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.

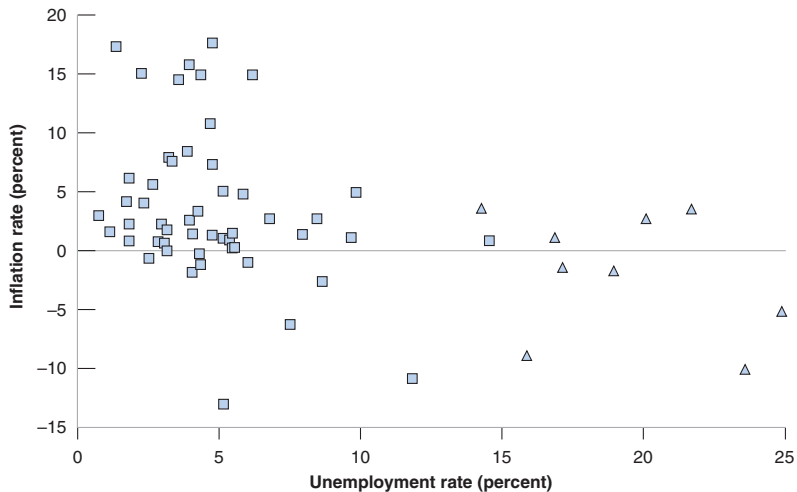Why not always use it gain more employment / output?

Answer: Lax monetary policy creates inflation.

Key issue
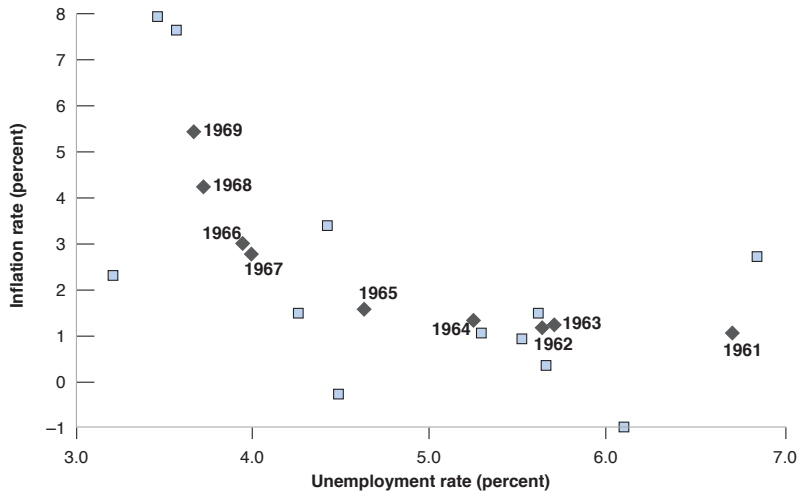
Can we buy more employment with more inflation?

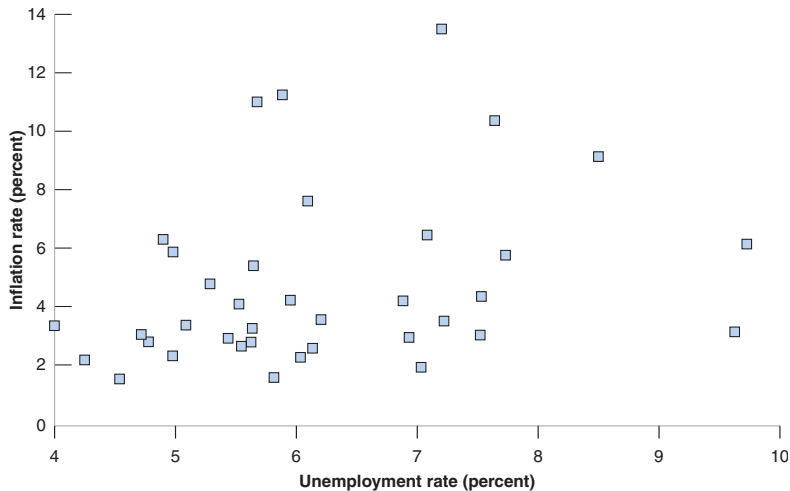What do the data show?

