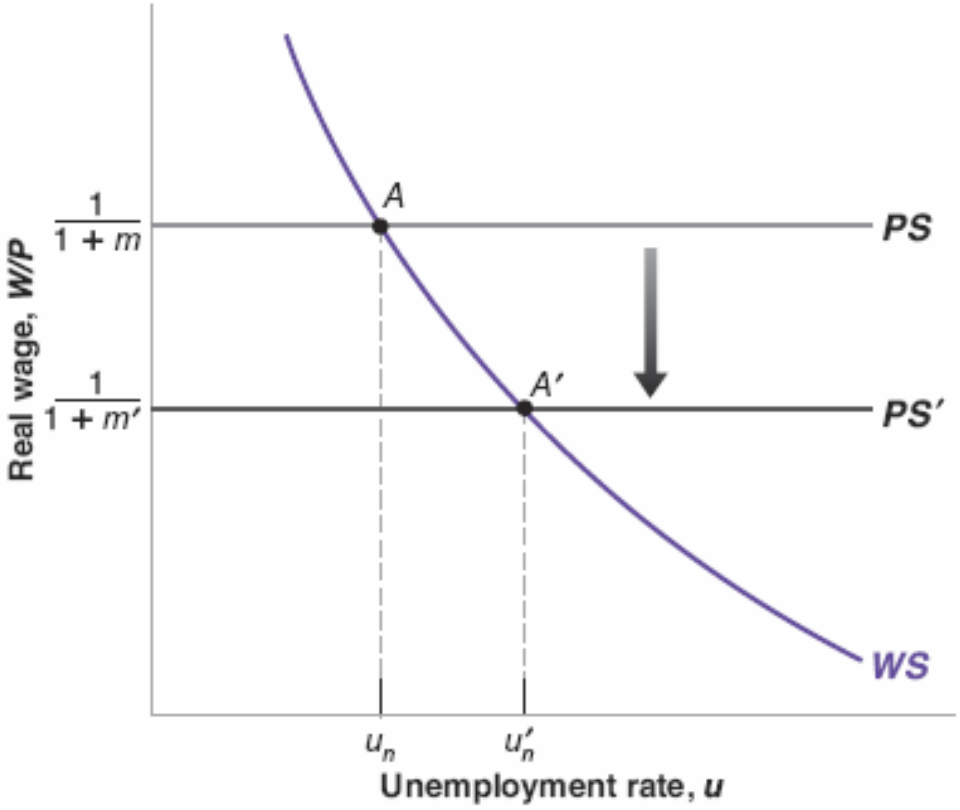
- 1970s: OPEC (the Organization of Petroleum Exporting Countries) act as a monopoly and increased oil prices.
- 2000s: The fast growth of emerging economies led a rapid increase in world oil demand, and thus a steady increase in real oil prices.
- 2008: A large recession led to a sudden decrease in the demand for oil, and thus falling oil prices.
- 2014 and after: A combination of increased supply due to the increase in U.S. shale oil production and the partial breakdown of OPEC led to sudden drop in oil prices.

9-4 The Effects of an Increase in the Price of Oil

Figure 9-6 The Effects of an Increase in the Price of Oil on the Natural Rate of Unemployment

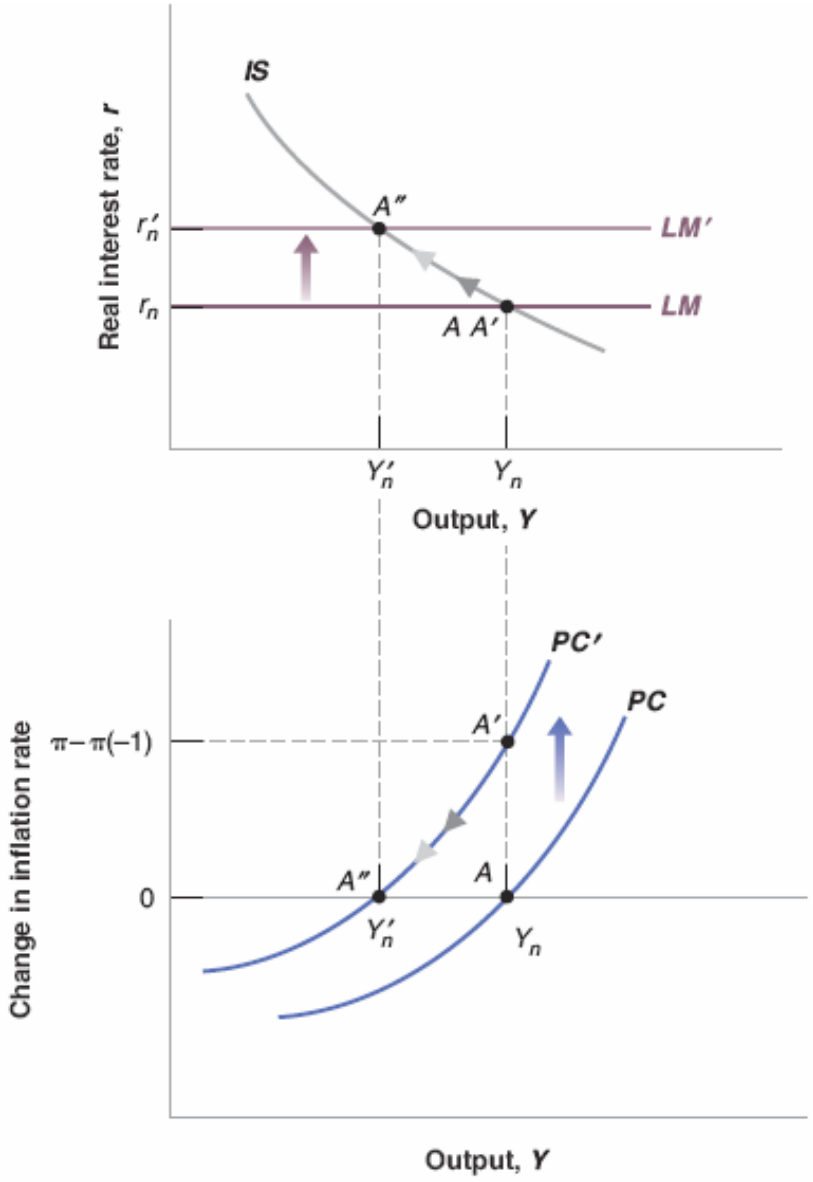
An increase in the price of oil is equivalent to an *increase in the markup*.

