ECON 421: Business Fluctuations

Spring 2015
Tu 6:00PM–9:00PM
Section 102

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Based on
Macroeconomics, **?**

Preface

This material is somewhat more mathematical than usual. The chapter consider 2 contrasting views on the fundamental relationship between inflation and unemployment.

- The Original Phillips Curve and
- The Modified Phillips Curve.

Since each view exploits a different set of mathematical relationships, I recommend spending time thinking about why it is important to consider both views. Why didn't the book just present one of these views?

Origin of the Name

- In 1958, A. W. Phillips drew a diagram plotting the rate of inflation against the rate of unemployment in the United Kingdom for each year from 1861 to 1957.
- He found clear evidence of a negative relation between inflation and unemployment.

Inflation, Expected Inflation, and Unemployment

In order to derive the relationship between inflation and unemployment, we convert the AS relation from *levels* (P) to *rates of change* (π). Use the following:

- Let $F(\underset{-}{u}, \underset{+}{z})$ relationship:
  $F(\underset{-}{u}, \underset{+}{z}) = 1 - \alpha u_t + z$,
- Inflation is $\pi_t = \frac{P_t - P_{t-1}}{P_{t-1}}$ and note that $\frac{P_t}{P_{t-1}} = 1 + \pi_t$,
- $(1+x)(1+y) \approx 1 + x + y$ and $\frac{1+x}{1+y} \approx 1 + x - y$ for small x and y. (Since xy and y^2 are small.)
- And recall,

$$\left(\begin{array}{c} Firms\ set \\ prices\ so\ that \\ wages\ are \\ \frac{1}{1+m}\ below \\ prices. \end{array}\right) = W = \left(\begin{array}{c} Wages \\ depend \\ on\ P^e, \\ u, and\ z. \end{array}\right)$$

$$P\left(\frac{1}{1+m}\right) = W = \underset{+}{P^e} F(\underset{-}{u}, \underset{+}{z})$$

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$$AS \rightarrow P_t = P_t^e (1+m) F(u, z)$$

$$\frac{P_t}{P_{t-1}} = \frac{P_t^e}{P_{t-1}} (1+m) F(u, z)$$

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

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

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

$$Phillips\ Curve \rightarrow \pi_t \approx \pi_t^e + m + z - \alpha u_t$$

Implications of the Phillips Curve

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

- An increase in expected inflation, π_t^e, leads to an increase in actual inflation, π_t.
- Given expected inflation[1], π_t^e, an increase in the markup m, or an increase in the factors that affect wage determination, z, leads to an increase in inflation, π_t.
- Given expected inflation, π_t^e, an increase in the unemployment rate u leads to a decrease in inflation π_t.

[1] i.e. supposing it is fixed.

The Original Phillips Curve

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

Imagine an economy where inflation, π_t^e,

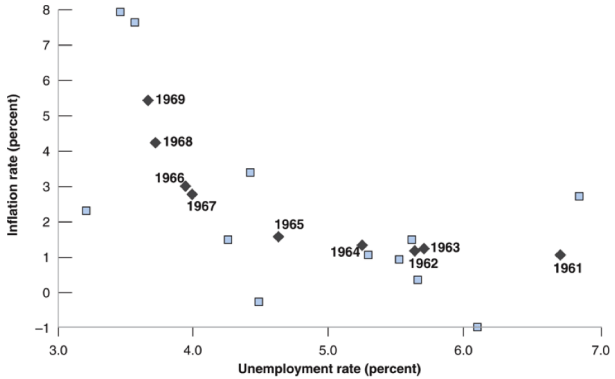
- is positive in some years,
- negative in others, and
- is on average equal to zero.

