

Inflation and Unemployment

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Econ520

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Objectives

This section is about the trade-off between inflation and unemployment.

In this section you will learn:

1. How and when expansionary monetary policy reduces **unemployment**.
2. When does it generate **inflation** instead.
3. The importance of **expectations** for monetary policy.

The Question

Monetary policy stimulates aggregate demand.

Why not always use it gain more employment / output?

Answer: Lax monetary policy creates inflation.

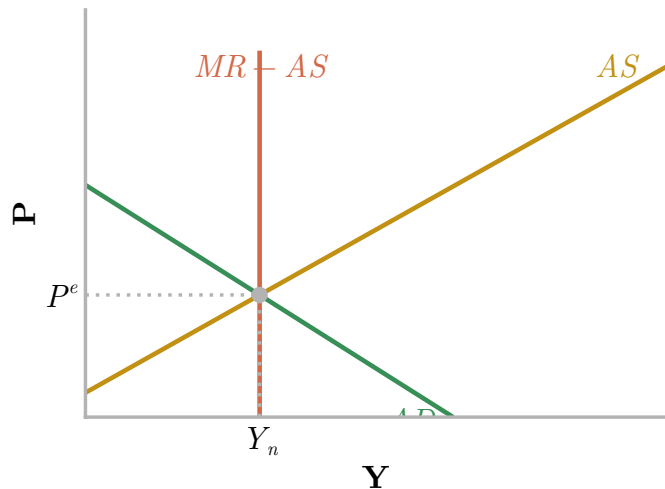
Key issue

Can we buy more employment with more inflation?

What do the data show?

And what does the AS/AD model predict?

Higher inflation \Rightarrow more output?



What happens if the Fed keeps shifting AD out?

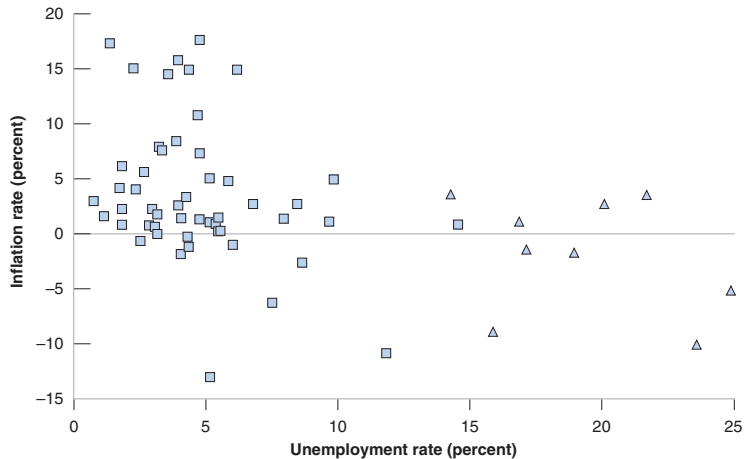
Model Prediction

The Fed can buy higher output with higher inflation.

Intuition...

Is the intuition plausible?

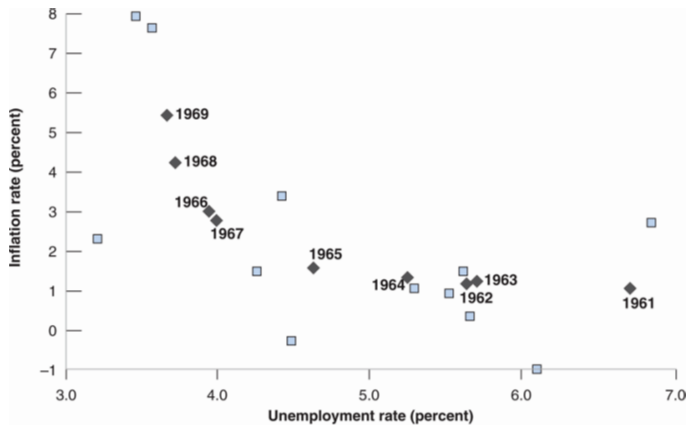
The Data: 1900-1960



High inflation seems associated with low unemployment.