The Phillips Curve: 1900-1960

High inflation - low unemployment

The 1960s

The 1960s are especially clear.

Modern Data: 1970-2010
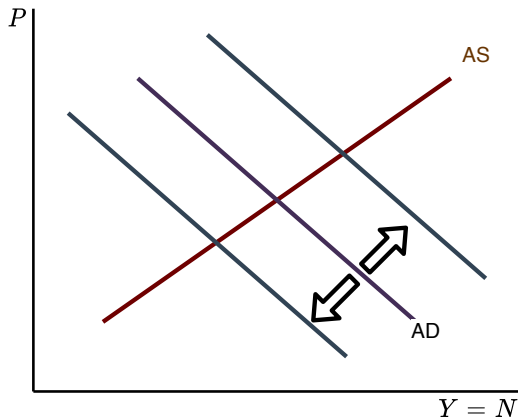

Breakdown of the Phillips Curve

Phillips Curve: Intuition

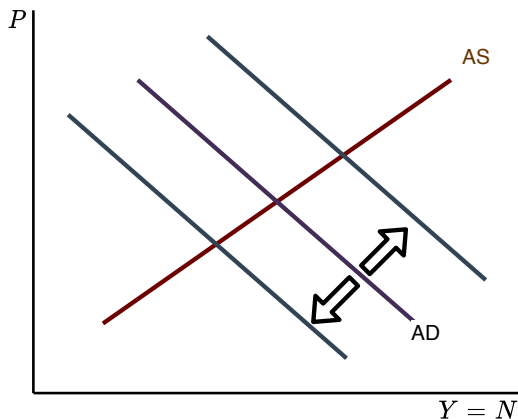Assume that economic fluctuations are mostly driven by AD shocks.

▶ 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

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

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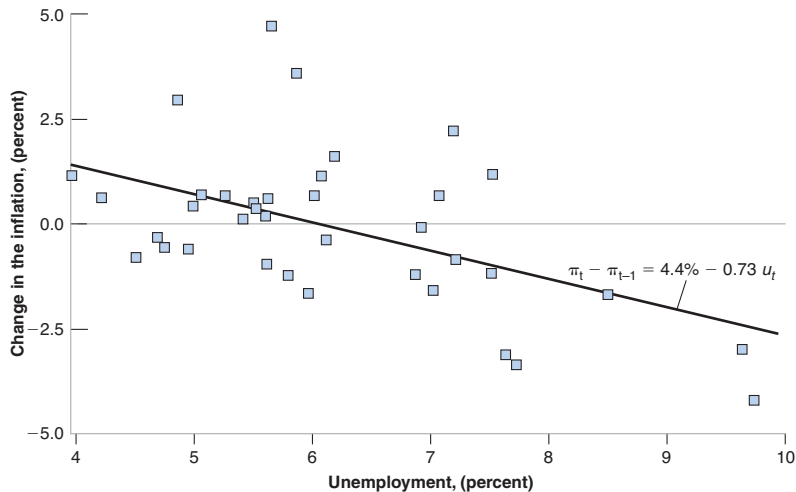
- ▶ up to the 1960s inflation was unanticipated
- ▶ afterwards it was anticipated and hence did not affect output

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

$$\pi_t - \pi_{t-1} = 4.4\% - 0.73\,u_t$$

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

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

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

Deriving the Philips Curve

Start from aggregate supply

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

Divide by last period's prices:

$$\frac{P}{P^e} = \frac{P}{P_{-1}}\frac{P_{-1}}{P^e} = \frac{1+\pi}{1+\pi^e} \tag{4}$$

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

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

Therefore:

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

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

$$u = \frac{L-N}{L} = 1 - \frac{N}{L} \qquad (6)$$

where:

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

In words:

unemployment rate $=$ 1 - employment rate.

