Inflation and Unemployment

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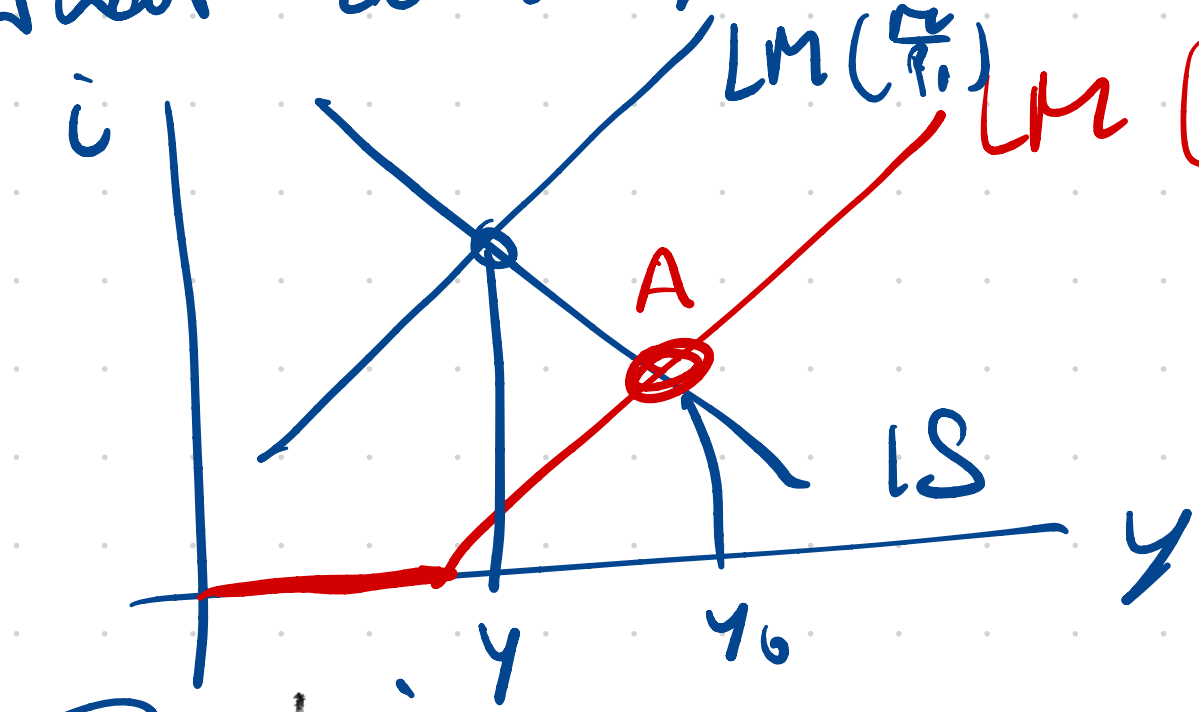
Econ520

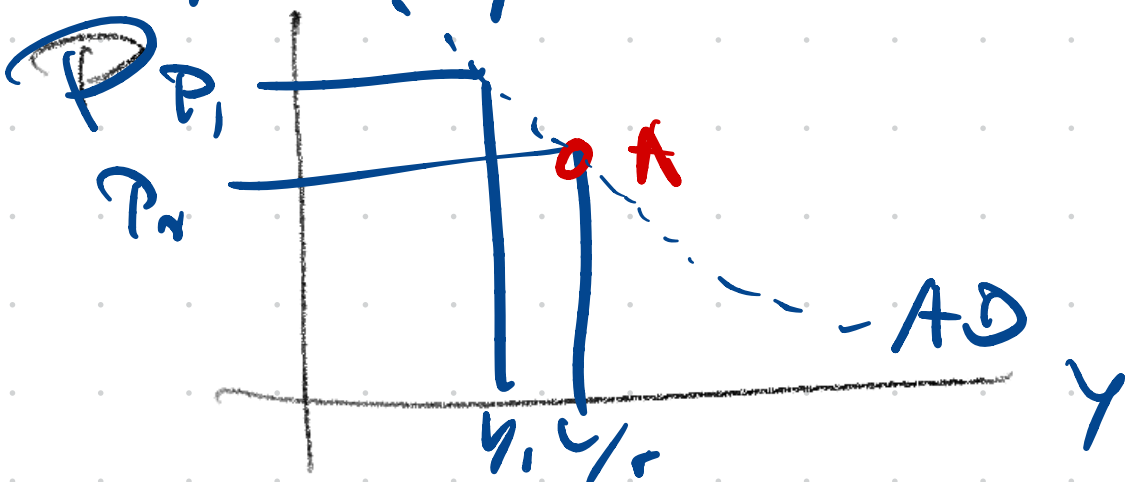
August 28, 2024

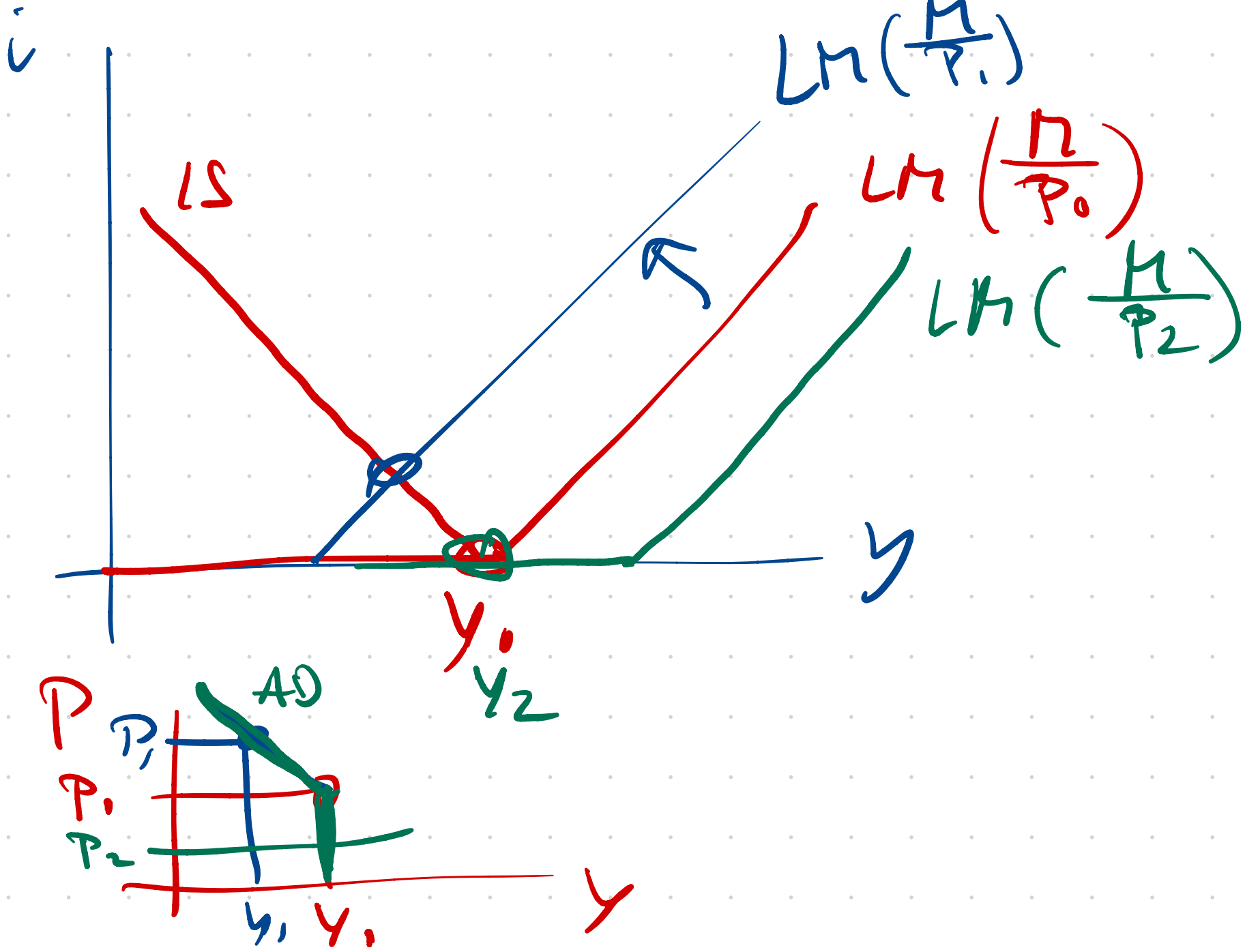
AS- AD w/ Liquidity Trap

What does AD look like?