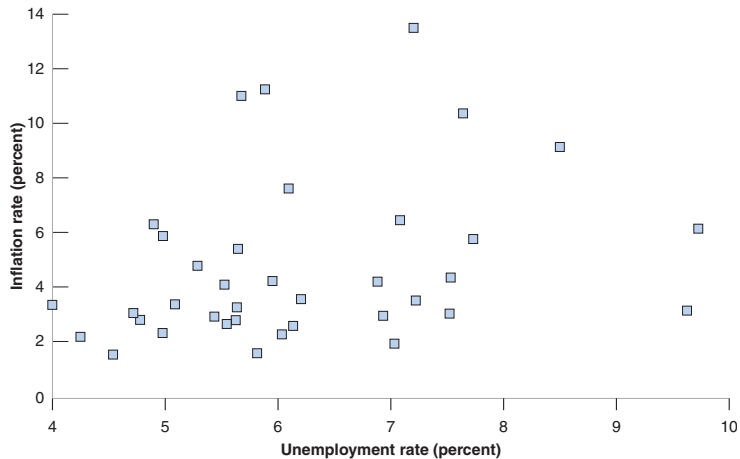
► “Phillips Curve”

The Data: 1960s



The 1960s are especially clear.

Modern Data: 1970-2010



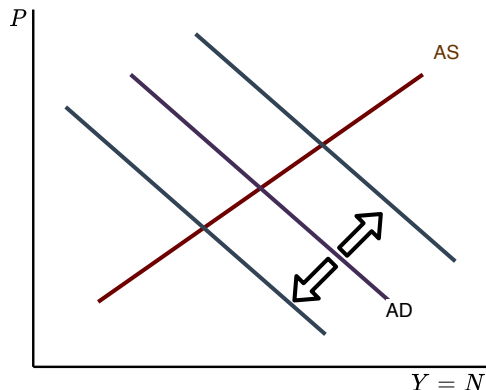
Breakdown of the Phillips Curve

Phillips Curve: Intuition

Assume that economic fluctuations are mostly driven by *AD* shocks.

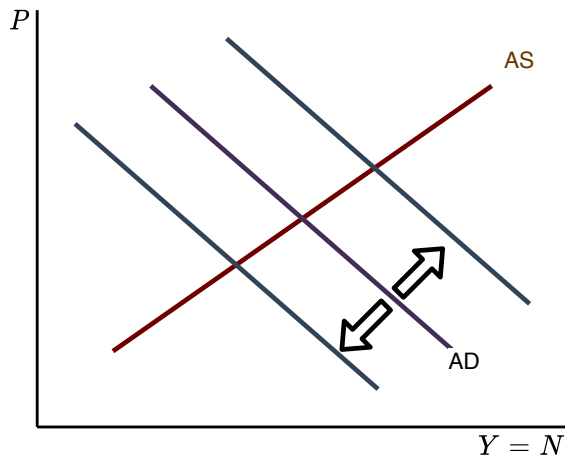
- ▶ The *AS* curve is stable over time.

Then we get a positive correlation between inflation and unemployment.



Phillips Curve: Intuition

How does the analysis change when the price changes are expected?



Why Might the Phillips Curve Break Down?

We know: only **unanticipated** inflation increases output

$$Y^s = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (1)$$

A natural idea:

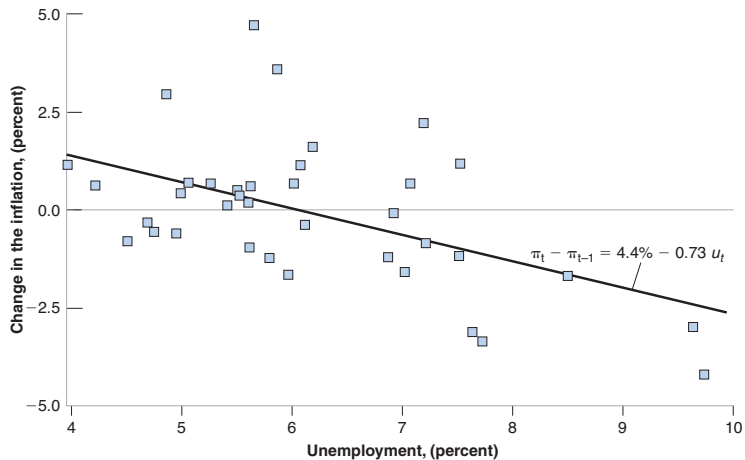
- ▶ up to the 1960s inflation was unanticipated
- ▶ afterwards it was anticipated and hence did not affect output

We need a measure of **unanticipated inflation**.