Relationship with unemployment

Recall the aggregate production function:

$$Y/L = N/L = 1 - u \tag{7}$$

or

$$u = 1 - Y/L = 1 - F\left(\frac{1+\pi}{1+\pi^e}\frac{1}{1+m}, z\right)/L \tag{8}$$

Implications

$$u = 1 - F\left(\frac{1+\pi}{1+\pi^e}\frac{1}{1+m}, z\right)/L \tag{9}$$

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

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

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

Simplification

$$u = 1 - F\left(\frac{1+\pi}{1+\pi^e}\frac{1}{1+m}, z\right)/L \qquad (10)$$

Approximately

$$\frac{1+\pi}{1+\pi^e} \approx 1 + \pi - \pi^e \qquad (11)$$

Example:

$$\pi = 0.05, \pi^e = 0.03 \implies \frac{1+\pi}{1+\pi^e} - 1 = 0.0194 \approx 0.02 \qquad (12)$$

Simplification

Take a linear approximation:

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

But typically the Phillips curve is written as:

"inflation is a decreasing function of unemployment"

$$\pi - \pi^e = \frac{\beta_m m + \beta_z z}{\beta_\pi} \qquad (14)$$
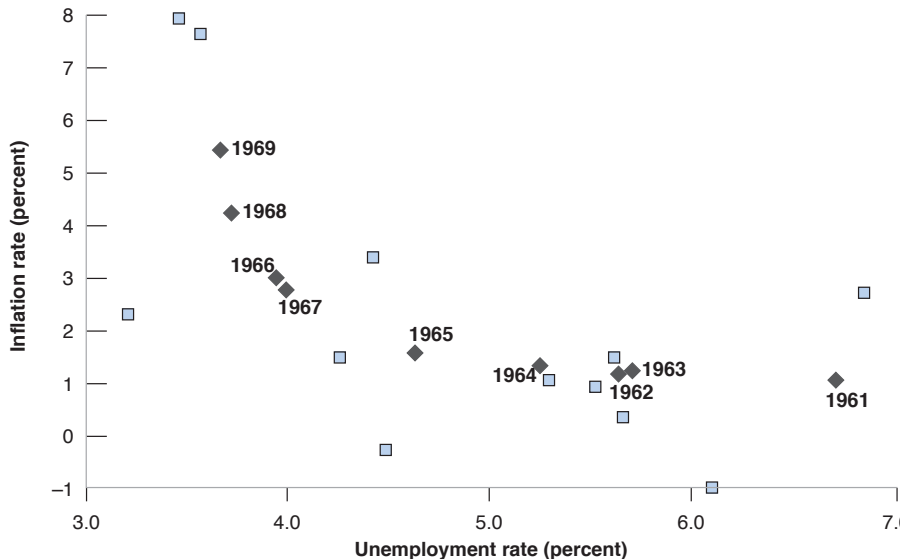
Or even simpler:

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

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

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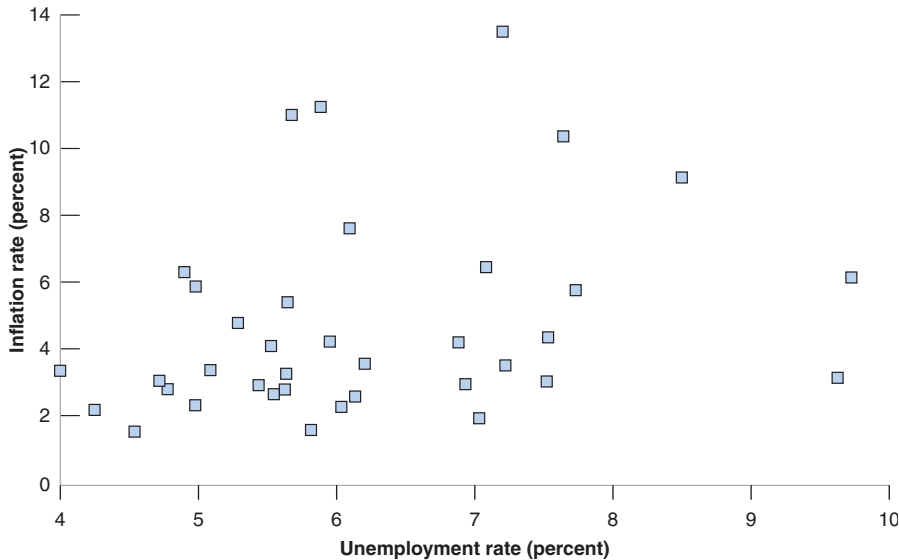
The Phillips Curve Through Time

