

The Labor Market and the Phillips Curve – *part 2*

GRADUATE MACRO – LAB SESSION 8

ETTORE GALLO



Class Outline

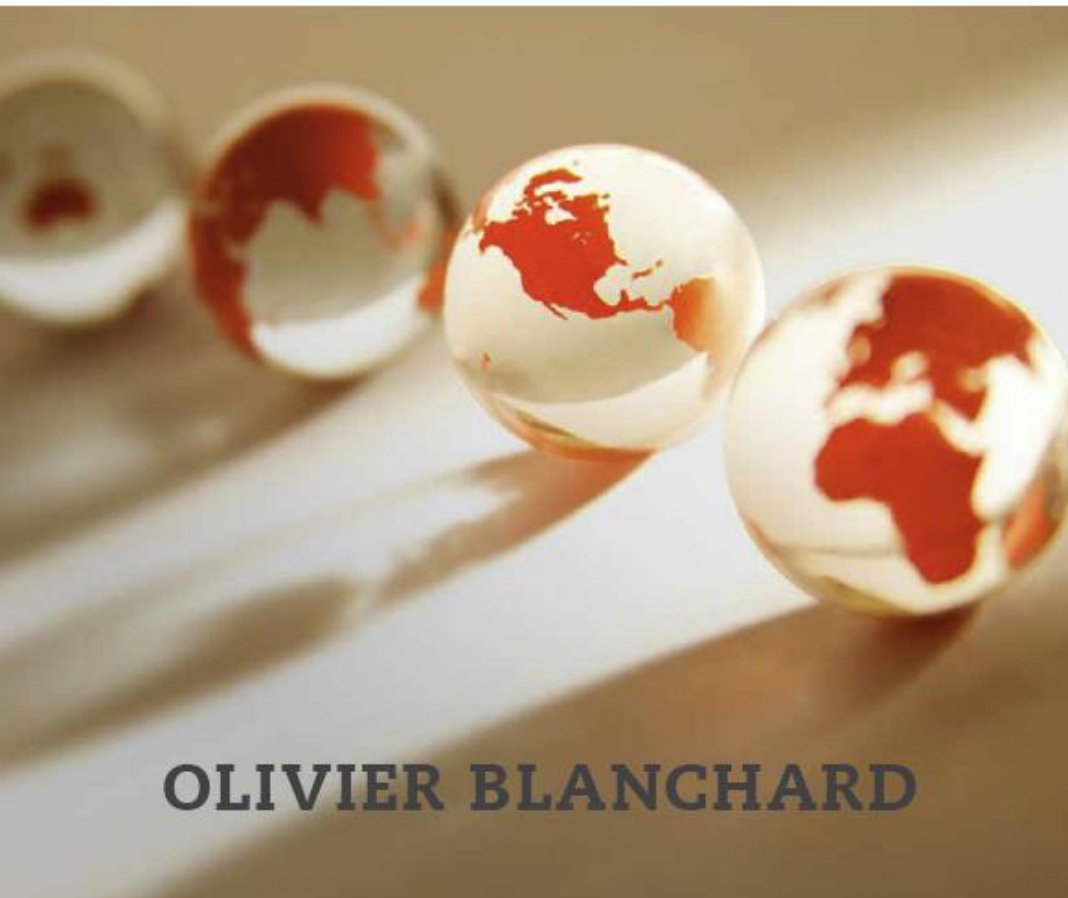
- 8-1 Inflation, Expected Inflation, and Unemployment
- 8-2 The Phillips Curve and Its Mutations
- 8-3 The Phillips Curve and the Natural Rate of Unemployment

Short vs. medium run

- In the **short run**, the factors that determine movements in output are the factors we focused on in the preceding chapters: monetary policy, fiscal policy, and so on.
- In the **medium run**, output tends to return to the natural level. The factors that determine unemployment and, by implication, output, are the factors we have focused on this chapter.