A simple measure: the change of the inflation rate

- ▶ Can we buy more output by **raising** inflation?

The New Phillips Curve: 1970-2010



Rising inflation – low unemployment

Summary

Until 1960

- ▶ higher inflation was associated with lower unemployment

After 1960

- ▶ rising inflation was associated with lower unemployment

Questions:

1. Why the change?
2. Can we buy persistently higher employment with ever rising inflation?

2. Theory Underlying the Phillips Curve

Deriving the Phillips Curve

We derive a Philips Curve of the form

$$\pi = \pi^e + (m + z) - \alpha u \quad (2)$$

In words:

- ▶ holding fixed π^e : there is a stable Philips Curve
inflation and unemployment are negatively related
- ▶ in general: there is a “modified” Philips Curve that relates **unexpected inflation**
to unemployment

Key point: The Phillips Curve is just AS rewritten.

Deriving the Philips Curve

Start from aggregate supply

$$Y^s = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (3)$$

In words:

- Output is high (above Y_n) when $P > P^e$

Equivalent: Y is high when there is **unanticipated inflation**:

$$Y^s = F\left(\frac{1+\pi}{1+\pi^e} \frac{1}{1+m}, z\right) \quad (4)$$

- $\pi_t \equiv (P_t - P_{t-1}) / P_{t-1}$: **actual** inflation rate
- $\pi_t^e \equiv (P_t^e - P_{t-1}) / P_{t-1}$: **expected** inflation rate

Anticipated inflation does not matter

- It is built into wage contracts.

Deriving the Phillips Curve

Unemployment is low when output is high.

Therefore:

- Unemployment is low when there is unanticipated inflation

Or in simple linear form:

$$\pi - \pi^e = (m + z) - \alpha u \quad (5)$$

$-\alpha$ is the slope of the Phillips Curve.

► Details

The Phillips Curve shifts around over time as labor market conditions $(m + z)$ change.

Implications

$$\pi - \pi^e = (m + z) - \alpha u \quad (6)$$

1. $\pi^e \uparrow$: Need higher π to support the same u

Intuition:

1. $m \uparrow$: $u \uparrow$ for given π, π^e

Intuition:

2. Given π^e , we have a Phillips curve ($u \uparrow \implies \pi \downarrow$)

Intuition:

Policy Implications

Can governments exploit the Phillips Curve?

A key result that is central for all of monetary policy

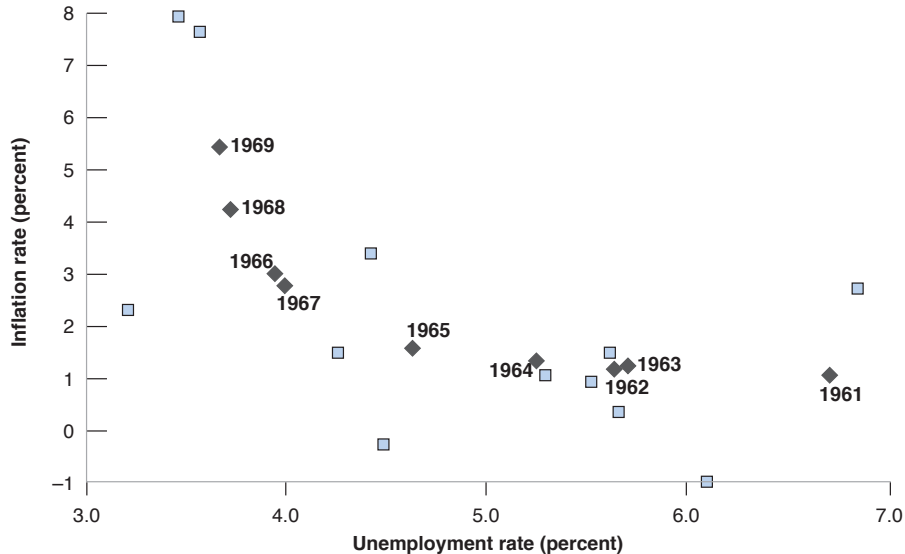
For money to be non-neutral, inflation must be **unexpected**

This is the key difficulty of monetary policy.