$P_1 > P_0$

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LM(M/P0)
LM(M/P2)
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y2
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P1
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P2
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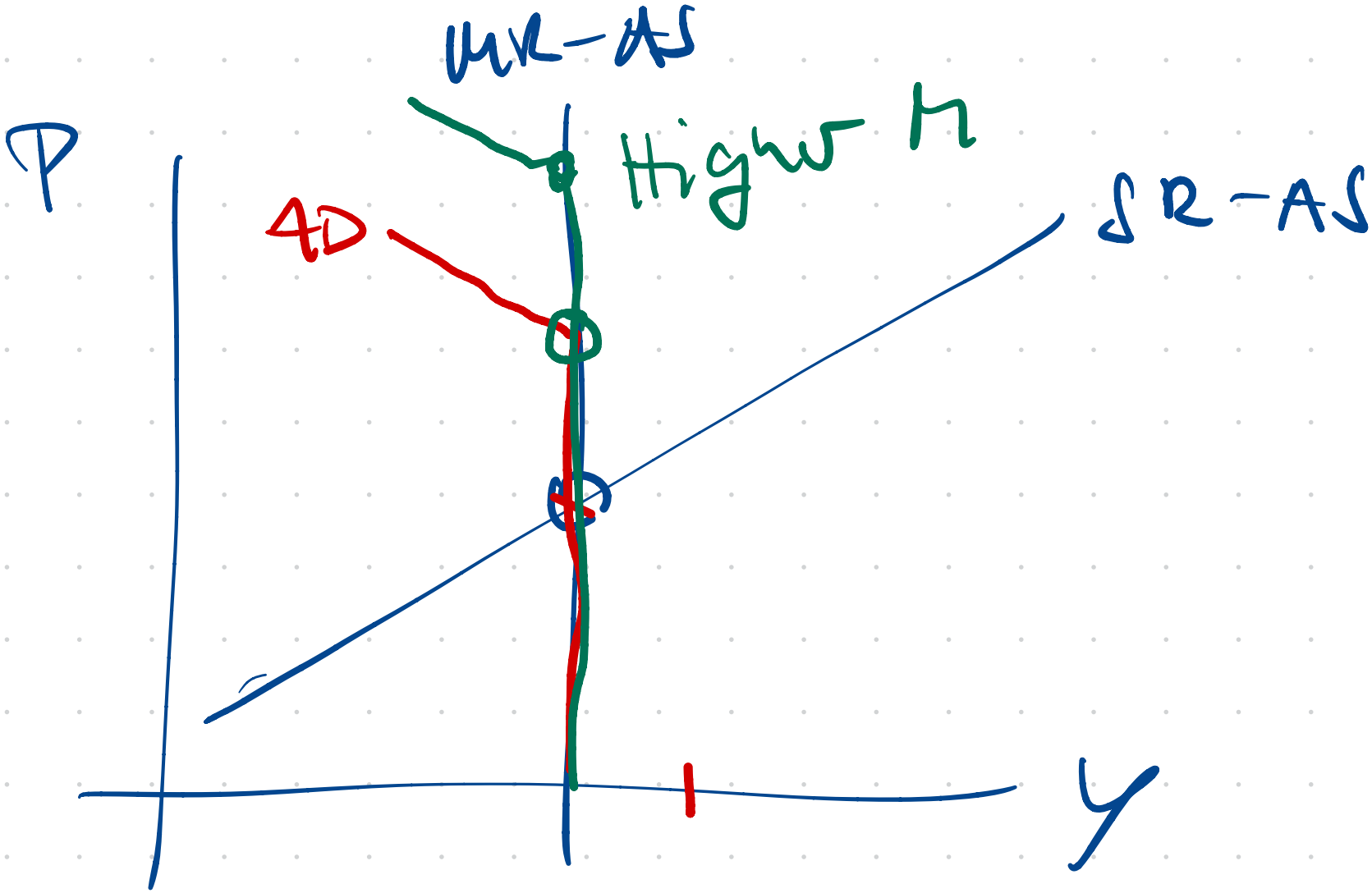
LR-AS
Higher M
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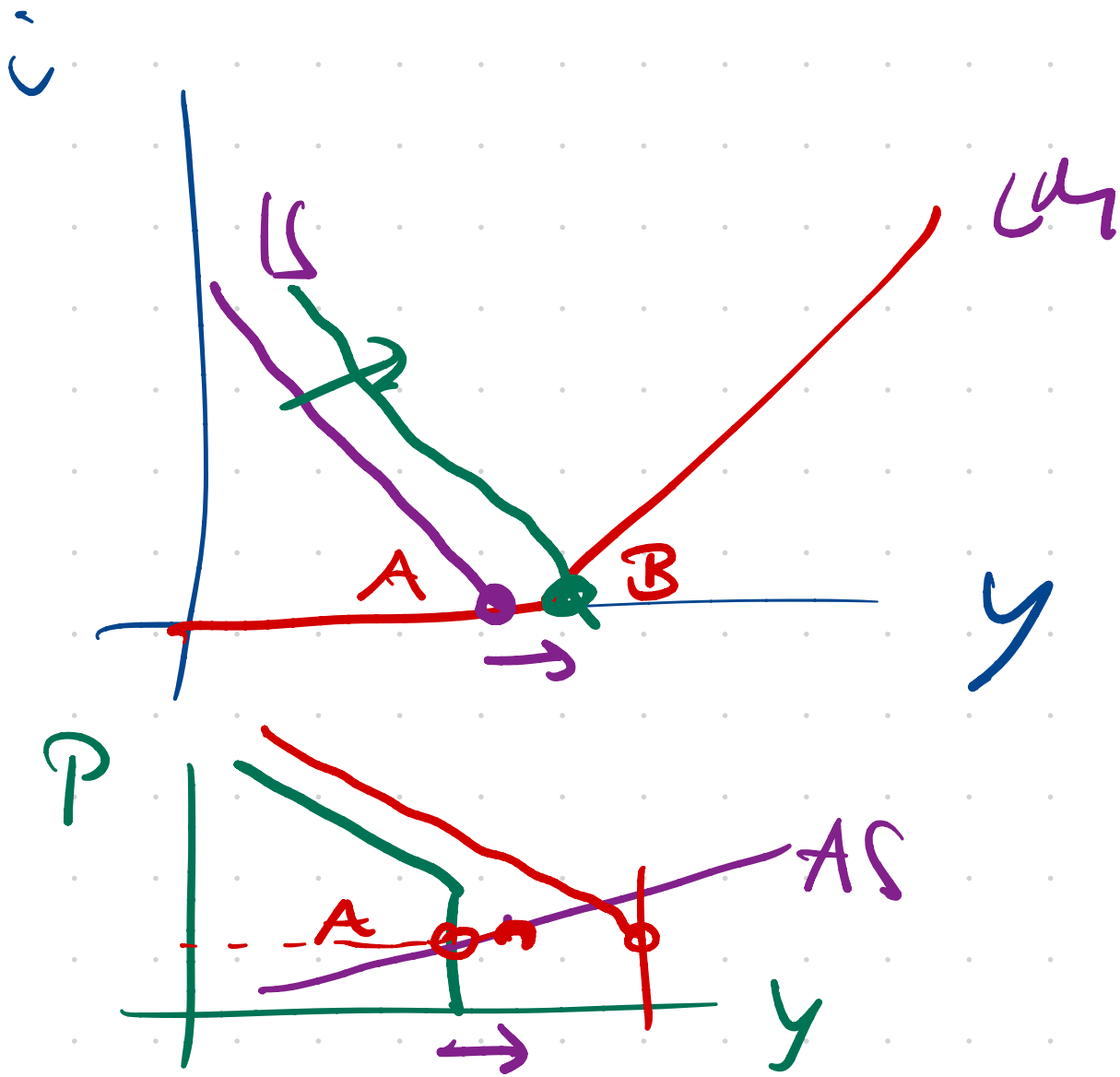
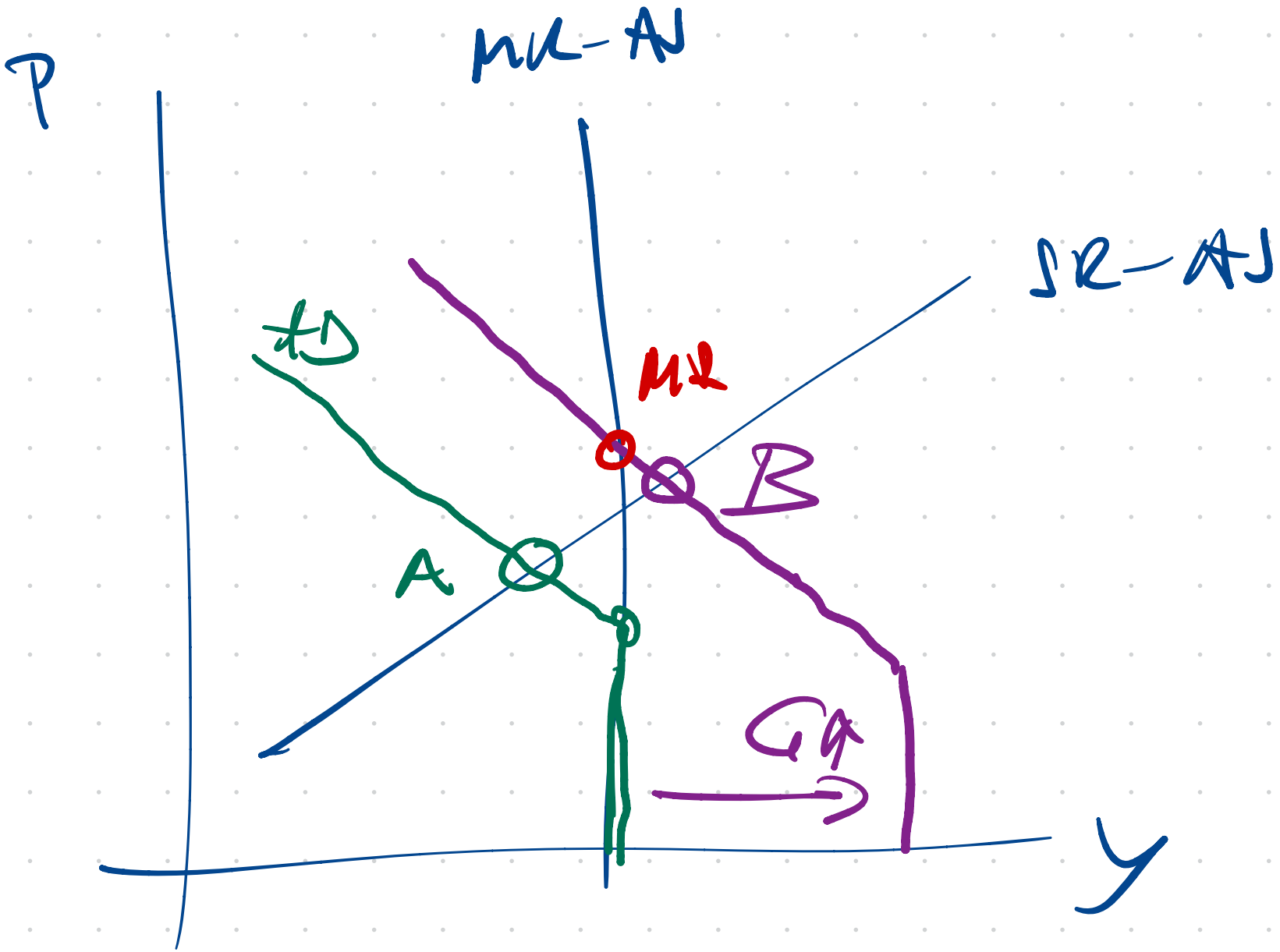
Fiscal Policy $G\uparrow$