MACROECONOMICS

SEVENTH EDITION



OLIVIER BLANCHARD

The Phillips Curve, the Natural Rate of Unemployment, and Inflation

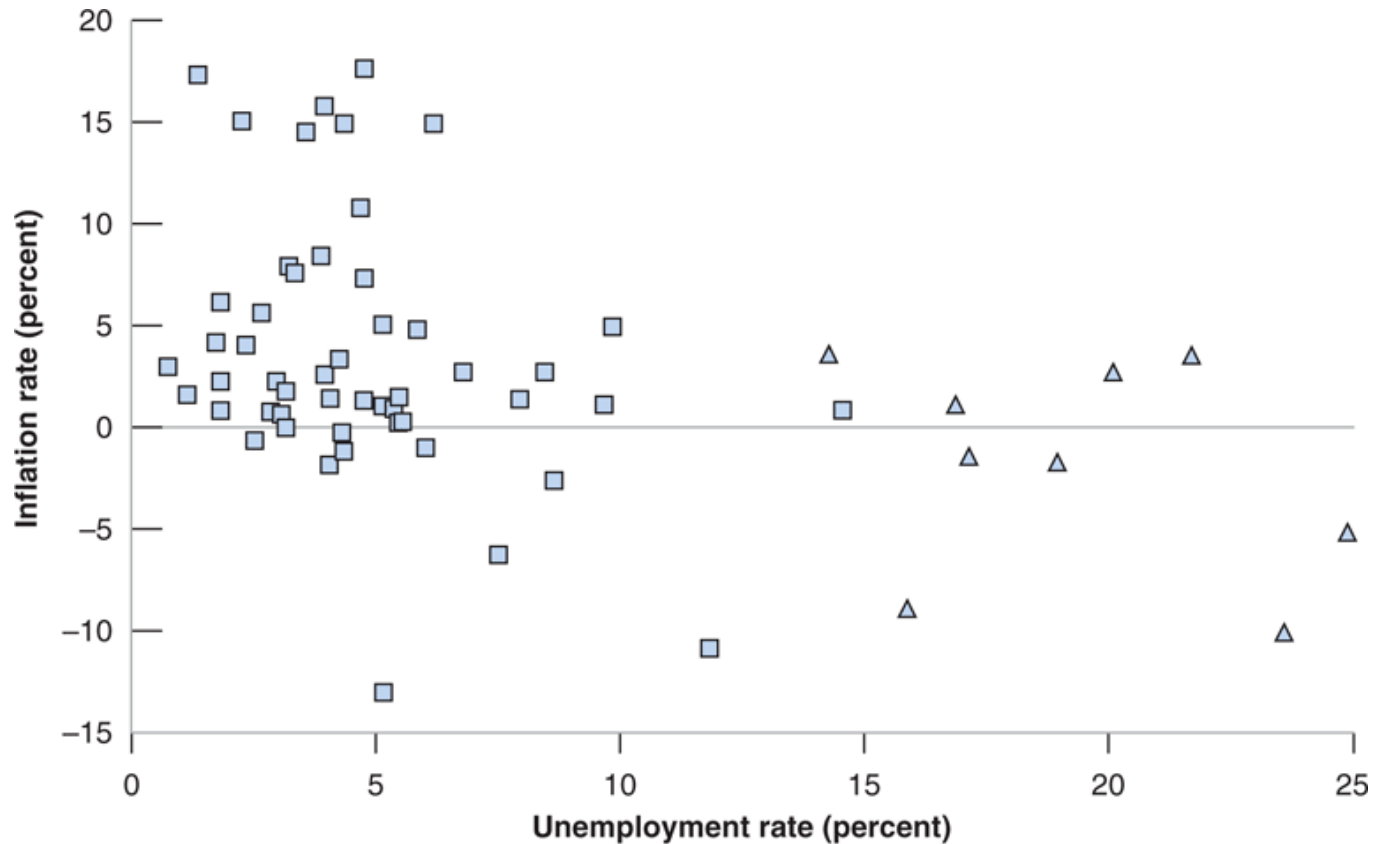
Chapter 8

The Phillips Curve, the Natural Rate of Unemployment, and Inflation

- In 1958. A.W. Phillips found a negative relation between inflation and unemployment.
- Two years later, Paul Samuelson and Robert Solow labeled this relation the **Phillips curve**, which became central to macroeconomic thinking and policy.

Figure 8-1 Inflation versus Unemployment in the United States, 1900–1960

During the period 1900-1960 in the United States, a low unemployment rate was typically associated with a high inflation rate, and a high unemployment rate was typically associated with a low or negative inflation rate.