With the average inflation rate equal to zero in the past, it is reasonable for wage setters to expect that inflation will be equal to zero over the next year as well ($\pi_t^e = 0$).

$$\pi_t = m + z - \alpha u_t$$

Inflation versus Unemployment in the United States, 1948–1969

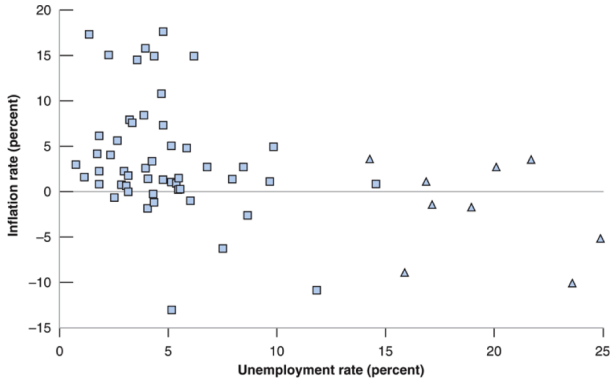
- During the 1960s, U.S. macroeconomic policy was aimed at maintaining unemployment in the range that appeared consistent with moderate inflation.
- The negative relation between unemployment and inflation provided a reliable guide to the joint movements in unemployment and inflation.



CPIAUSCL Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

Inflation Versus Unemployment in the United States, 1900–1960

- During the longer 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.



the United States. http://hsus.cambridge.org/HSUSWeb/index.do

The Natural Rate of Unemployment

In order to derive the natural rate of unemployment using the Original Phillips Curve, solve for the unemployment rate when the expected inflation rate equals the actual inflation rate.

$$\begin{aligned} \pi_t &= \pi_t^e + m + z - \alpha u_t \\ 0 &= m + z - \alpha u_t \\ \alpha u_t &= m + z \\ u_t &= \frac{m+z}{\alpha} \end{aligned}$$

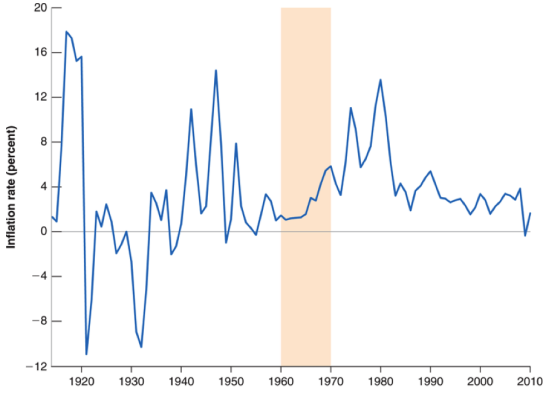
Price-Wage Spiral

Suppose low unemployment leads to a higher nominal wage.

- In response to the higher nominal wage, firms increase their prices. The price level increases.
- In response to the higher price level, workers ask for a higher nominal wage the next time the wage is set.
- The higher nominal wage leads firms to further increase their prices. As a result, the price level increases further.
- In response to this further increase in the price level, workers, when they set the wage again, ask for a further increase in the nominal wage.
- And so the race between prices and wages results in steady wage and price inflation.

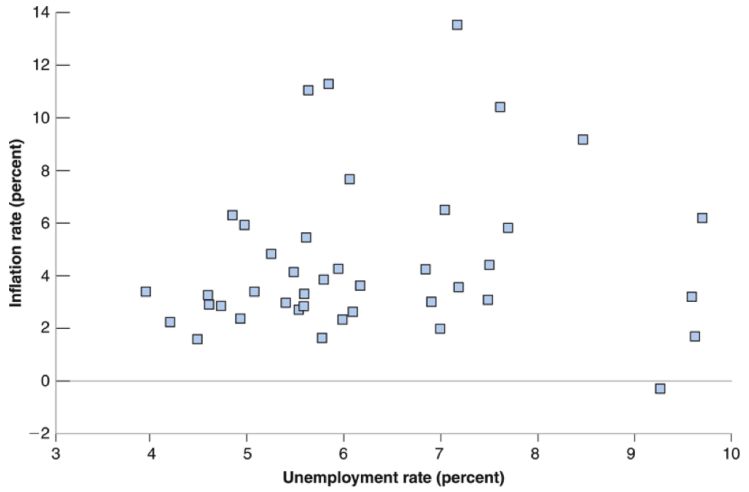
Inflation Over Time in the US

- Since the 1960s, the U.S. inflation rate has been consistently positive.
- Inflation has also become more persistent: A high inflation rate this year is more likely to be followed by a high inflation rate next year.