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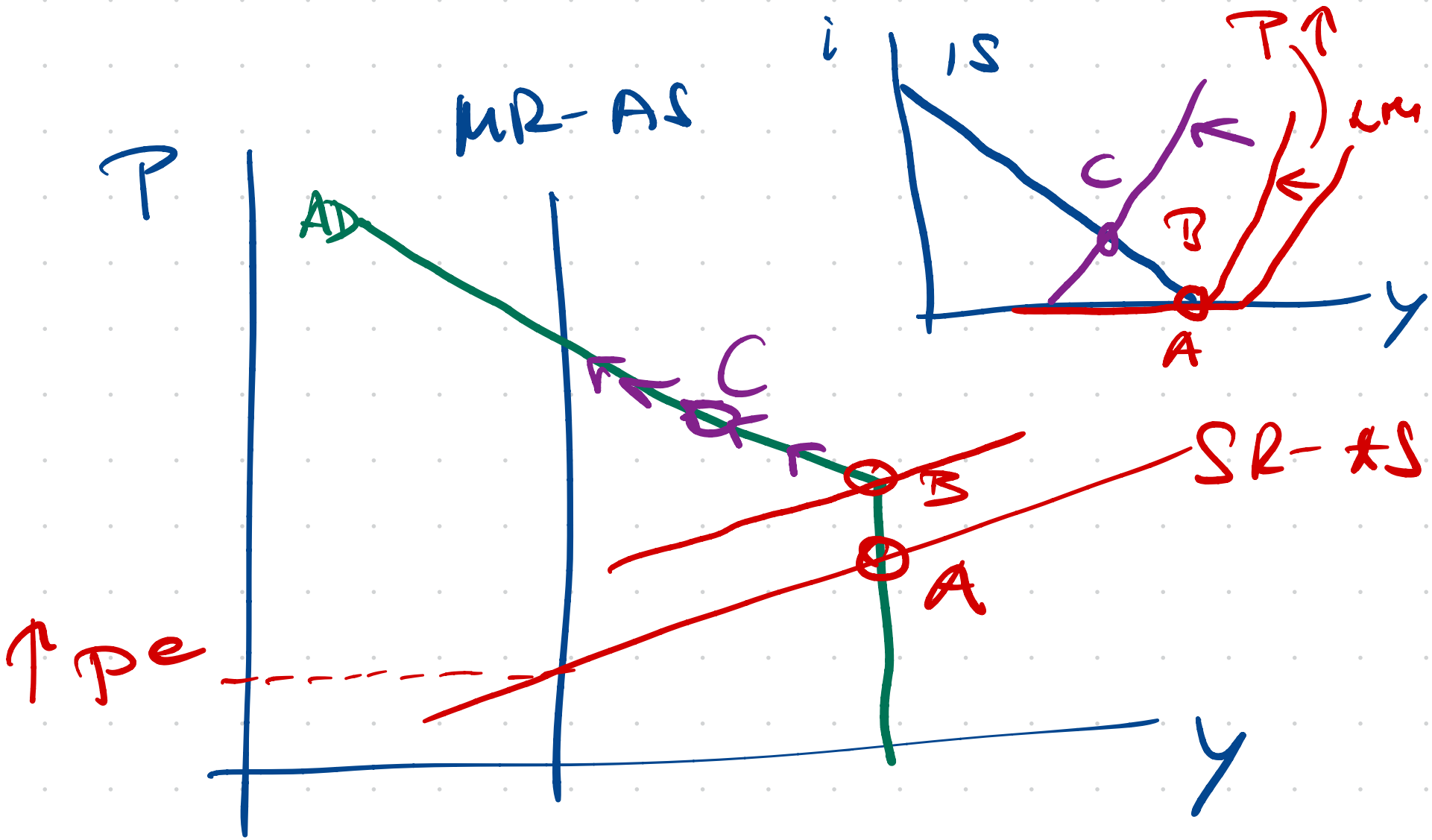
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Objectives

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.

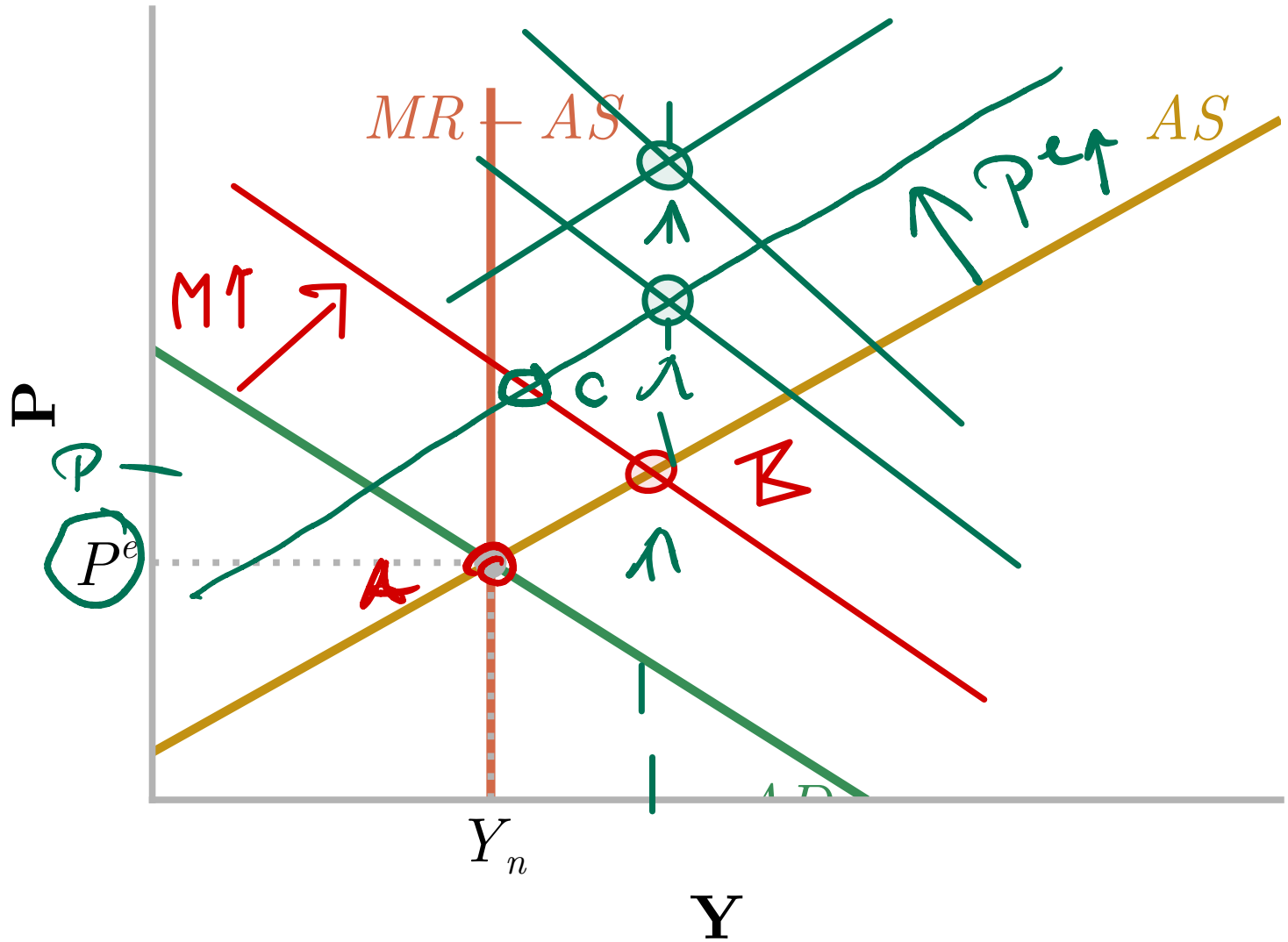
Key issue

Can we buy more employment with more inflation?