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

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

The 1970s and Beyond
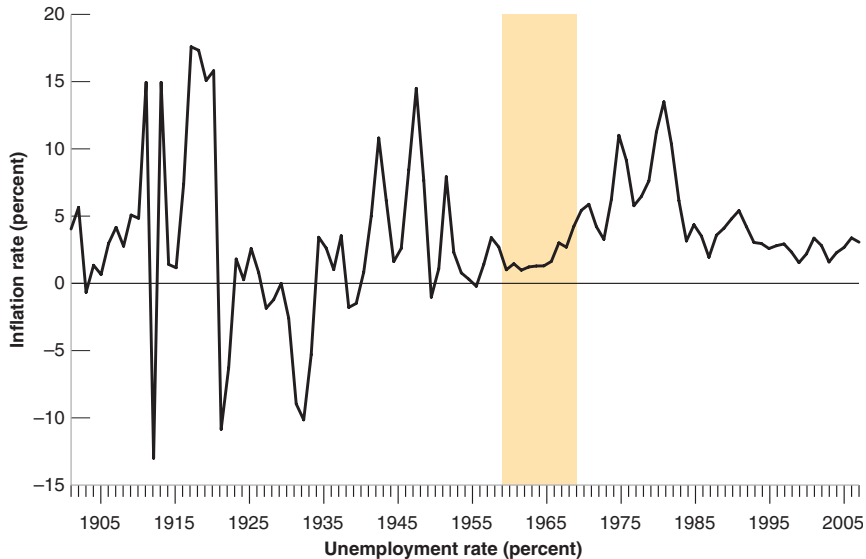

No relationship between inflation and unemployment

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

$$\pi_t^e = \theta \pi_{t-1} \tag{17}$$

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

A coarse approximation:

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

Modified Phillips Curve

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

Modified Phillips Curve

Figure showing a scatter plot with "Change in the inflation, (percent)" on the y-axis (ranging from −5.0 to 5.0) and "Unemployment, (percent)" on the x-axis (ranging from 4 to 10), with a downward-sloping fitted line labeled $\pi_t - \pi_{t-1} = 4.4\% - 0.73\, u_t$
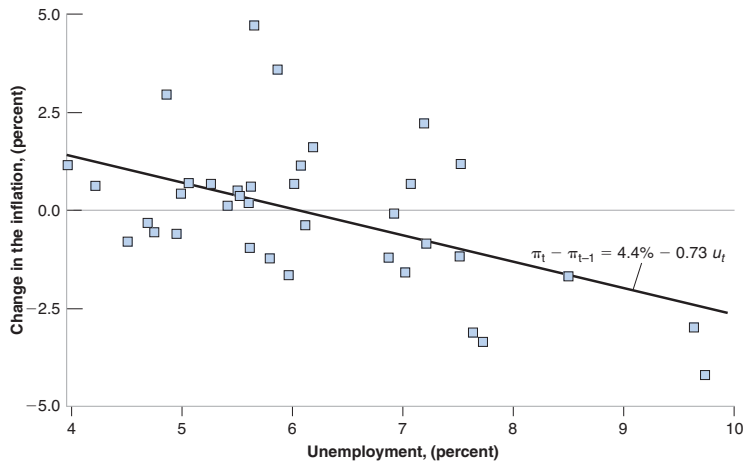
Implications

- 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)

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.

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 $\implies$ move up labor demand curve $\implies$ real wages rise.

▶ But in the short run, with sticky prices / wages: more complicated.