Source: Historical Statistics of the United States. <http://hsus.cambridge.org/HSUSWeb/index.do>

8-1 Inflation, Expected Inflation, and Unemployment

- Recall the wage determination equation (7.1):

$$W = P^e F(u, z) \quad (7.1)$$

and the price determination equation (7.3):

$$P = (1 + m)W \quad (7.3)$$

- Substitute equation (7.1) for W in equation (7.3):

$$P = P^e(1 + m) F(u, z)$$

8-1 Inflation, Expected Inflation, and Unemployment

- Assume a specific form for F :

$$F(u, z) = 1 - \alpha u + z$$

so that the *relation between the price level, the expected price level, and the unemployment rate* is:

$$P = P^e (1 + m)(1 - \alpha u + z) \quad (8.1)$$

or in terms of inflation rate π and the expected inflation rate π^e :

$$\pi = \pi^e + (m + z) - \alpha u \quad (8.2)$$

8-1 Inflation, Expected Inflation, and Unemployment

- *An increase in π^e leads to an increase in π .*
- *Given π^e , an increase in m , or an increase in z , leads to an increase in π .*
- *Given π^e , a decrease in u leads to an increase in π .*
- Equation (2.2) with a time index t :

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t \quad (8.3)$$

8-2 The Phillips Curve and Its Mutations

- Assume $\pi_t^e = \bar{\pi}$, so that equation (8.3) becomes:

$$\pi_t = (m + z) - \alpha u_t \quad (8.4)$$

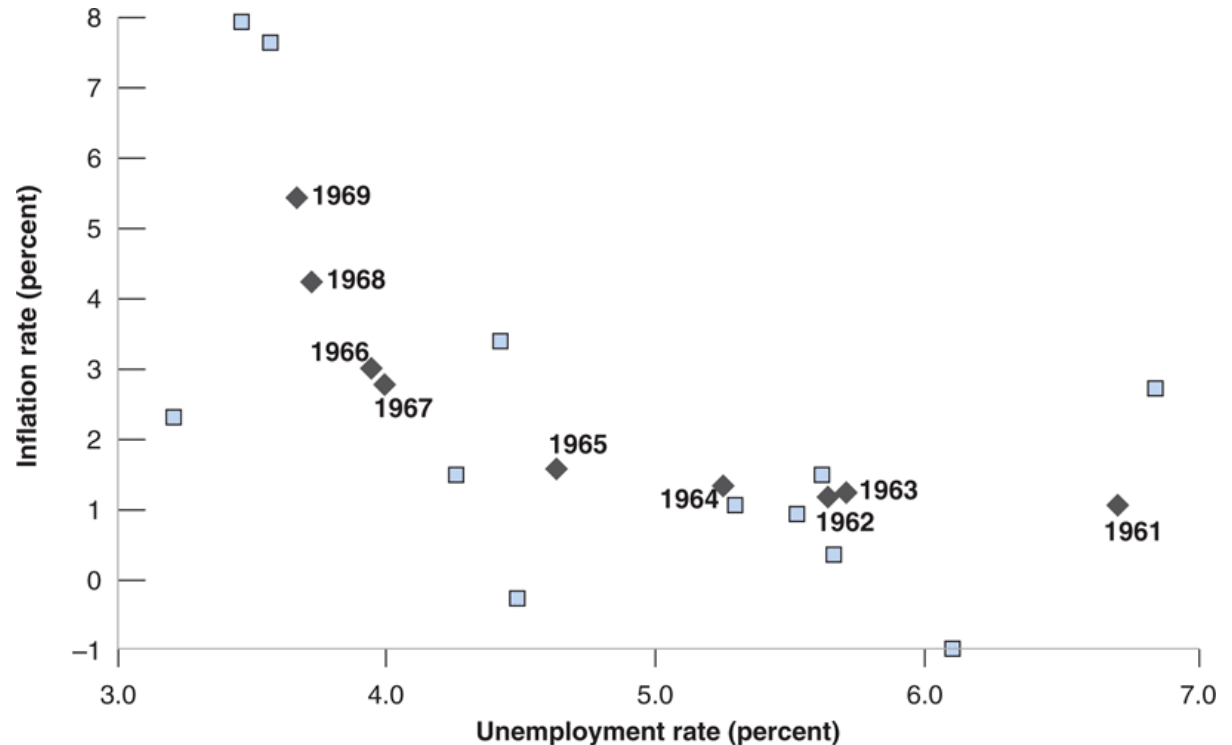
which is a negative relation between unemployment and inflation.

- This Phillips curve relation was observed in the United States in the 1960s.
- The relation vanished in the 1970s because wage setters changed the way they formed inflation expectations.

8-2 The Phillips Curve and Its Mutations

Figure 8-2 Inflation versus Unemployment in the United States, 1948–1969

The steady decline in the U.S. unemployment rate throughout the 1960s was associated with a steady increase in the inflation rate.

