

# Monetary policy

## 2. The Phillips curve

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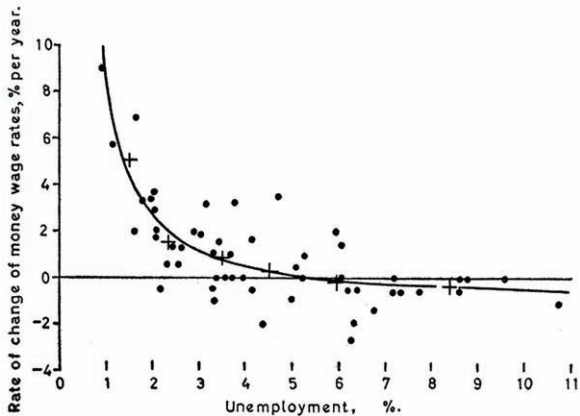
# The original Phillips curve

- The original Phillips curve was derived in a study for the UK (Phillips, 1958) that showed that there was a negative relation between **unemployment** and **nominal wage growth**
- This suggested that **lower** unemployment could only be achieved with **higher** nominal wage growth
- In other words, there would be a **trade-off** between nominal wage growth and unemployment

# The original Phillips curve

Figure: Phillips (1958)

1861–1913



# Deriving the original Phillips curve

- The original Phillips curve can be derived from a model with wage indexation. Suppose that the production function is given by:

$$Y_t = F(L_t)$$

- If we assume competitive firms, with flexible prices, then they will set the wages so that the marginal product of labour equals the real wage:

$$F'(L_t) = \frac{W_t}{P_t}$$

# Deriving the original Phillips curve

Suppose that wages are set with indexation to the previous period price level ( $P_{t-1}$ ):

$$W_t = AP_{t-1}, A > 0$$

then:

$$F'(L_t) = \frac{W_t}{P_t} = \frac{AP_{t-1}}{P_t} = \frac{A}{1 + \pi_t} \quad (1)$$

Where inflation is given by  $\pi_t = \frac{P_t}{P_{t-1}} - 1$

As  $F'(L_t)$  is positive but declining with employment ( $F''(L) \leq 0$ ), there is an upward sloping relation between employment (and therefore output) and inflation.

# The modern Phillips curve

The modern Phillips curve can be written as:

$$\pi_t = \pi_t^e - \beta(u_t - u_t^n) + v_t$$

where:

- $\pi$  -inflation
- $\pi^e$  - expected inflation
- $u$ - unemployment
- $(u_t - u_t^n)$  - the deviation of unemployment from its natural rate
- $v$  - supply shocks
- $\beta > 0$  - sensitivity of inflation to cyclical unemployment  $(u_t - u_t^n)$

# Differences relative to the original Phillips curve

- The crucial difference of the modern Phillips curve is the role given to **inflation expectations** (due to Friedman(1968) and Phelps(1968))
- The Phillips curve can be written in terms of output as:

$$\pi_t = \pi_t^e + \beta(\ln Y_t - \ln Y_t^n) + v_t$$

where  $Y_t^n$  is the level of output that would prevail with flexible prices (natural rate of output, potential or full employment output)



# Phillips curve with adaptive expectations - the NAIRU

When the process of expectations formation is of the adaptive type, it is usual to call the natural rate of unemployment the **NAIRU (Non-Accelerating Inflation Rate of Unemployment)**.

To see why, suppose that inflation expectations equal the previous period inflation rate:

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

Then the Phillips curve is given by:

$$\pi_t = \pi_{t-1} - \beta(u_t - u_t^n) + v_t$$

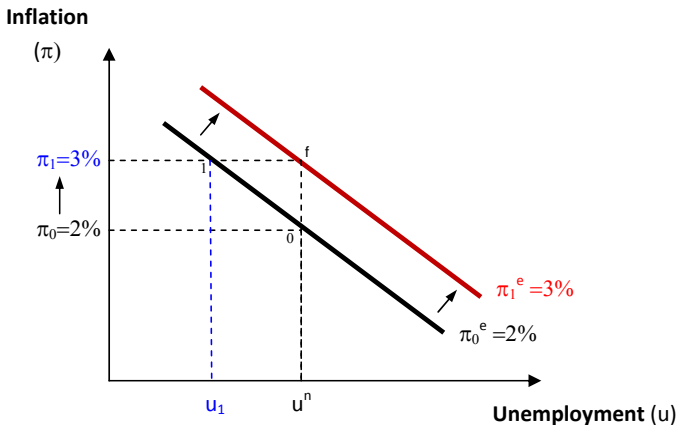
Clearly, assuming  $v_t = 0$ , inflation will not increase as long as  $u_t = u_t^n$ , so  $u_t^n$  is the NAIRU.

# Differences relative to the original Phillips curve

- **Expected inflation** is crucial for the relation
- The trade-off between inflation and unemployment only occurs in the **short run**.
- In the **long-run** it is not possible to reduce unemployment by raising inflation as the process governing inflation expectations will also adjust (*Lucas critique*). This provides support to **price stability** as a policy objective.

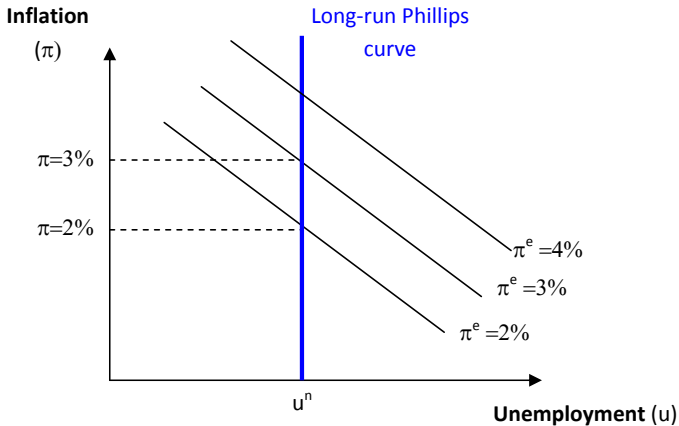
# The short-run Phillips curve

**Figure:** A surprise rise in inflation reduces unemployment, but only temporarily



# The Phillips curve in the long-run: no trade-off

Figure: Unemployment converges to the natural rate in the long-run



# The hybrid Phillips curve

The modern version of the Phillips curve recognizes both the existence of backward-looking and forward looking elements in the process governing inflation:

$$\pi_t = \phi E_t(\pi_{t+1}) + (1 - \phi)\pi_{t-1} + \lambda(\ln Y_t - \ln Y_t^n) + v_t, 0 \leq \phi \leq 1$$

The hybrid Phillips curve can be derived from micro-foundations

# Difficulties in using the Phillips curve

In practice, there are difficulties in using the concepts of the natural rate of unemployment or of the NAIRU:

- Difficult to derive from Phillips curves due to **supply shocks or other effects** (e.g. monetary policy, globalization)
- The natural rate **may change** over time (due to demographic changes or labour market frictions)
- Some macroeconomic shocks can have long-lasting consequences - **hysteresis**:
  - Periods of high unemployment may discourage job search and lead to higher structural unemployment.
  - Insider-outsider issues - those who retain jobs may push real wages too high keeping outsiders out of job

# The euro area unemployment-inflation trade-off

**Figure:** Inflation and unemployment in the euro area, quarterly data (1970-2011)