What do the data show?

And what does the AS/AD model predict?

Higher inflation $\Longrightarrow$ more output?



What happens if the Fed keeps shifting AD out?

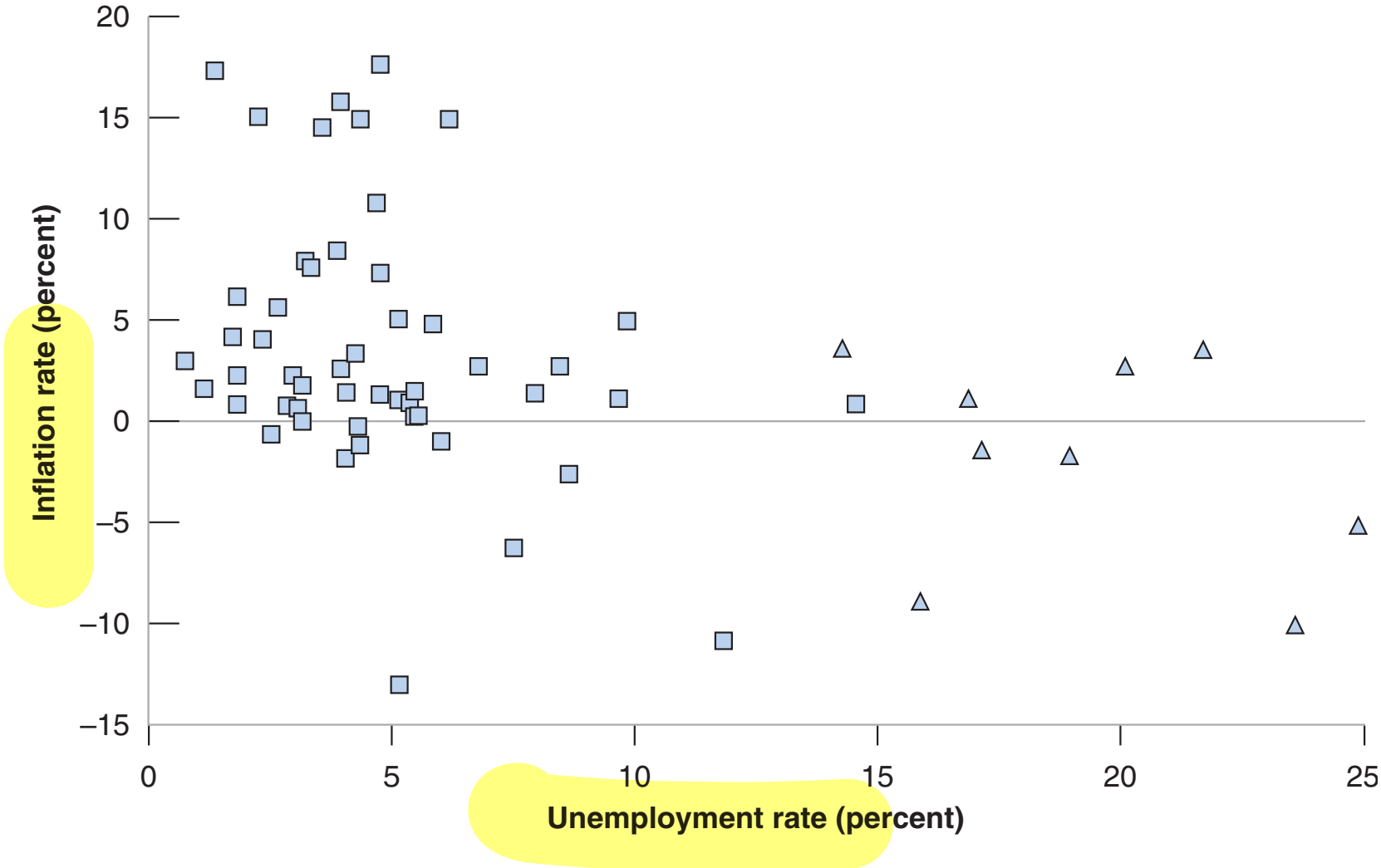
Model Prediction

The Fed can buy higher output with higher inflation.

Intuition...

Is the intuition plausible?

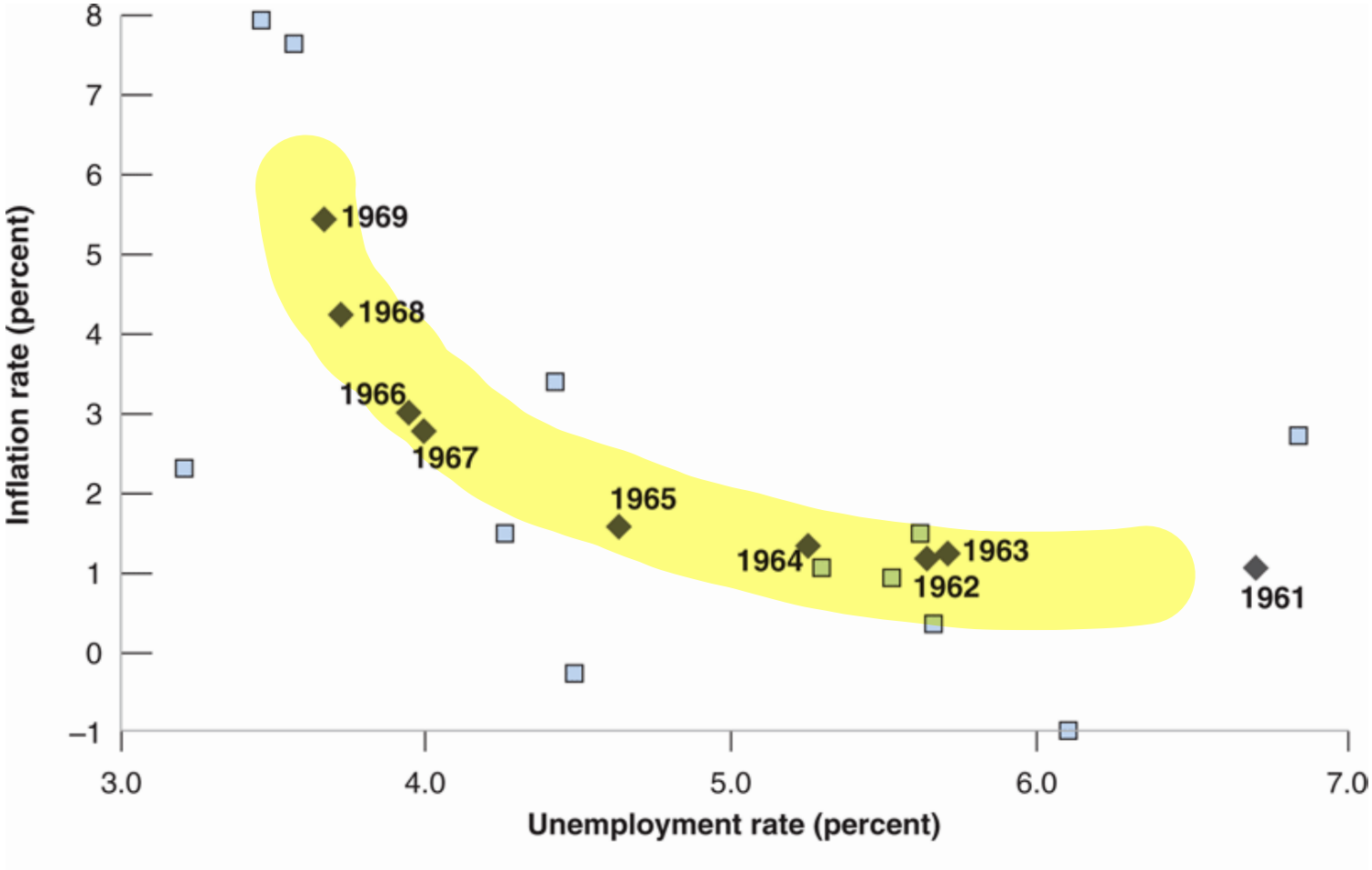
The Data: 1900-1960



High inflation seems associated with low unemployment.