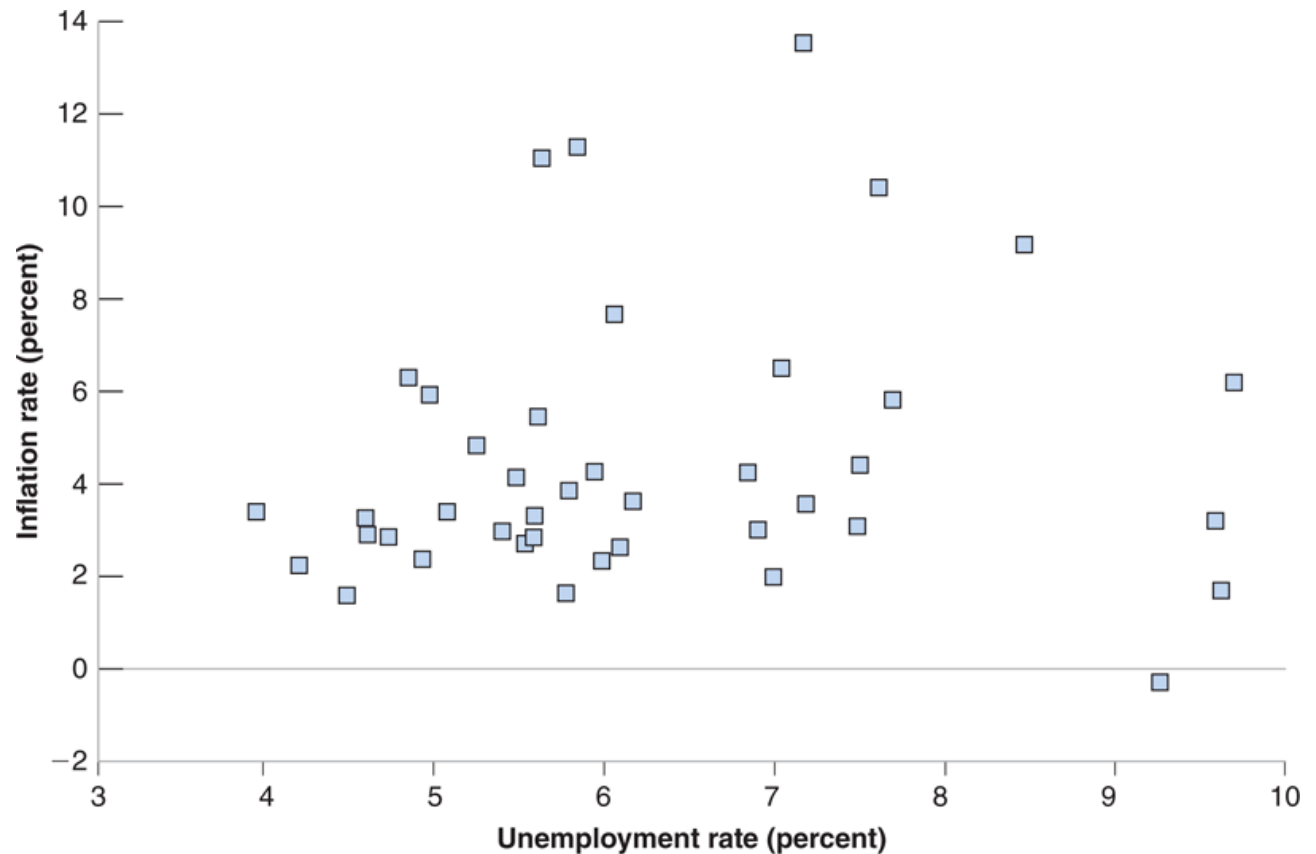


Source: Series UNRATE, CPIAUSCL Federal Reserve Economic Data (FRED) <http://research.stlouisfed.org/fred2/>

8-2 The Phillips Curve and Its Mutations

Figure 8-3 Inflation versus Unemployment in the United States, 1970–2010

Beginning in 1970 in the United States, the relation between the unemployment rate and the inflation rate disappeared.



Source: See Figure 8-2.