Simply raising inflation every year cannot work.

3. The Phillips Curve Through Time

The 1950s and 60s



The economy moves up along a stable Phillips Curve

Interpretation

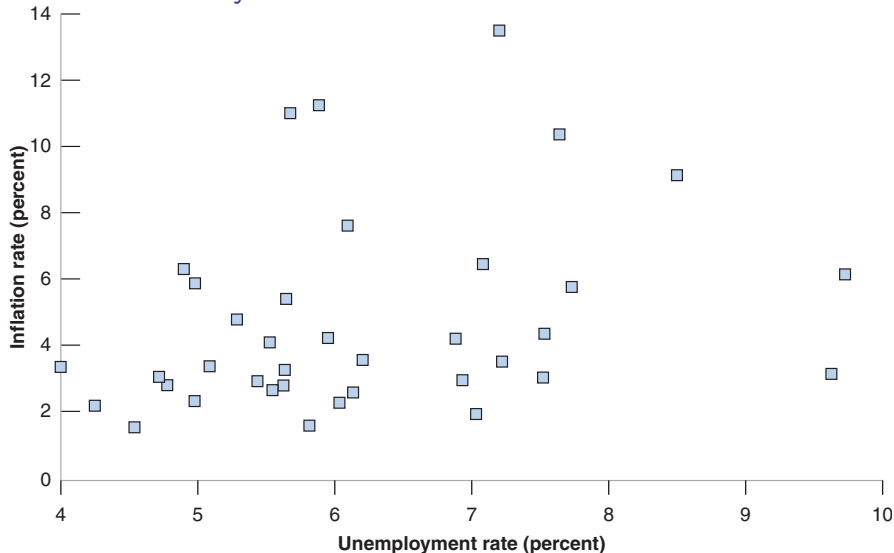
Inflation had been stable for a long time

π^e remained roughly fixed

Then the original Phillips curve emerges

$$\pi = \underbrace{\pi^e}_{\text{fixed}} + (m + z) - \alpha u \quad (7)$$

The 1970s and Beyond

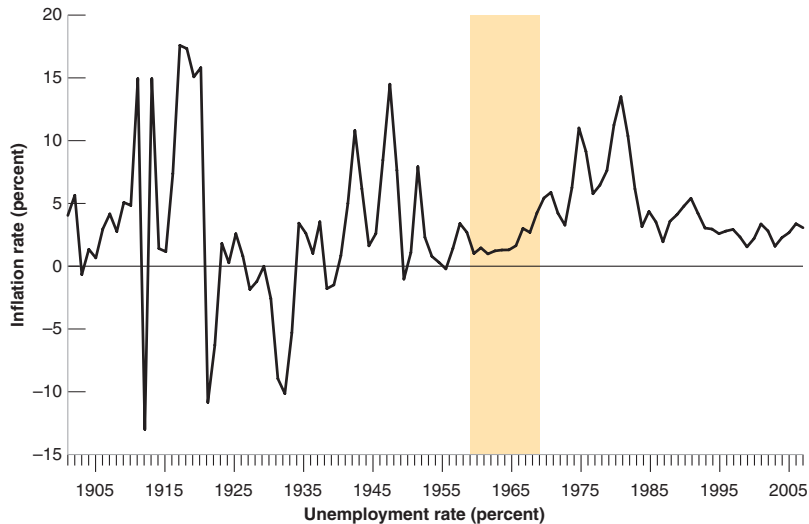


No relationship between inflation and unemployment

Interpretation

- ▶ A change in inflation expectations.
- ▶ Before the 1960s: inflation fluctuated around 0
 - ▶ little persistence
- ▶ It was reasonable to expect roughly zero inflation
- ▶ After 1960s: inflation was generally positive
 - ▶ strong persistence
- ▶ Zero inflation would have been a poor forecast

Inflation Rates



Low persistence pre 1960. Past inflation is a poor predictor.