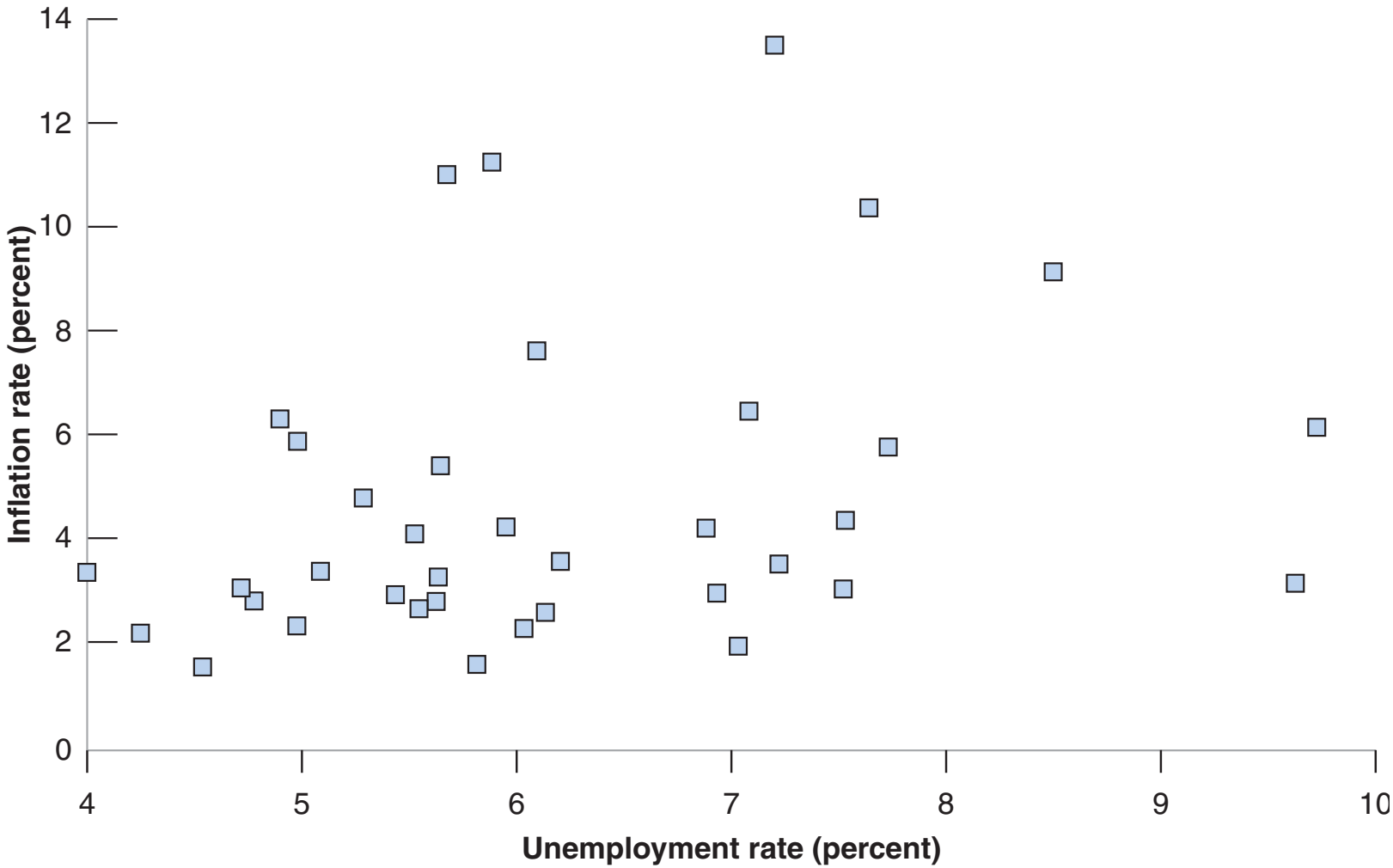
- "Phillips Curve"

The Data: 1960s



The 1960s are especially clear.

Modern Data: 1970-2010



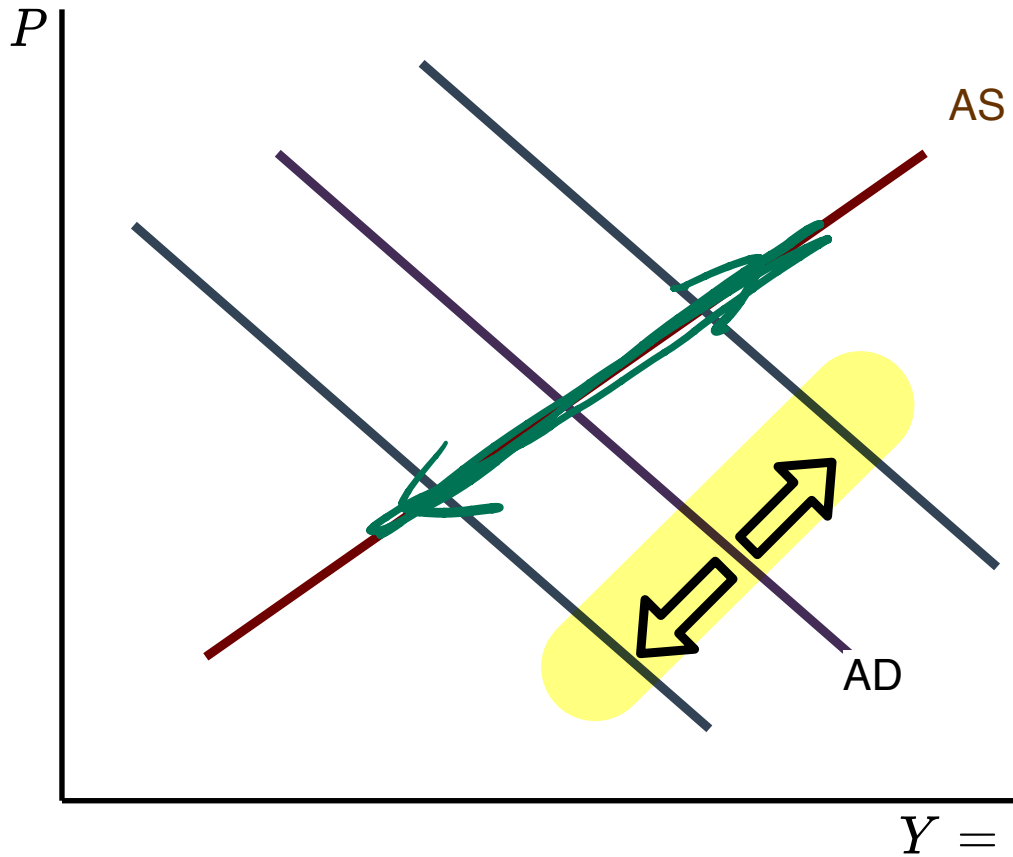
Breakdown of the Phillips Curve

Phillips Curve: Intuition

Assume that economic fluctuations are mostly driven by AD shocks.

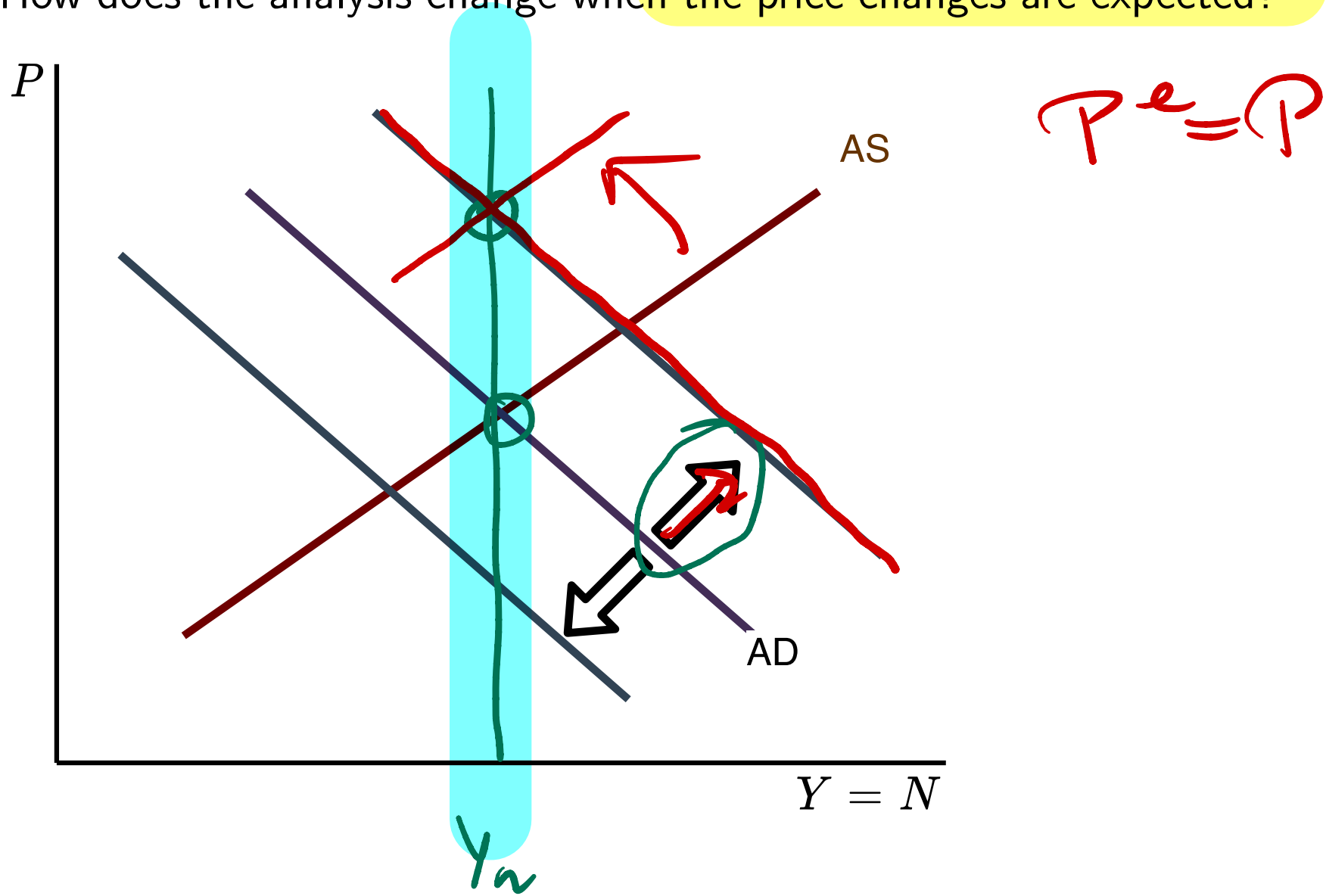
- The AS curve is stable over time.