8-2 The Phillips Curve and Its Mutations

- Suppose expected inflation this year depends on a constant value $\bar{\pi}$ with weight $1-\theta$, and partly on inflation last year with weight θ :

$$\pi_t^e = (1 - \theta)\bar{\pi} + \theta\pi_{t-1} \quad (8.5)$$

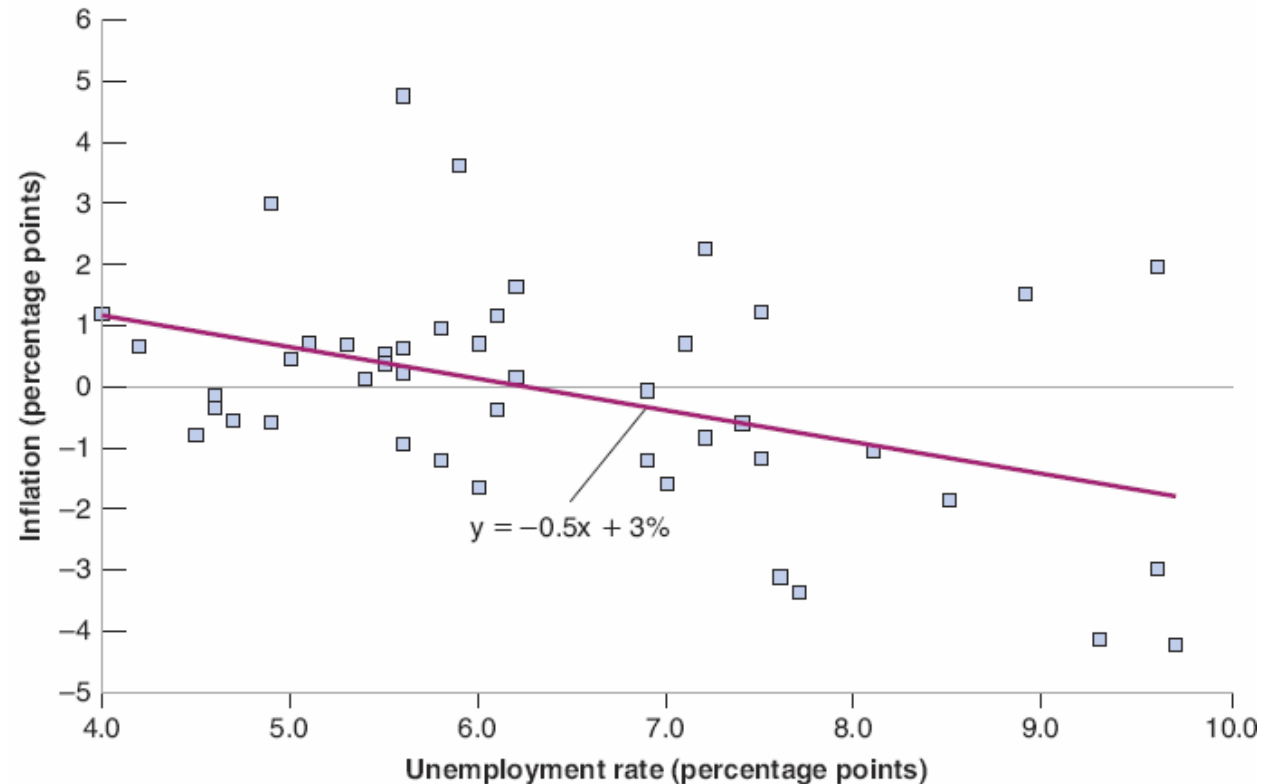
- When $\theta = 0$, $\pi_t = \bar{\pi} + (m + z) - \alpha u_t$
- When $\theta > 0$, $\pi_t = [(1 - \theta)\bar{\pi} + (m + z)] + \theta\pi_{t-1} - \alpha u_t$
- When $\theta = 1$, $\pi_t - \pi_{t-1} = (m + z) - \alpha u_t$, so the unemployment rate affects not the inflation rate, but rather the change in the inflation rate.

8-2 The Phillips Curve and Its Mutations

Figure 8-4 Change in Inflation versus Unemployment in the United States, 1974–2014

Since 1970, there has been a negative relation between the unemployment rate and the change in the inflation rate in the United States.

Series CPIAUCSL, UNRATE: Federal Reserve Economic Data (FRED)
<http://research.stlouisfed.org/fred2/>.



8-2 The Phillips Curve and Its Mutations

- The line that best fits the scatter of points in Figure 8-4 is:

$$\pi_t - \pi_{t-1} = 3.0\% - 0.5u_t \quad (8.7)$$

which is called the **modified Phillips curve**, or the **expectations-augmented Phillips curve**, or the **accelerationist Phillips curve**.