Source: Years 1900–1914, Historical Statistics of the United States, Millennial Edition Online, Cambridge University Press, 2006. After 1914: Series CPIAUNS, Federal Reserve Economic Data (FRED) http://research.stlouisfed.org/fred2/

Inflation Versus Unemployment in the United States, 1970–2010



Source: See Figure 8-2.

$\pi_t^e \neq 0$

Suppose that $\pi_t^e = \theta\pi_{t-1}$

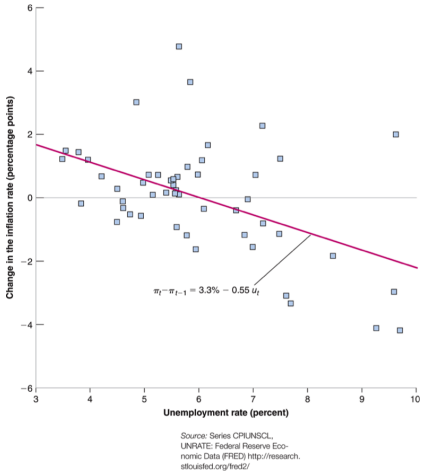
- As inflation became persistent in the 70s, workers and firms started changing the way they formed expectations.
- They started assuming that if inflation had been high last year, inflation was likely to be high this year as well.
- The parameter θ, the effect of last year's inflation rate on this year's expected inflation rate, increased.
- The evidence suggests that, by the mid-1970s, people expected this year's inflation rate to be the same as last year's inflation ratein other words, that θ was equal to 1.

$$\pi_t = \theta\pi_{t-1} + m + z - \alpha u_t$$

So, when $\theta = 1$, the unemployment rate affects not the inflation rate, but rather the *change in the inflation rate*: High unemployment leads to decreasing inflation; low unemployment leads to increasing inflation.

$$\pi_t - \pi_{t-1} = m + z - \alpha u_t$$

Change in Inflation versus Unemployment in the US, 1970–2010



$$\pi_t - \pi_{t-1} = m + z - \alpha u_t$$

The Modified Phillips Curve

$$\pi_t - \pi_{t-1} = m + z - \alpha u_t$$

This version of the Phillips curve is known, interchangeably as

- The **modified Phillips curve**,
- The **expectations-augmented Phillips curve** (to indicate that pt - 1 stands for expected inflation), or
- The **accelerationist Phillips curve**.

Using the modified Phillips Curve, the natural rate of unemployment is is the rate of unemployment required to keep the inflation rate constant. As before, this is

$$u_t = \frac{m + z}{\alpha}.$$

This is also called the non-accelerating inflation rate of unemployment, or **NAIRU**.

The Neutrality of Money, Revisited

Let g_M represent the growth in the money supply.

$$\pi = g_M$$

- This relation tells us that in the medium run, the rate of inflation is determined by the rate of money growth.
- *Inflation is always and everywhere a monetary phenomenon.* –Milton Friedman
- As we have seen, factors such
  - as the monopoly power of firms,
  - strong unions,
  - strikes,
  - fiscal deficits, and
  - increases in the price of oil

  do affect the price level and, by implication, do affect inflation in the short run. But, unless they affect the rate of money growth, they have no effect on inflation in the medium run.

Practice Problem

Suppose that the Phillips curve is given by

$$\pi_t = \pi_t^e + 0.1 - 2u_t$$

Assume $\pi_t = \theta\pi_{t-1}^e$ and suppose that θ is initially equal to 0. Suppose that the rate of unemployment is initially equal to the natural rate. In year t, the authorities decide to bring the unemployment rate down to 3% and hold it there forever.

1. What is the natural rate of unemployment?
2. Determine the rate of inflation in years t, $t+1$, $t+2$, and $t+5$.
3. Do you believe the answer given in (2)? Why or why not? (Hint: Think about how people are likely to form expectations of inflation.)

Now suppose that in year $t+5$, u increases from 0 to 1. Suppose that the government is still determined to keep u at 3% forever.

4. Why might u increase in this way?
5. What will the inflation rate be in years t + 5, t + 6, and t+7?
6. Do you believe the answer given in (5)? Why or why not?

References