

# Inflation and Unemployment

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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.

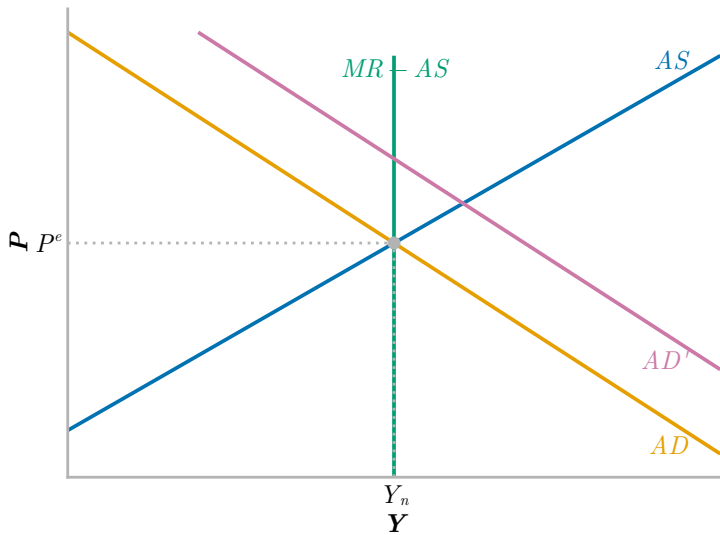
## Key issue

Can we buy more employment with more inflation?

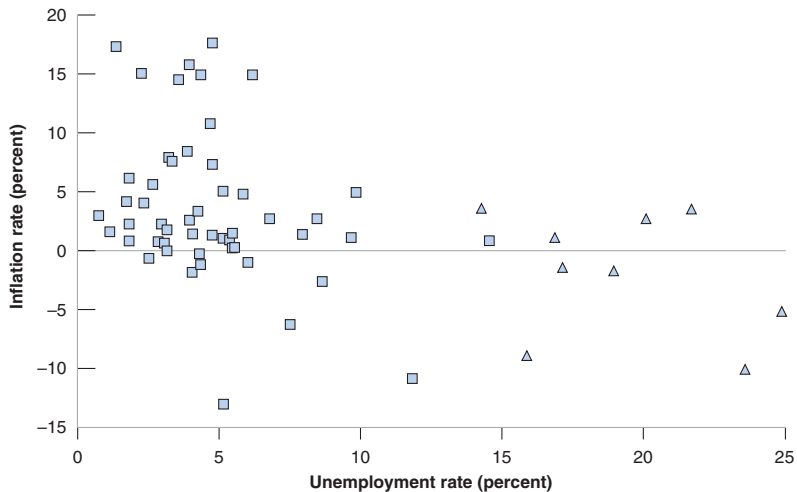
What do the data show?

And what does the AS/AD model predict?

Higher inflation  $\Rightarrow$  more output?