- We shall simply call equation (8.7) the Phillips curve, as opposed to the *original* Phillips curve (8.4).

8-3 The Phillips Curve and the Natural Rate of Unemployment

- Suppose $\pi = \pi^e$ and solve for u_n in equation (8.3):

$$u_n = \frac{m + z}{\alpha} \quad (8.8)$$

- Rewrite equation (8.3) as

$$\pi_t - \pi_t^e = -\alpha \left(u_t - \frac{m + z}{\alpha} \right)$$

so equation (8.8) can be rewritten as

$$\pi_t - \pi_t^e = -\alpha (u_t - u_n) \quad (8.9)$$

8-3 The Phillips Curve and the Natural Rate of Unemployment

- If π^e is well approximated π_{t-1} , then

$$\pi_t - \pi_{t-1} = -\alpha(u_t - u_n) \quad (8.10)$$

$$u_t < u_n \Rightarrow \pi > \pi_{t-1}$$

$$u_t > u_n \Rightarrow \pi < \pi_{t-1}$$

- So the natural rate of unemployment is also called the **non-accelerating inflation rate of unemployment (NAIRU)**.

FOCUS: Theory ahead of Facts: Milton Friedman and Edmund Phelps

- Milton Friedman and Edmund Phelps argued that the trade-off between inflation and unemployment in the late 1960s was an illusion.
- Accordingly, the Phillips curve is a temporary, rather than a permanent, trade-off between inflation and unemployment that comes not from inflation per se, but from a rise rate of inflation, which results in unanticipated inflation.

8-4 A Summary and Many Warnings

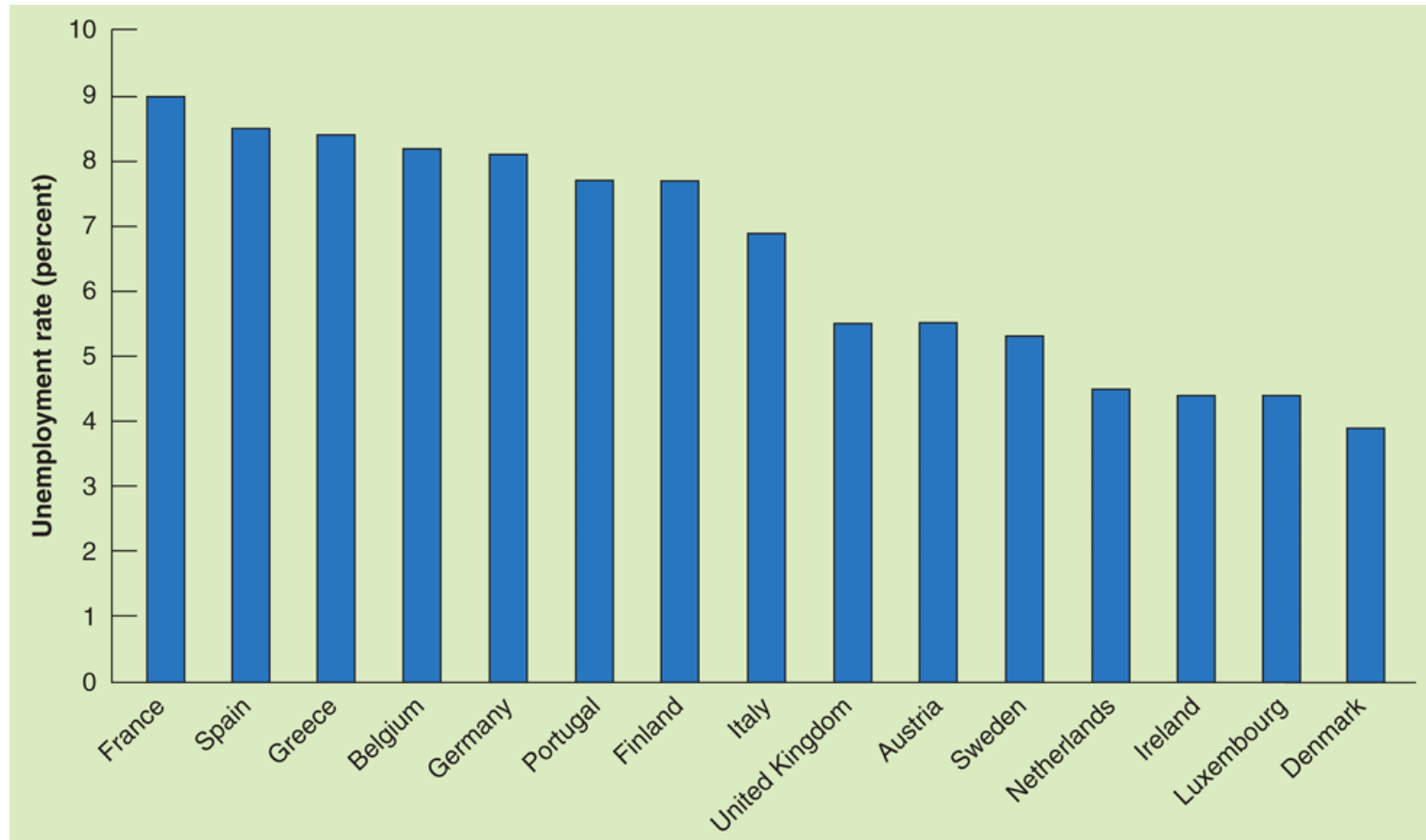
- The relation between unemployment and inflation in the United States today is well captured by a relation between the change in the inflation rate and the deviation of the unemployment rate from the natural rate of unemployment.
- When the unemployment rate is above (below) the natural rate of unemployment, the inflation rate typically decreases (increases).
- The natural rate of unemployment differ across countries due to, e.g., **labor-market rigidities**, and also over time.