Modified Phillips Curve

Assume that agents form expectations according to

$$\pi_t^e = \theta \pi_{t-1} \quad (8)$$

Of course, one could do better than that...

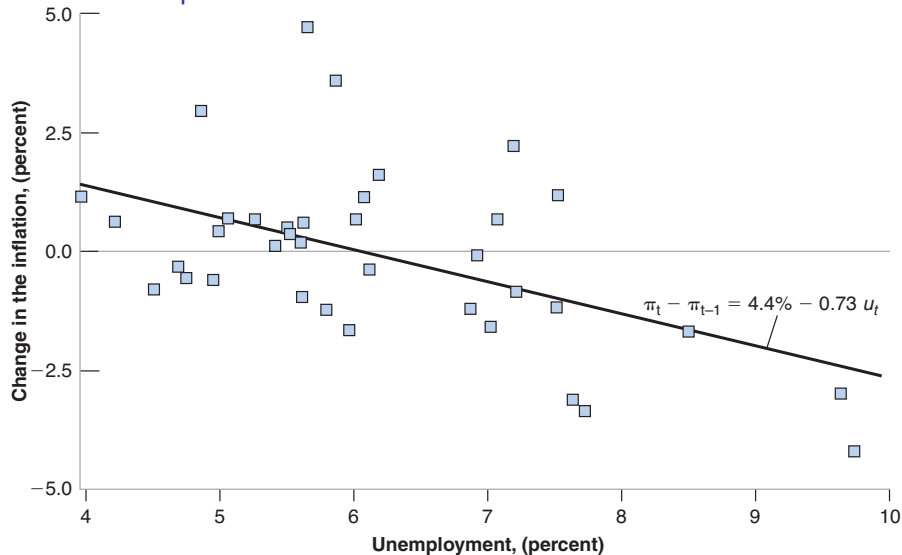
A coarse approximation:

- ▶ 1960s: $\theta = 0$
- ▶ 1970s: $\theta = 1$

Modified Phillips Curve

$$\pi_t - \pi_{t-1} = (m + z) - \alpha u_t \quad (9)$$

Modified Phillips Curve



Note: Change in inflation on the vertical axis.

Implications

- ▶ Original Phillips Curve:
 - ▶ government can buy lower unemployment by raising inflation **once**
 - ▶ intuition: wage setters never catch on to the fact that tomorrow's prices will be higher than today's
- ▶ Modified Phillips Curve:
 - ▶ government can buy lower unemployment by raising inflation **again and again**
 - ▶ intuition: wage setters never catch on to the fact that tomorrow's inflation will be higher than today's
- ▶ Clearly, this can't work either (at least not forever)

NAIRU

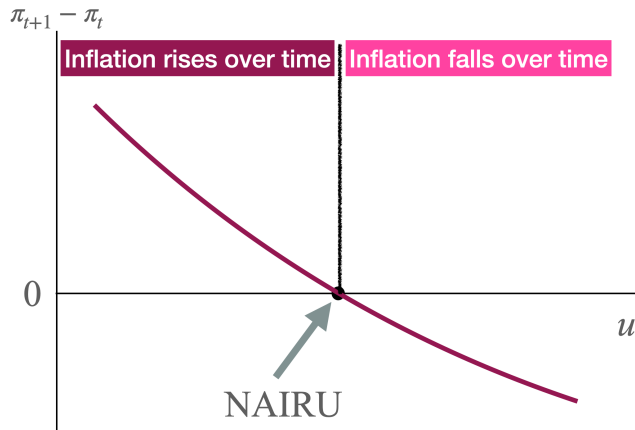
The modified Phillips Curve implies:

- ▶ Only one unemployment rate is consistent with constant inflation
- ▶ The **level** of inflation does not matter