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:

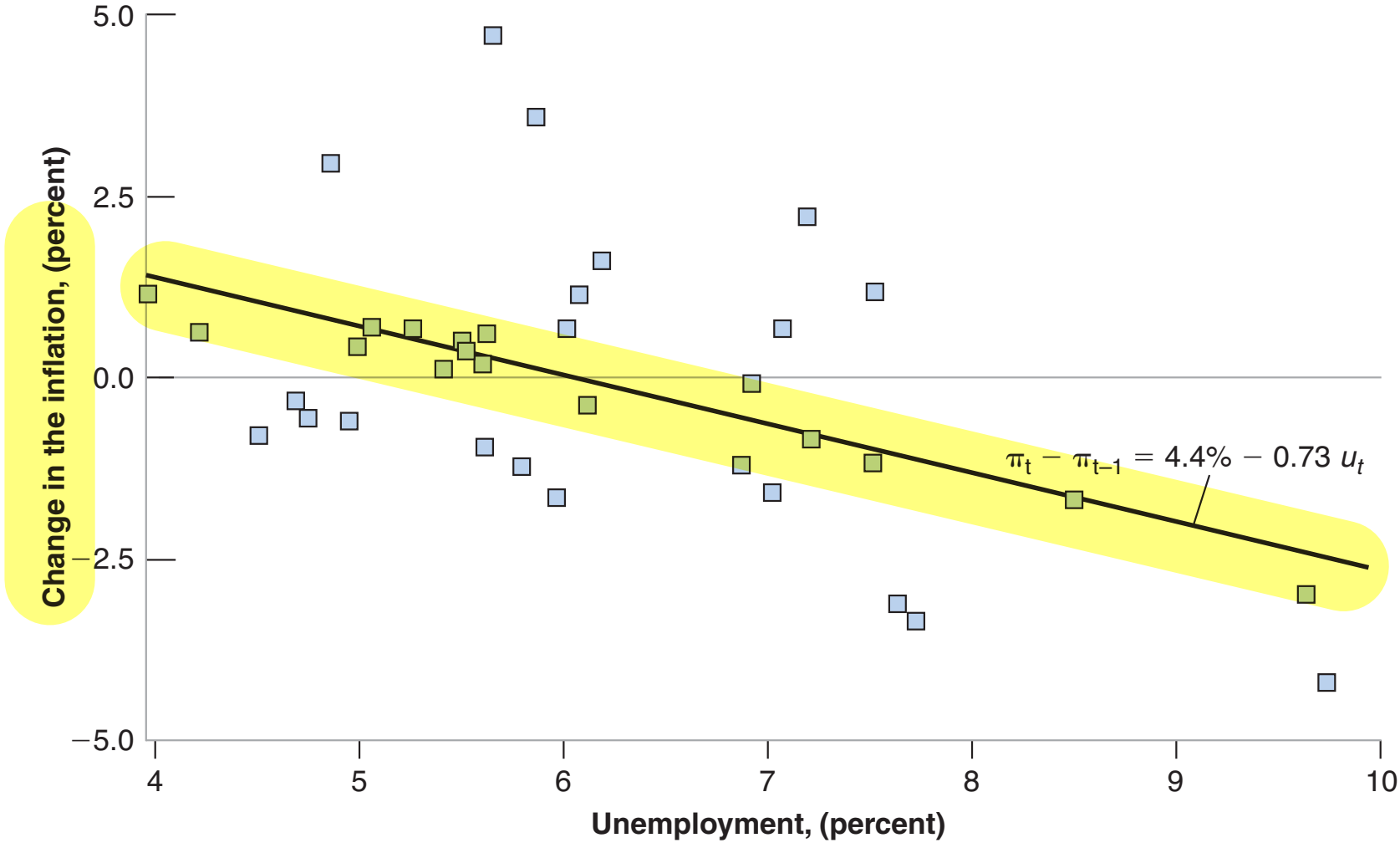
- up to the 1960s inflation was unanticipated
- afterwards it was anticipated and hence did not affect output

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:

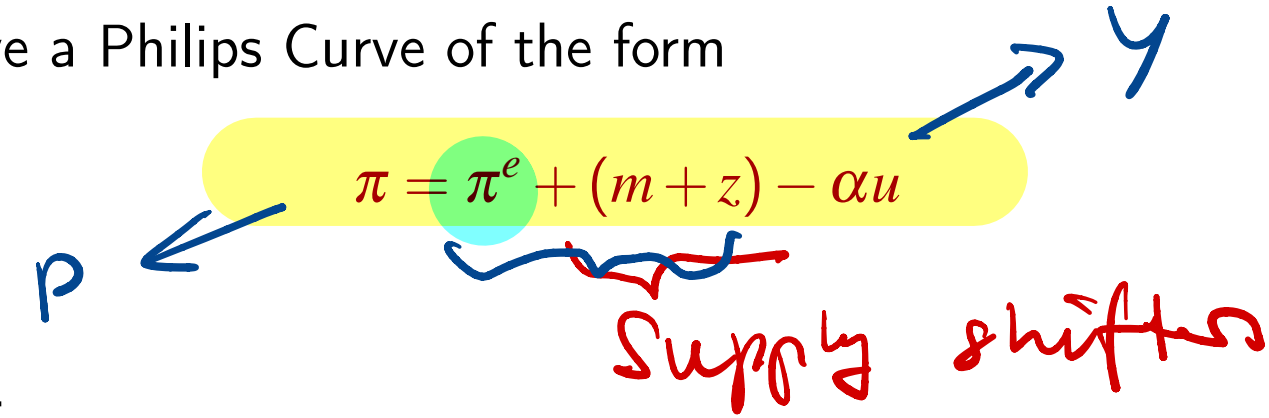
1. Why the change?
2. Can be buy persistently higher employment with ever rising inflation?

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 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

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

In words:

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

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

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

- $\pi_t \equiv (P_t - P_{t-1})/P_{t-1}$: **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:

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

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

▸ Details

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

Implications

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

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

Intuition:

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

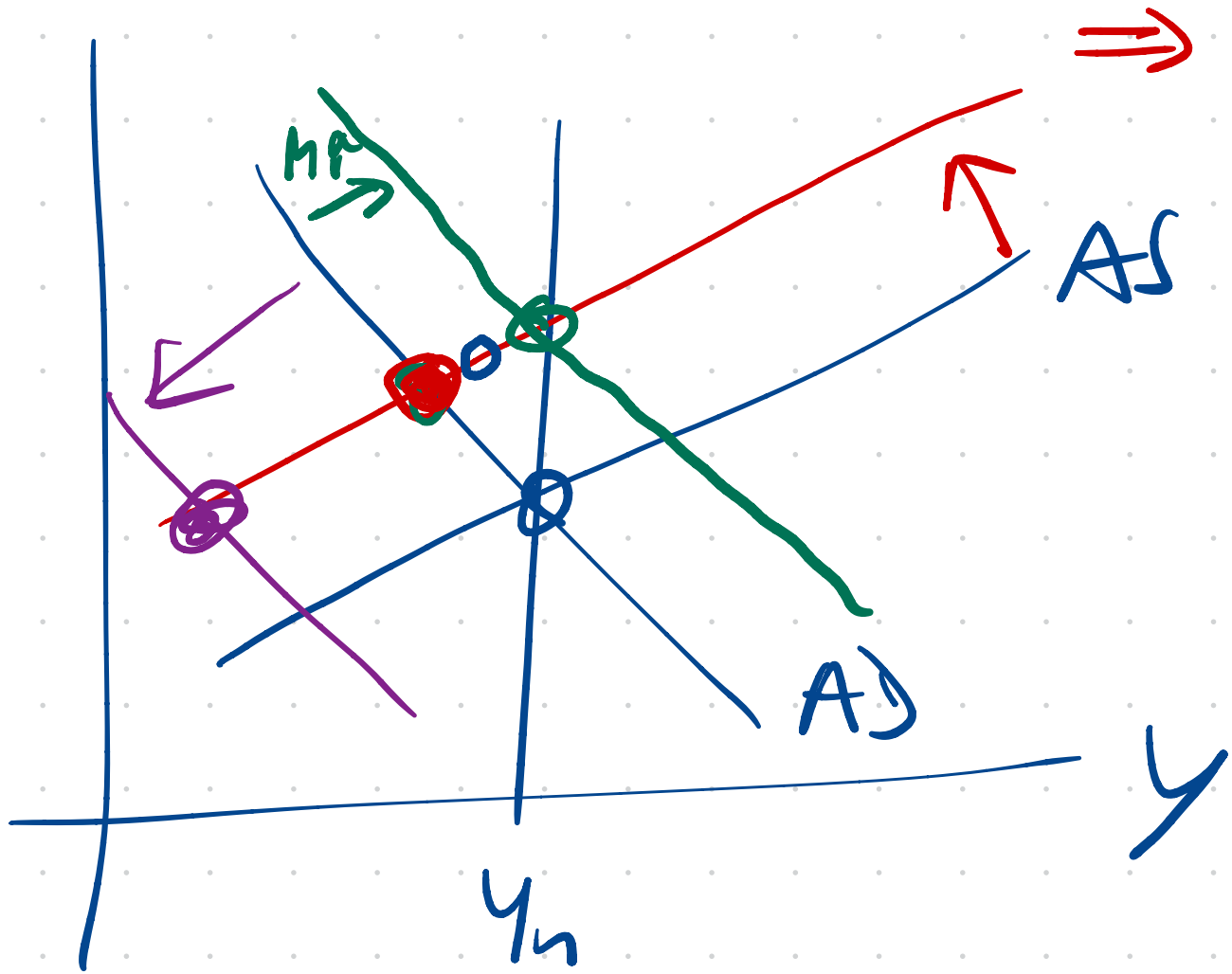
   Intuition:

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

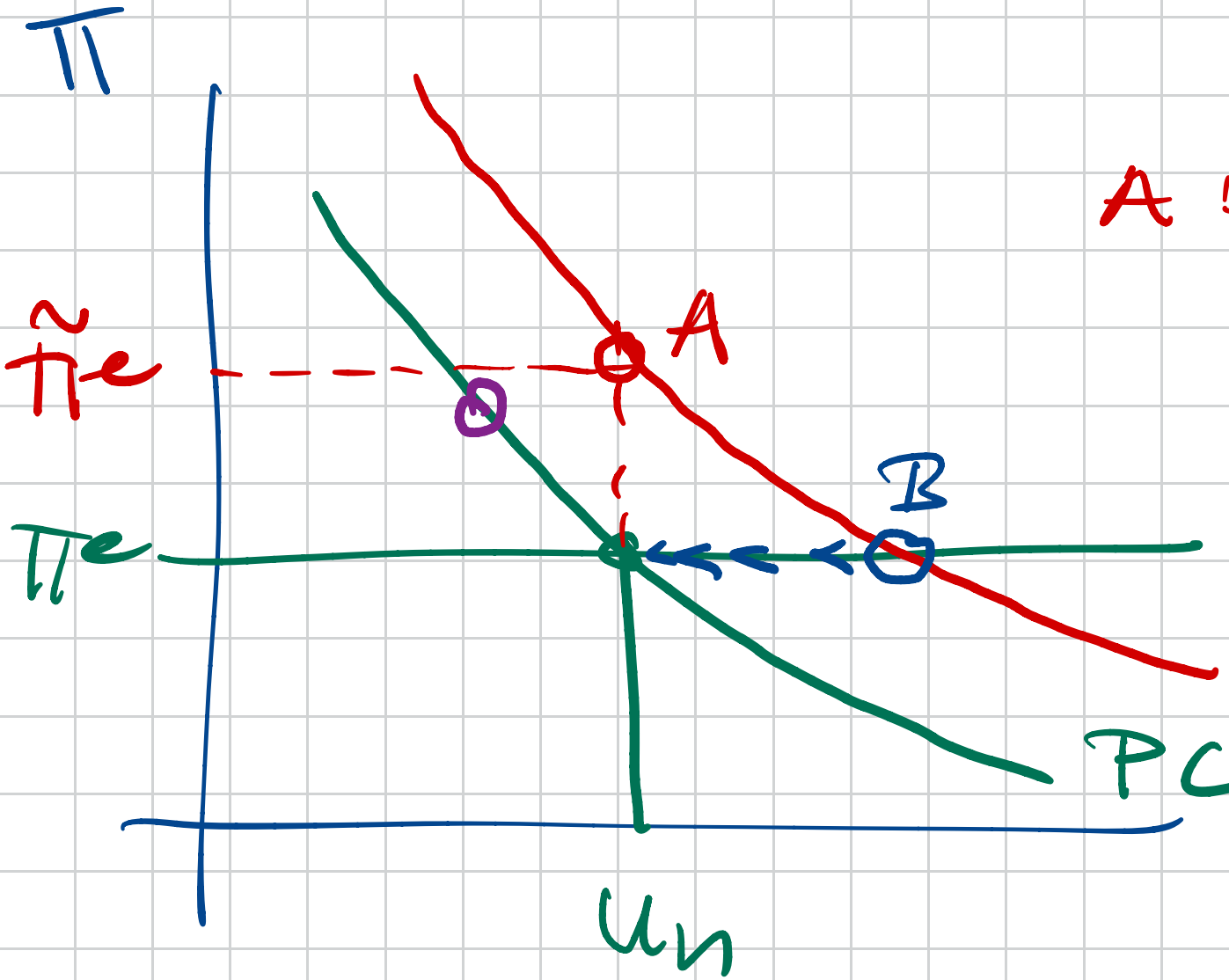
   Intuition:

$\pi^e \uparrow$

$\Rightarrow P^e \uparrow$



$Y = N$



$\pi^e \uparrow$

A : Rouwen
$\pi \uparrow \Rightarrow \tilde{\pi}^e$

B : stabiliz
π
$\pi^e \downarrow$

$\pi = \tilde{\pi}^e + \underset{-\alpha}{m+z}$

Policy Implications

Can governments exploit the Phillips Curve?

A key result that is central for all of monetary policy

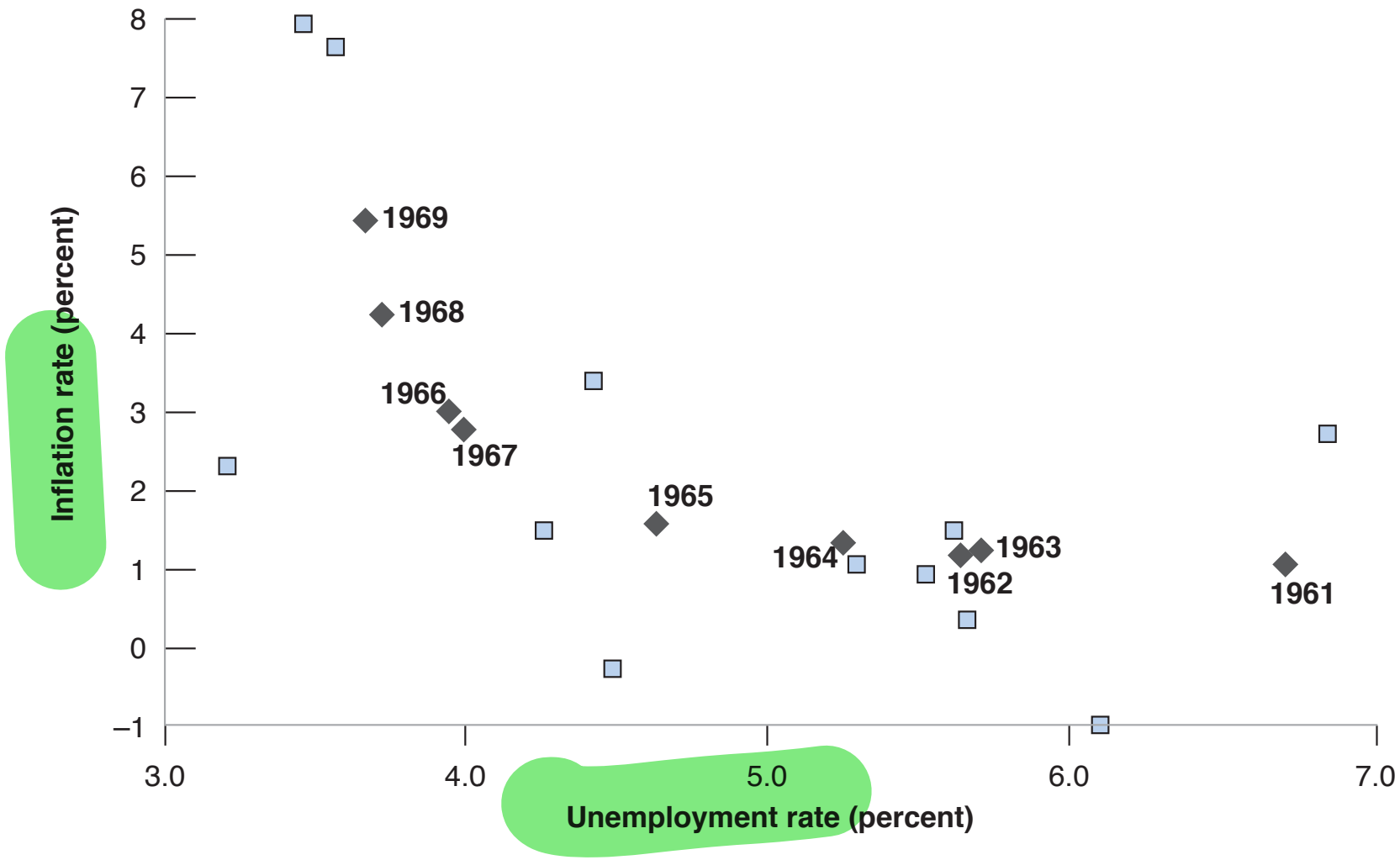
For money to be non-neutral, inflation must be **unexpected**