FOCUS: What Explains European Unemployment?

- Factors for labor-market rigidities:
 - A generous system of unemployment insurance
 - A high degree of employment protection
 - Minimum wages
 - Bargaining rules, such as extension agreements
- Key facts of unemployment in Europe:
 - Unemployment was not always high
 - Some European countries actually had low unemployment prior to the start of the current crisis

FOCUS: What Explains European Unemployment?

Figure 1 Unemployment Rates in 15 European Countries, 2006



FOCUS: Changes in the U.S. Natural Rate of Unemployment since 1990

- Possible explanations for the decrease of the U.S. natural rate of unemployment from 7 to 8% in the 1980s to about 5% today:
 - Increased globalization and stronger competition between U.S. and foreign firms may have lowered the markup.
 - Increases in employment by temporary help agencies.
 - The aging U.S. population and a decrease in the proportion of young workers and thus the unemployment rate.
 - An increase in the incarceration rate.
 - The increase in the number of workers on disability.

8-4 A Summary and Many Warnings

- When the inflation rate becomes high, the terms of wage agreements tend to change with the level of inflation.
- **Wage indexation** is a provision that automatically increases wages in line with inflation.
- Suppose λ a proportion of labor contracts that is indexed, so nominal wages move one-for-one with changes in the actual price level, equation (8.9) becomes

$$\pi_t = [\lambda \pi_t + (1 - \lambda) \pi_{t-1}] - \alpha(u_t - u_n) \quad (8.11)$$

8-4 A Summary and Many Warnings

- When $\lambda=0$, equation (8.11) becomes equations (8.10).
- When $\lambda>0$, equation (8.11) becomes:

$$\pi_t - \pi_{t-1} = -\frac{\alpha}{(1 - \lambda)} (u_t - u_n)$$

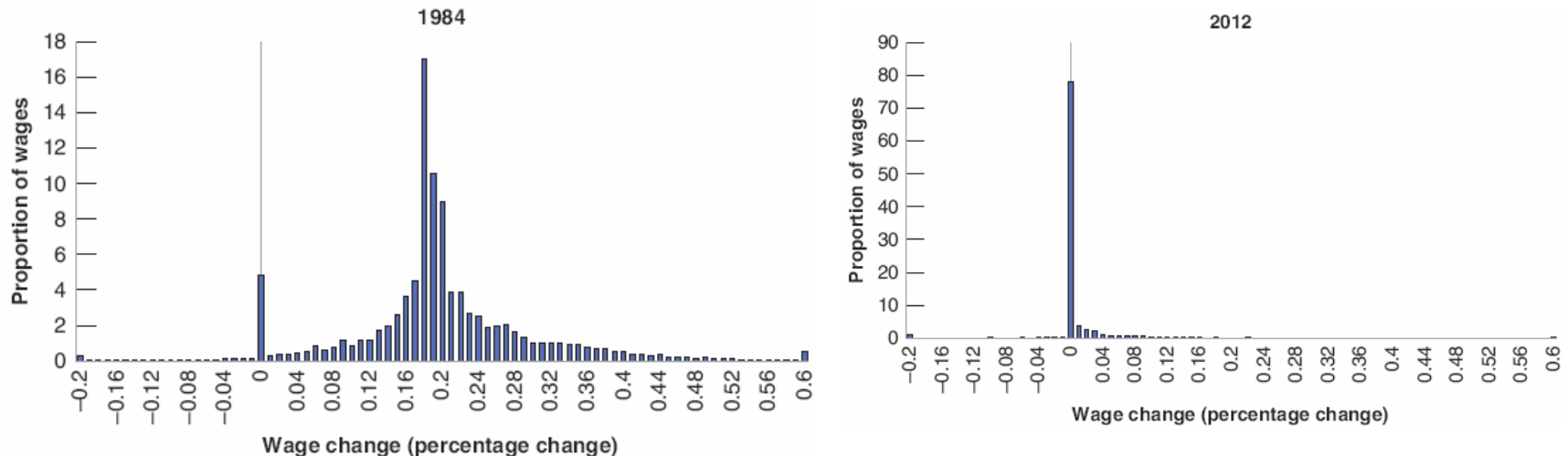
- *Wage indexation increases the effect of unemployment on inflation.*
- Without wage indexation, lower unemployment increases wages, which in turn increases prices.