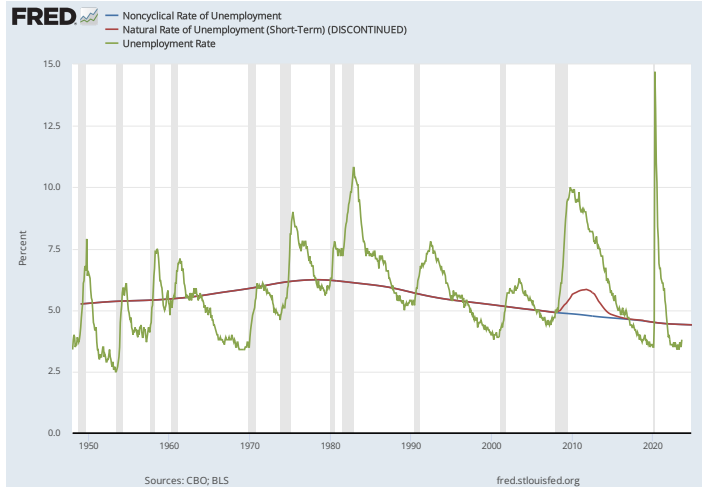
NAIRU: “Non-accelerating inflation rate of unemployment”

- ▶ the point where the modified PC crosses 0
- ▶ “full employment”

NAIRU



NAIRU In the Data



Source: FRED

Review

NAIRU is the rate of unemployment arising from all sources except fluctuations in aggregate demand. – FRED

Does this make sense? What does it say?

Review

[NAIRU] is used to gauge the amount of current and projected slack in labor markets, which is a key input into CBO's projections of inflation. – FRED

What does this say in English?

Reading

Text: Blanchard, Macroeconomics:

- ▶ 6th through 8th ed., ch. 8

Deriving the Phillips Curve I

Start from aggregate supply

$$Y^s = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (10)$$

Divide by last period's prices:

$$\frac{P}{P^e} = \frac{P}{P_{-1}} \frac{P_{-1}}{P^e} = \frac{1+\pi}{1+\pi^e} \quad (11)$$

- ▶ $\pi \equiv (P - P_{-1})/P_{-1}$: **actual** inflation rate
- ▶ $\pi^e \equiv (P^e - P_{-1})/P_{-1}$: **expected** inflation rate

Deriving the Phillips Curve II

The Philips Curve is now

$$Y^s = F\left(\frac{1+\pi}{1+\pi^e} \frac{1}{1+m}, z\right) \quad (12)$$

In words:

- ▶ For P to pull ahead of P^e by 5%, we need 5% unanticipated inflation
- ▶ I.e.: $\pi = \pi^e + 5\%$
- ▶ Or $\frac{1+\pi}{1+\pi^e} = 1.05$

Deriving the Phillips Curve III

Approximately

$$\frac{1 + \pi}{1 + \pi^e} \approx 1 + \pi - \pi^e \quad (13)$$

Example:

$$\pi = 0.05, \pi^e = 0.03 \implies \frac{1 + \pi}{1 + \pi^e} - 1 = 0.0194 \approx 0.02 \quad (14)$$

$$Y^s = F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) \quad (15)$$

In words:

- ▶ AS supply rises when prices are higher than expected
- ▶ or when inflation is higher than expected

Deriving the Phillips Curve IV

Anticipated inflation is built into wage demands

- ▶ it is “neutral” (does not affect real AS)

Next step: translate changes in Y^S into changes in unemployment.

Relationship with unemployment I

$$u = \frac{L - N}{L} = 1 - \frac{N}{L} \quad (16)$$

where:

- ▶ u : unemployment rate
- ▶ N : employment
- ▶ L : labor force

Relationship with unemployment II

In words:

unemployment rate = 1 - employment rate.

Recall the aggregate production function:

$$Y/L = N/L = 1 - u \quad (17)$$

or

$$u = 1 - Y/L = 1 - F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) / L \quad (18)$$

$$u = 1 - F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) / L \quad (19)$$

Relationship with unemployment III

Take a linear approximation:

$$u = \beta_m m + \beta_z z - \beta_\pi (\pi - \pi^e) \quad (20)$$

But typically the Phillips curve is written as:

"inflation is a decreasing function of unemployment"

$$\pi - \pi^e = \frac{\beta_m m + \beta_z z - u}{\beta_\pi} \quad (21)$$

Or even simpler:

$$\pi = \pi^e + (m + z) - \alpha u \quad (22)$$