It leads to lower real wages and a higher natural rate of unemployment.



9-4 The Effects of an Increase in the Price of Oil

Figure 9-7 Short and Medium Run Effects of an Increase in the Price of Oil



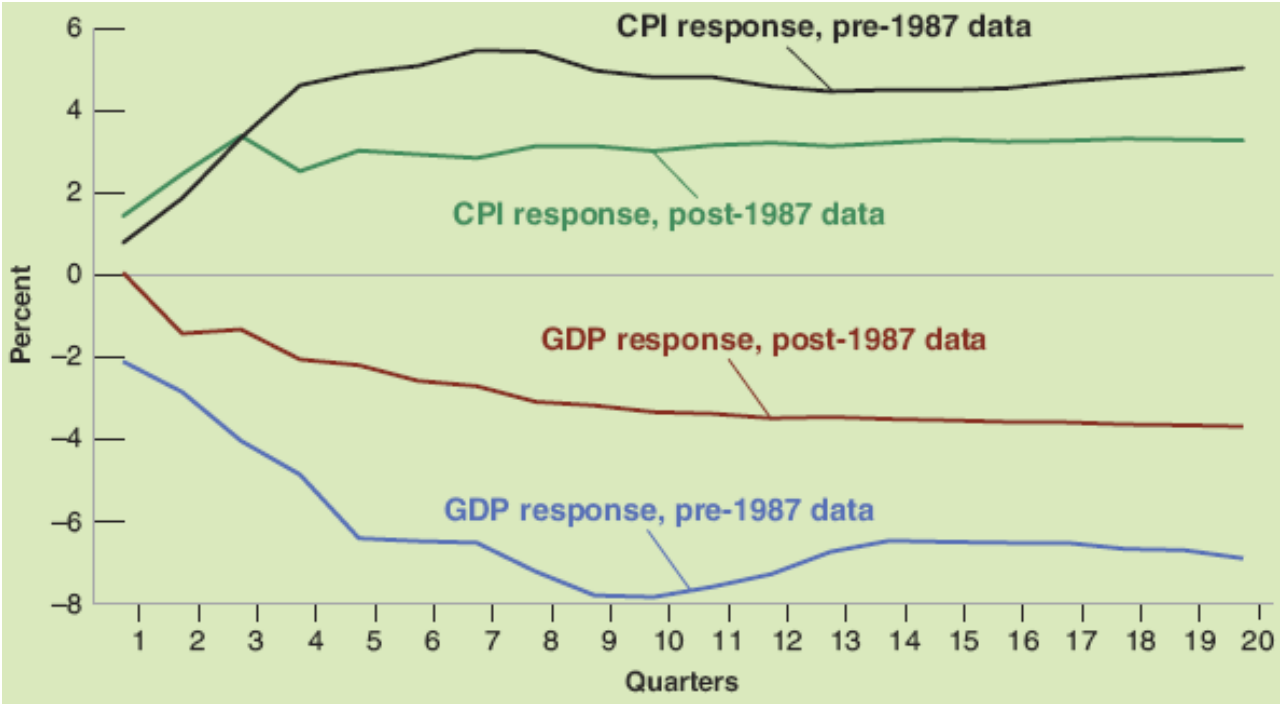
- If *A*′ is the short-run equilibrium, then if the central bank increases the policy rate to stabilize inflation, then the economy moves to its medium-run equilibrium at point *A*″.
- **Stagflation** (lower output and higher inflation) occurs along the way.

FOCUS: Oil Price Increases: Why Were the 2000s So Different from the 1970s?

Figure 1 The Effects of a 100% Permanent Increase in the Price of Oil on the CPI and on GDP

The effects of an increase in the price of oil on output and the price level are smaller than they used to be.

Plausible explanations include U.S. workers' lower bargaining power, and inflation that was more anchored by monetary policy.



9-5 Conclusions

- Shocks or changes in policy typically have different effects in the short run and in the medium run.
- Disagreements about the effects of various policies depend on how fast you think the economy adjusts to shocks.
- Movements in output around its trend are called **output fluctuations** (**business cycles**).
- **Economic fluctuations** are the results of shocks and their dynamic effects, called the **propagation mechanism**.