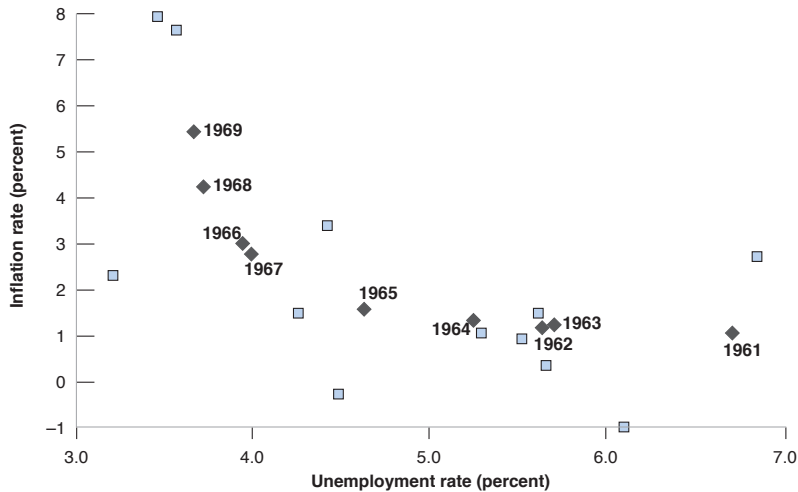


# The Phillips Curve: 1900-1960



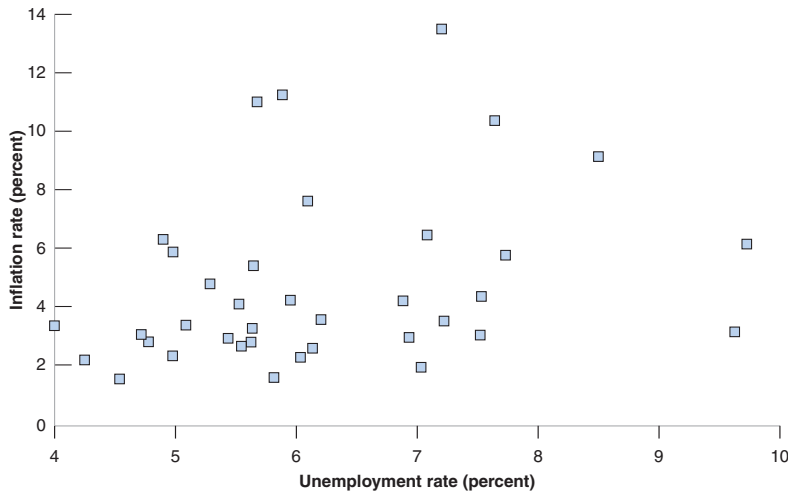
High inflation - low unemployment

## The 1960s



The 1960s are especially clear.

## Modern Data: 1970-2010



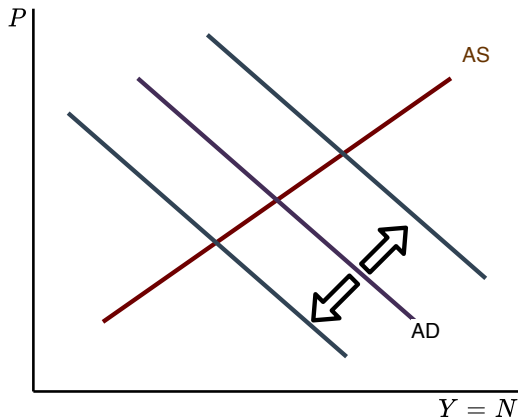
Breakdown of the Phillips Curve

## Phillips Curve: Intuition

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

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

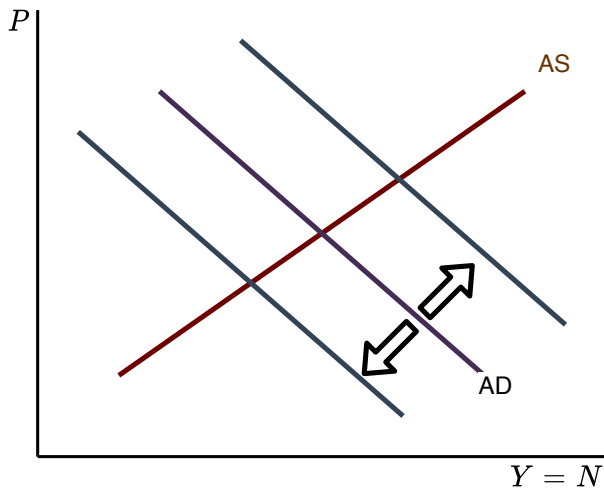
Then we get a positive correlation between inflation and unemployment.





## 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:

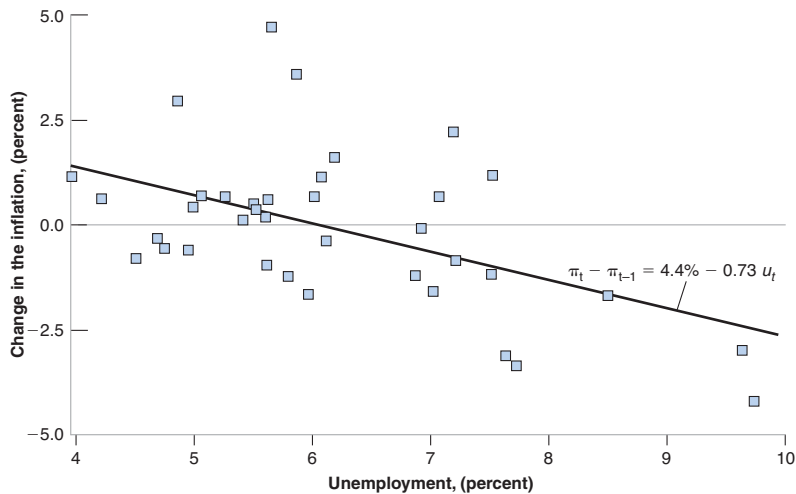
- ▶ up to the 1960s inflation was unanticipated
- ▶ afterwards it was anticipated and hence did not affect output

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 be buy persistently higher employment with ever rising inflation?

