# Inflation and Unemployment

Prof. Lutz Hendricks

Econ520

August 25, 2025

## **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.

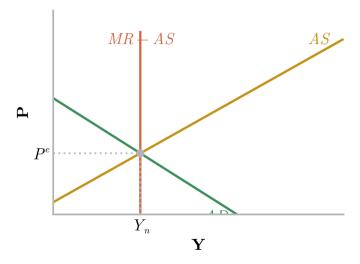
### Key issue

Can we buy more employment with more inflation?

What do the data show?

And what does the AS/AD model predict?

# Higher inflation $\implies$ more output?



What happens if the Fed keeps shifting AD out?

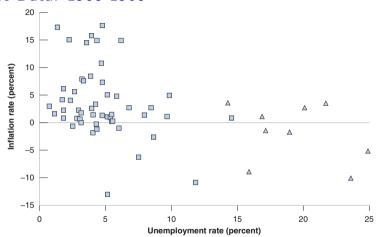
#### Model Prediction

The Fed can buy higher output with higher inflation.

Intuition...

Is the intuition plausible?

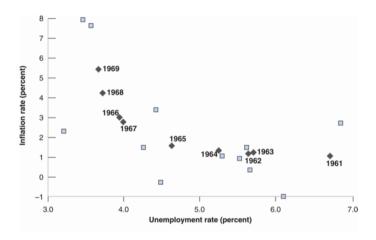
#### The Data: 1900-1960



High inflation seems associated with low unemployment.

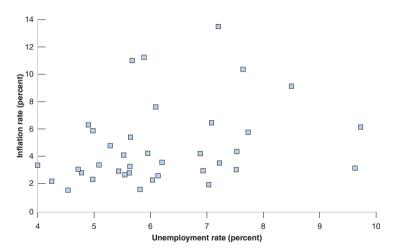
"Phillips Curve"

#### The Data: 1960s



The 1960s are especially clear.

### Modern Data: 1970-2010



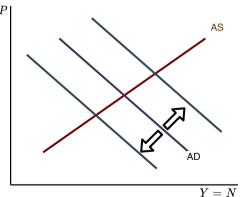
Breakdown of the Phillips Curve

### Phillips Curve: Intuition

Assume that economic fluctuations are mostly driven by AD shocks.

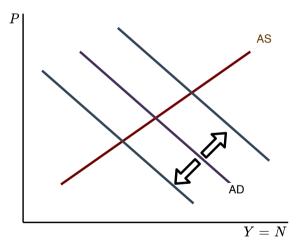
► The AS curve is stable over time.

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

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

A natural idea:

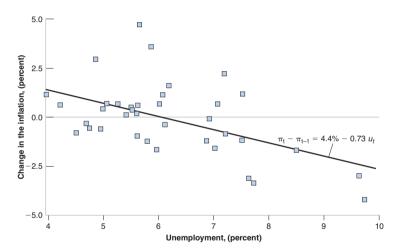
- ▶ up to the 1960s inflation was unanticipated
- afterwards it was anticipated and hence did not affect output

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 be 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

$$\pi = \pi^e + (m+z) - \alpha u \tag{2}$$

#### In words:

- holding fixed  $\pi^e$ : 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

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

In words:

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

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

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

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

$$\pi - \pi^e = (m+z) - \alpha u \tag{5}$$

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



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

# **Implications**

$$\pi - \pi^e = (m+z) - \alpha u \tag{6}$$

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

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

2. Given  $\pi^e$ , we have a Phillips curve  $(u \uparrow \Longrightarrow \pi \downarrow)$  Intuition:

### Policy Implications

Can governments exploit the Phillips Curve?

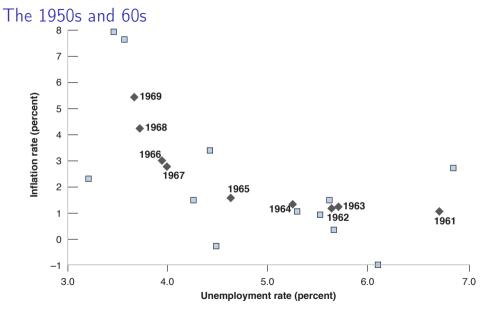
A key result that is central for all of monetary policy

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



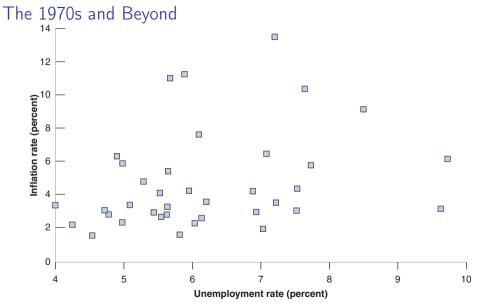
The economy moves up along a stable Phillips Curve

#### Interpretation

Inflation had been stable for a long time  $\pi^e$  remained roughly fixed

Then the original Phillips curve emerges

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

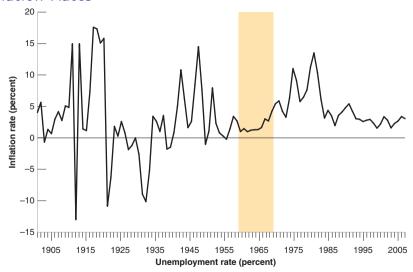


No relationship between inflation and unemployment

#### 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

$$\pi_t^e = \theta \pi_{t-1} \tag{8}$$

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

A coarse approximation:

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

Modified Phillips Curve

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

## Modified Phillips Curve 5.0 Change in the inflation, (percent) 2.5 0.0 **%** . $-\pi_{t-1} = 4.4\% - 0.73 u_t$ 2.5 -5.05 10

Unemployment, (percent)

Note: Change in inflation on the vertical axis.

### **Implications**

- Original Phillips Curve:
  - government can buy lower unemployment by raising inflation
  - 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 over time
  - 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)

# Reading

Text: Blanchard, Macroeconomics:

▶ 6th through 8th ed., ch. 8

# Deriving the Phillips Curve I

Start from aggregate supply

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

Divide by last period's prices:

$$\frac{P}{P^e} = \frac{P}{P_{-1}} \frac{P_{-1}}{P^e} = \frac{1+\pi}{1+\pi^e} \tag{11}$$

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

# Deriving the Phillips Curve II

The Philips Curve is now

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

$$\frac{1+\pi}{1+\pi^e} \approx 1+\pi-\pi^e \tag{13}$$

Example:

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

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

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

$$u = \frac{L - N}{L} = 1 - \frac{N}{L} \tag{16}$$

#### 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:

$$Y/L = N/L = 1 - u \tag{17}$$

or

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

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

## Relationship with unemployment III

Take a linear approximation:

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

But typically the Phillips curve is written as: "inflation is a decreasing function of unemployment"

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

Or even simpler:

$$\pi = \pi^e + (m+z) - \alpha u \tag{22}$$