The Pandemic Shock
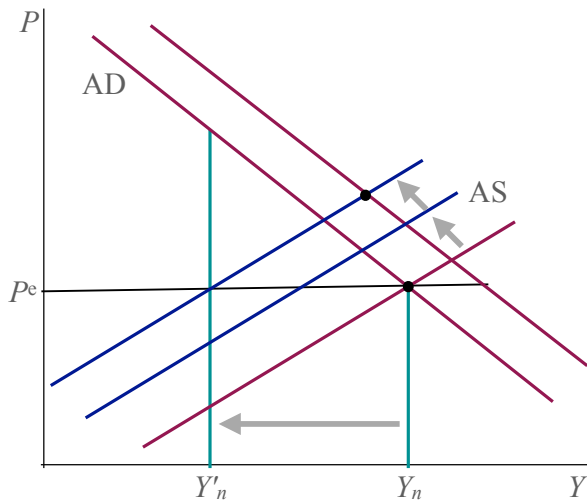
NAIRU and Policy

NAIRU

If the modified PC is correct, there is one unemployment rate that is consistent with constant inflation (at any level)

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. ... [It] 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.*

"from all sources except fluctuations in aggregate demand"

- ▶ frictional: workers in between jobs
- ▶ structural: unemployable workers who would like to work
- ▶ voluntary: "pretending" to look for work
- ▶ but not: deviations from MR equilibrium

"gauge the ... slack in labor markets"

- ▶ $Y < Y_n$: stimulating AD not likely to cause inflation
- ▶ $Y > Y_n$: need to reduce AD to avoid inflation

NAIRU Fluctuations
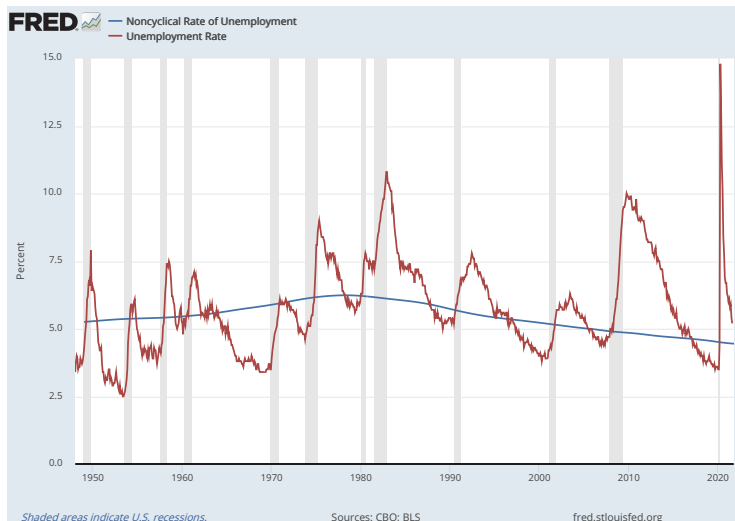
Source: FRED

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.
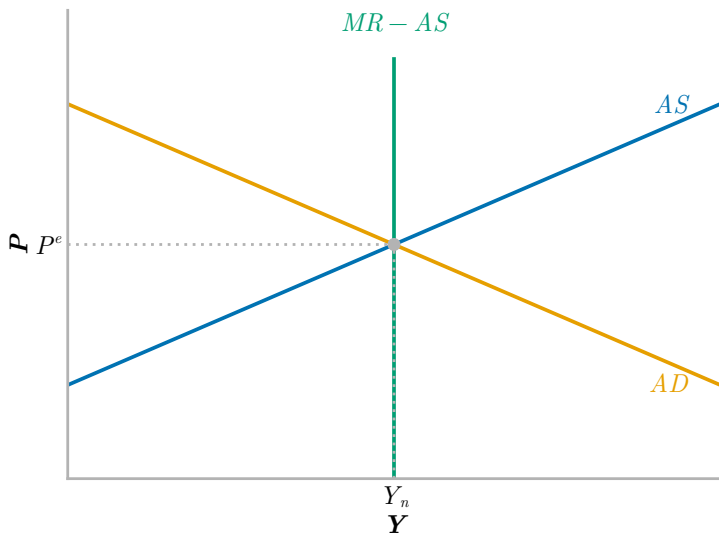
Credible disinflation

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?

The Fed targets 2% per year.

- ▶ Why not 0% or 10%?

We don't have a good answer.

Why not zero inflation?

- ▶ nominal wages may be downward rigid
- ▶ more room to cut interest rates
- ▶ 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
- ▶ harder to control and predict
- ▶ redistribution (debtors vs savers; job stayers vs movers)

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 that 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.