## 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  $\pi^e$ : 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

# Deriving the Philips Curve

Start from aggregate supply

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

Divide by last period's prices:

$$\frac{P}{P^e} = \frac{P}{P_{-1}} \frac{P_{-1}}{P^e} = \frac{1+\pi}{1+\pi^e} \quad (4)$$

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

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

Therefore:

$$Y^s = F\left(\frac{1+\pi}{1+\pi^e} \frac{1}{1+m}, z\right) \quad (5)$$

# Simplification

Approximately

$$\frac{1 + \pi}{1 + \pi^e} \approx 1 + \pi - \pi^e \quad (6)$$

Example:

$$\pi = 0.05, \pi^e = 0.03 \implies \frac{1 + \pi}{1 + \pi^e} - 1 = 0.0194 \approx 0.02 \quad (7)$$

$$Y^s = F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) \quad (8)$$



# Deriving the Phillips Curve

In words:

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

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

$$u = \frac{L - N}{L} = 1 - \frac{N}{L} \quad (9)$$

where:

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

In words:

unemployment rate = 1 - employment rate.

## Relationship with unemployment

Recall the aggregate production function:

$$Y/L = N/L = 1 - u \quad (10)$$

or

$$u = 1 - Y/L = 1 - F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) / L \quad (11)$$

# Implications

$$u = 1 - F\left(\frac{1 + \pi - \pi^e}{1 + m}, z\right) / L \quad (12)$$

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

Intuition:

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

Intuition:

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

Intuition:

## Simplification

Take a linear approximation:

$$u = \beta_m m + \beta_z z - \beta_\pi (\pi - \pi^e) \quad (13)$$

But typically the Phillips curve is written as:

*"inflation is a decreasing function of unemployment"*

$$\pi - \pi^e = \frac{\beta_m m + \beta_z z}{\beta_\pi} \quad (14)$$

Or even simpler:

$$\pi = \pi^e + (m + z) - \alpha u \quad (15)$$

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

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

# Policy Implications

Can governments exploit the Phillips Curve?

A key result that is central for all of monetary policy

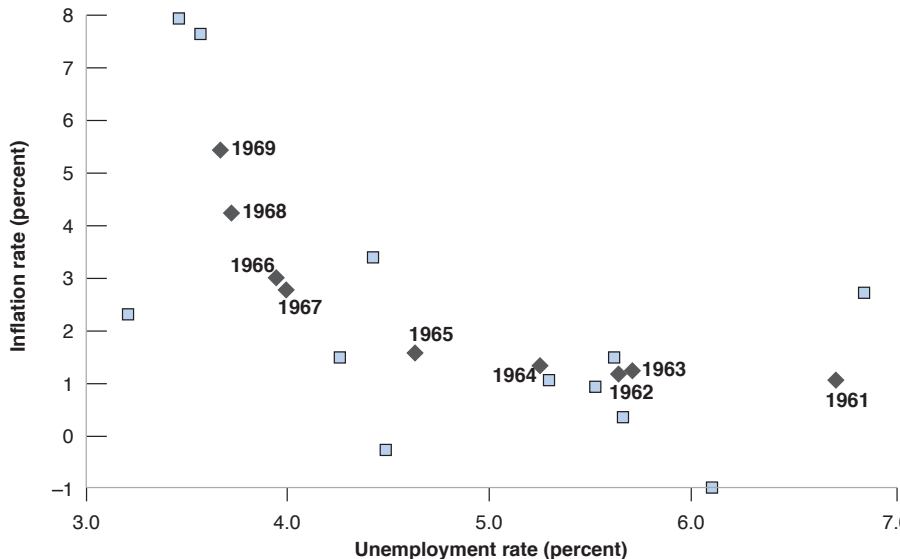
For money to be non-neutral, inflation must be **unexpected**

This is the key difficulty of monetary policy.

Simply raising inflation every year cannot work.