8-4 A Summary and Many Warnings

- When low inflation or deflation occurs, the Phillips curve relation breaks down.
- One possible reason is the reluctance of workers to accept cuts in nominal wages.

8-4 A Summary and Many Warnings

Figure 8-5 Distribution of wage changes in Portugal, in times of high and low inflation



- In 1984, the inflation rate was 27%, and the distribution of wage wages was roughly symmetric.
- In 2012, the inflation rate was just 2.1%, and the distribution of wages was bunched at zero with nearly no negative wage changes.

APPENDIX: How to go from the Relation between the Price Level, the Expected Price Level, and Unemployment to a Relation between Inflation, Expected Inflation, and Unemployment

- Equation (8.1) with time subscripts becomes:

$$P_t = P_t^e(1 + m)(1 - \alpha u_t + z)$$

- Divide both sides by P_{t-1} :

$$\frac{P_t}{P_{t-1}} = \frac{P_t^e}{P_{t-1}}(1 + m)(1 - \alpha u_t + z) \quad (8A.1)$$

- Rewrite P_t/P_{t-1} as $1 + \pi_t$ and do the same for the expected inflation rate, equation (8A.1) becomes:

$$(1 + \pi_t) = (1 + \pi_t^e)(1 + m)(1 - \alpha u_t + z)$$

$$\frac{(1 + \pi_t)}{(1 + \pi_t^e)(1 + m)} = 1 - \alpha u_t + z$$

- If the left side is not large, it becomes $1 + \pi_t - \pi_t^e - m$ and so:

$$\pi_t = \pi_t^e + (m + z) - \alpha u_t$$

Exercise 2

2. Discuss the following statements.

- a. The Phillips curve implies that when unemployment is high, inflation is low, and vice versa. Therefore, we may experience either high inflation or high unemployment, but we will never experience both together.
- b. As long as we do not mind having high inflation, we can achieve as low a level of unemployment as we want. All we have to do is increase the demand for goods and services by using, for example, expansionary fiscal policy.
- c. In periods of deflation, workers resist reductions in their nominal wages in spite of the fact prices are falling.

Exercise 3

2. The medium-run equilibrium is characterized by four conditions:

Output is equal to potential output $Y = Y_n$.

The unemployment rate is equal to the natural rate $u = u_n$.

The real policy interest rate is equal to the natural rate of interest r_n where aggregate demand equals Y_n .

The expected rate of inflation π^e is equal to the actual rate of inflation π .

- a. If the level of expected inflation is formed so π^e equals $\pi(-1)$, characterize the behavior of inflation in a medium-run equilibrium.
- b. If the level of expected inflation is $\bar{\pi}$, what is the level of actual inflation in the medium-run equilibrium?
- c. Write the IS relation as $Y = C(Y - T) + I(Y, r + x) + G$. Suppose r_n is 2%. If x increases from 3 to 5%, how must the central bank change r_n to maintain the existing medium-run equilibrium. Explain in words.
- d. Suppose G increases. How must the central bank change r_n to maintain the existing medium-run equilibrium? Explain in words.
- e. Suppose T decreases. How must the central bank change r_n to maintain the existing medium-run equilibrium? Explain in words.
- f. Discuss: In the medium run, a fiscal expansion leads to an increase in the natural rate of interest.