# The Phillips Curve Through Time

## The 1950s and 60s



The economy moves up along a stable Phillips Curve

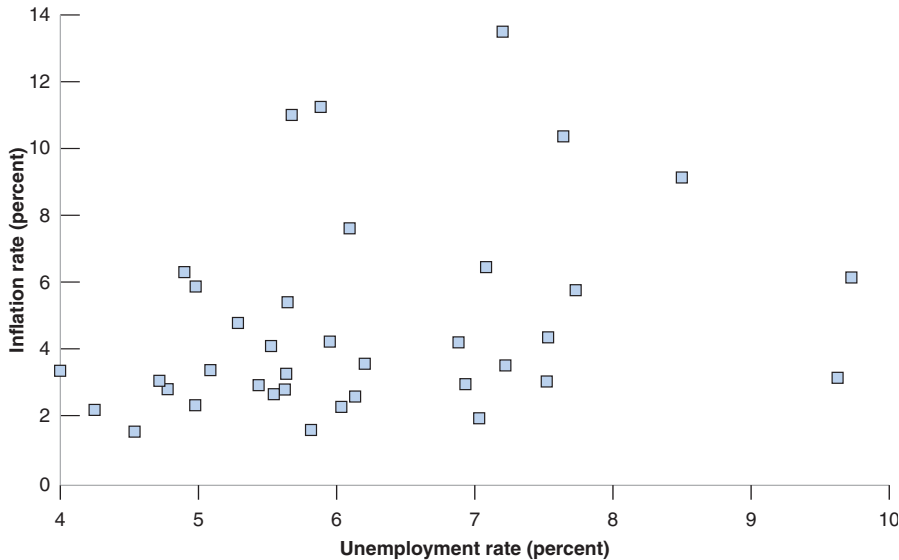


# Interpretation

- ▶ Inflation had been stable for a long time
- ▶  $\pi^e$  remained roughly fixed
- ▶ Then the original Phillips curve emerges

$$\pi = \underbrace{\pi^e}_{\text{fixed}} + (m + z) - \alpha u \quad (16)$$

## The 1970s and Beyond

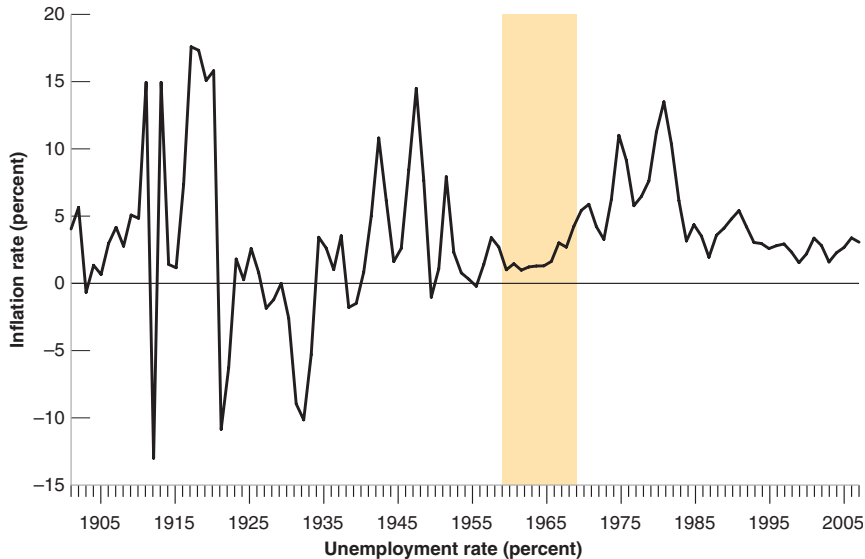


No relationship between inflation and unemployment

# 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



## Modified Phillips Curve

Assume that agents form expectations according to

$$\pi_t^e = \theta \pi_{t-1} \quad (17)$$

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

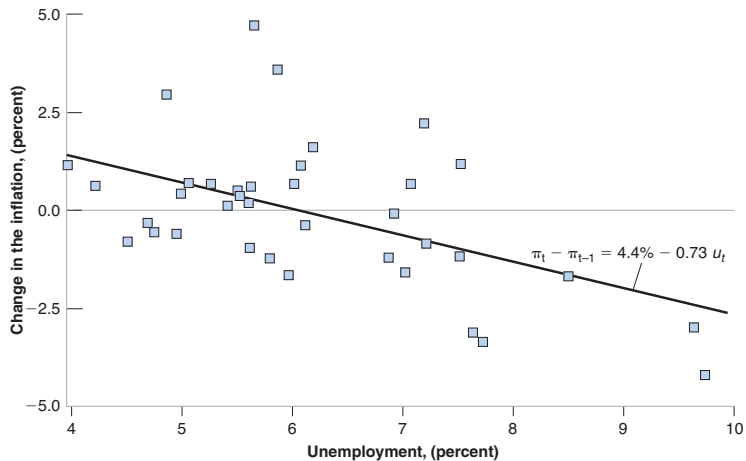
A coarse approximation:

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

Modified Phillips Curve

$$\pi_t - \pi_{t-1} = (m + z) - \alpha u_t \quad (18)$$

# Modified Phillips Curve



# 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)

## NAIRU and Policy



# 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 PC crosses 0

# NAIRU

Definition from FRED:

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

The causes of unemployment are separated into two groups:

## 1. NAIRU

- ▶ the MR equilibrium in the model
- ▶ hard to change through monetary policy

Includes

- ▶ frictional unemployment: workers in between jobs
- ▶ structural: unemployable workers who would like to work
- ▶ voluntary: “pretending” to look for work

## 2. Demand driven

- ▶ deviations from MR equilibrium

## How is NAIRU used?

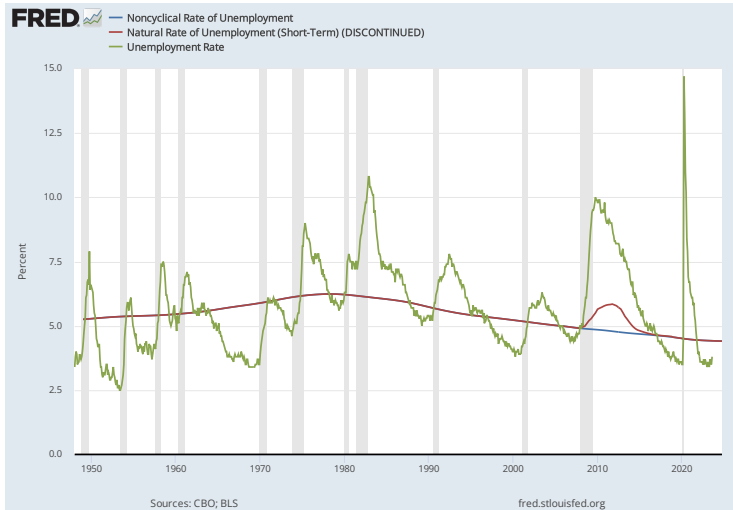
Also from FRED:

*[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.*

Where the economy is relative to NAIRU affects whether stimulating AD creates inflation

- ▶  $Y < Y_n$ : inflation will likely fall over time
  - ▶ stimulating AD not likely to cause inflation
- ▶  $Y > Y_n$ : inflation will likely rise over time
  - ▶ need to reduce AD to avoid inflation

# NAIRU Fluctuations



Source: FRED

## Phillips Curve: Applications

# The Phillips Curve in Reality

When is inflation a serious problem?

The answer depends on **inflation expectations**.

*If people believe we are entering a more inflationary era ... they could alter their behavior in self-fulfilling ways. Businesses would be quicker to raise prices and workers to demand raises. ...*

*That situation would leave ... the Federal Reserve faced with two bad choices: Allow inflation to take off in an upward spiral, or stop it by raising interest rates and quite possibly causing a recession. – NY Times March 24, 2021*

## Overheating

When people talk about an “**overheating**” economy; that’s what they mean.

- ▶ Inflation is high for long enough that inflation expectations rise.
- ▶ Then inflation becomes self-sustaining and bringing it down is costly.

In our model:

$$\pi - \pi^e = m + z - \alpha u \quad (19)$$

If inflation expectations rise, the Fed has two options:

1. **Accommodate:** Let  $\pi$  rise to validate the expectations  
Then unemployment need not rise.
2. **Hold the line:** Keep  $\pi$  at target (below  $\pi^e$ )  
Hope that  $\pi^e$  comes down over time.  
This requires a period of **recession** (high  $u$ ).

# Does a tight labor market cause inflation?

*U.S. labor costs increased strongly in the second quarter as a tight jobs market boosted wage growth, which could keep inflation elevated ... – Reuters July 29, 2022*

Is that how it works?

- ▶ “In the 12 months through June, the PCE price index advanced 6.8%”
- ▶ “Wages and salaries ... were up 5.3% on a year-on-year basis” (Reuters)

So real wages are actually **falling**.

How to think about this?



# Does a tight labor market cause inflation?

It's the wrong question.

The tight labor market is an endogenous outcome, not a shock.

It is caused either by a reduction in labor supply or by an increase in demand for goods.

During the pandemic, both happened.

- ▶ labor force participation dropped
- ▶ demand was pushed up by government transfers

But then why did real wages **fall**?

# The Pandemic Shock

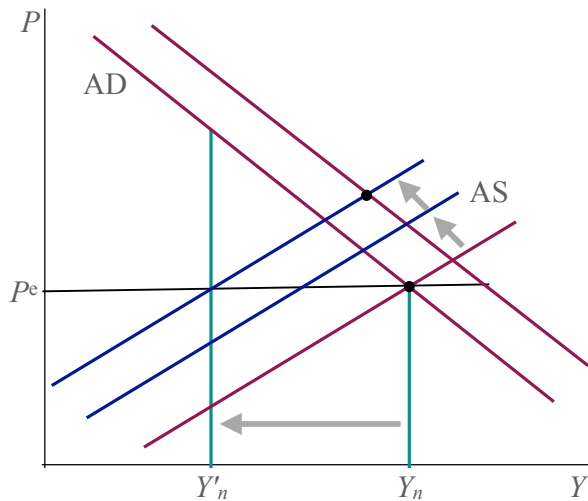
## Three shocks

1. Labor supply declines  $\rightarrow z \uparrow \rightarrow$  AS shifts left.
2. Stimulus checks  $\rightarrow$  AD shifts right.
3. Inputs costs rise  $\rightarrow m \uparrow \rightarrow$  AS shifts left **and** real wage falls.

Note: In our model, by assumption, shocks 1 and 2 do not change real wages.

- ▶ In reality: lower labor supply  $\Rightarrow$  move up labor demand curve  $\Rightarrow$  real wages rise.
- ▶ But in the short run, with sticky prices / wages: more complicated.

# The Pandemic Shock



# Credible disinflation

Conventional wisdom:

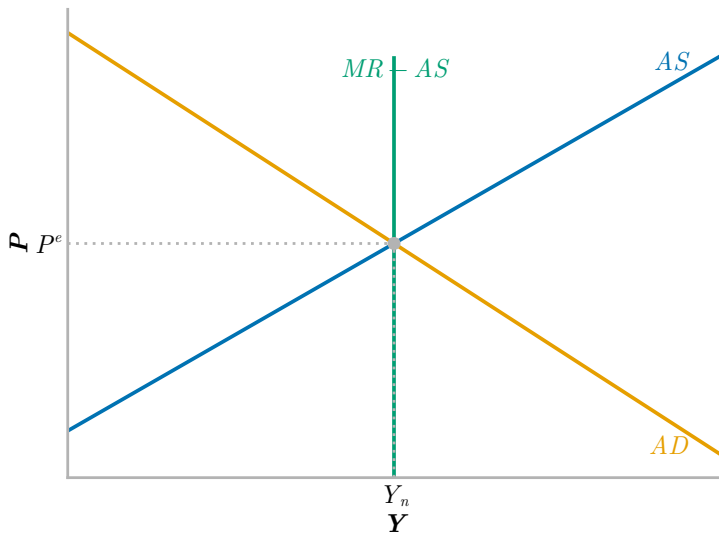
Disinflation (contractionary monetary policy) causes recession

There are several counter examples in history

- ▶ Germany after WW2
- ▶ Argentina introducing a currency board (pegging to the dollar)

The key: credibility.

## Credible disinflation



Compare credible / non-credible disinflation.

# What is the Optimal Inflation Rate?

We don't have a good answer.

The Fed targets 2% per year.

- ▶ Why not 0% or 10%?
- ▶ What does our theory imply?

# What is the Optimal Inflation Rate?

## Why not zero inflation?

- ▶ nominal wages may be downward rigid
- ▶ more room to cut interest rates in recessions
- ▶ can achieve negative real rates
- ▶ avoid deflation

# What is the Optimal Inflation Rate?

## Why not higher inflation?

- ▶ taxes on nominal capital income
- ▶ distorts sticky vs flexible prices
- ▶ redistribution (debtors vs savers; job stayers vs movers)

These are all valid reasons, but the main one is:

***High inflation is hard to control and predict***



# What is the Optimal Inflation Rate?

Conclusion by John Cochrane:

*... clear just how thin the scientific understanding behind the 2% mantra is, just how much our central banks pulled 2% out of a hat and then repeated it over and over again until it seemed carved in to stone.*

Making inflation predictable is probably more important than its exact value.

Useful reading: St Louis Fed 2006, St Louis Fed 2019

# Reading

Text: Blanchard and Johnson (2013), ch 8  
On NAIRU: Ball and Mankiw (2002)

## References I

- Ball, L. and N. G. Mankiw (2002): “The NAIRU in Theory and Practice,” *The Journal of Economic Perspectives*, 16, 115–136.
- Blanchard, O. and D. Johnson (2013): *Macroeconomics*, Boston: Pearson, 6th ed.