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

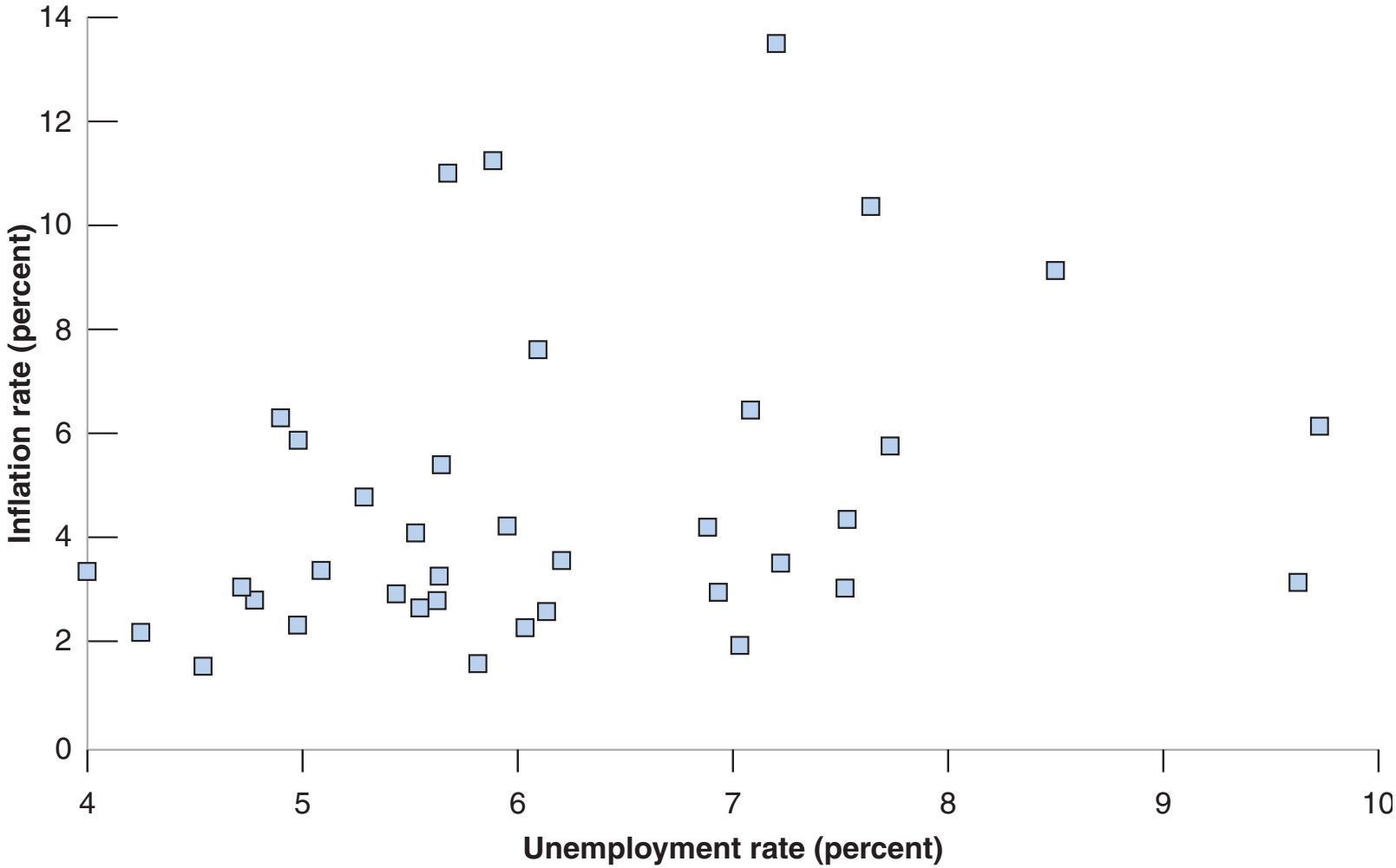
Inflation had been stable for a long time

π^e remained roughly fixed

Then the original Phillips curve emerges

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

The 1970s and Beyond

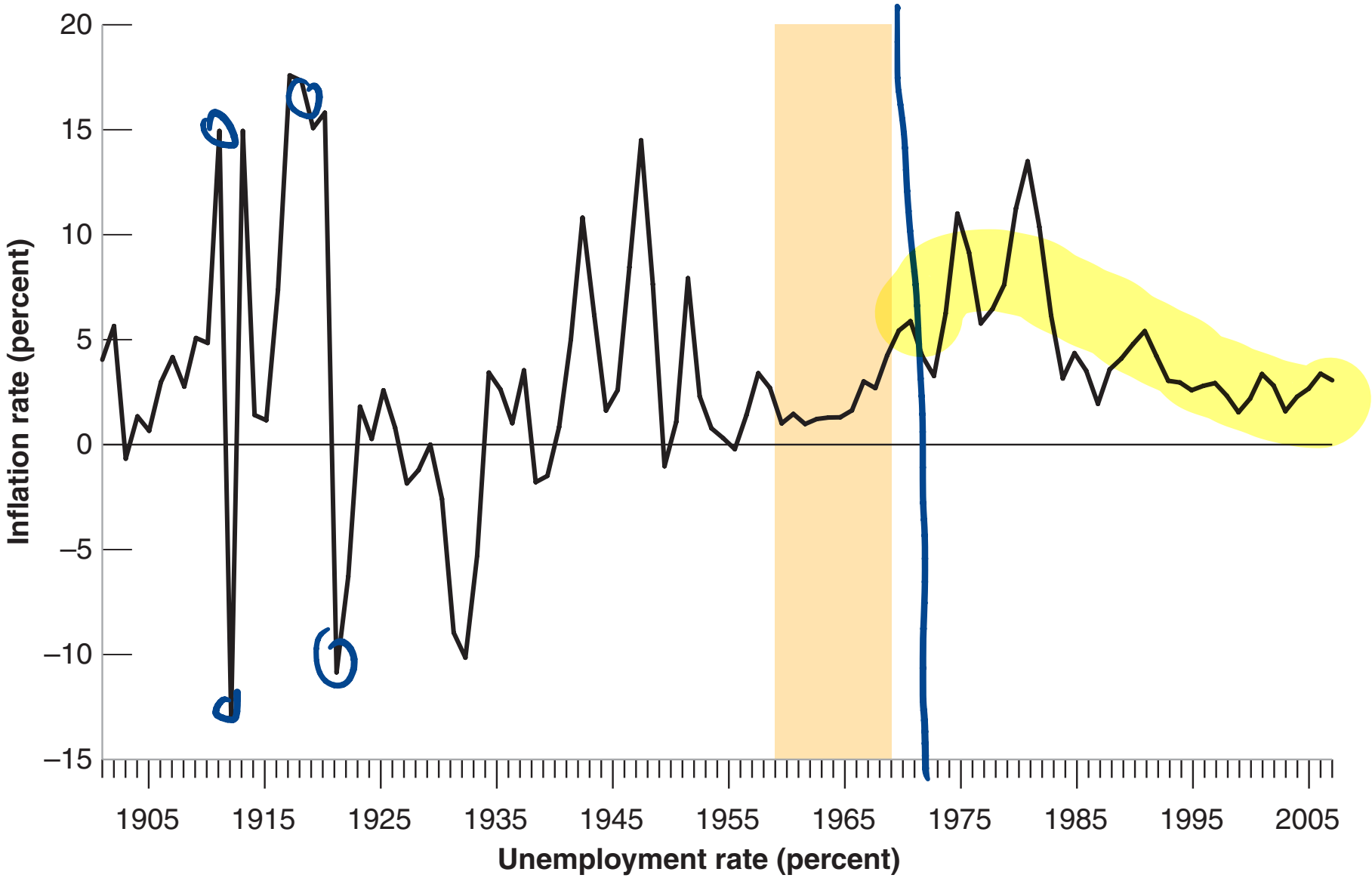


No relationship between inflation and unemployment

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



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...

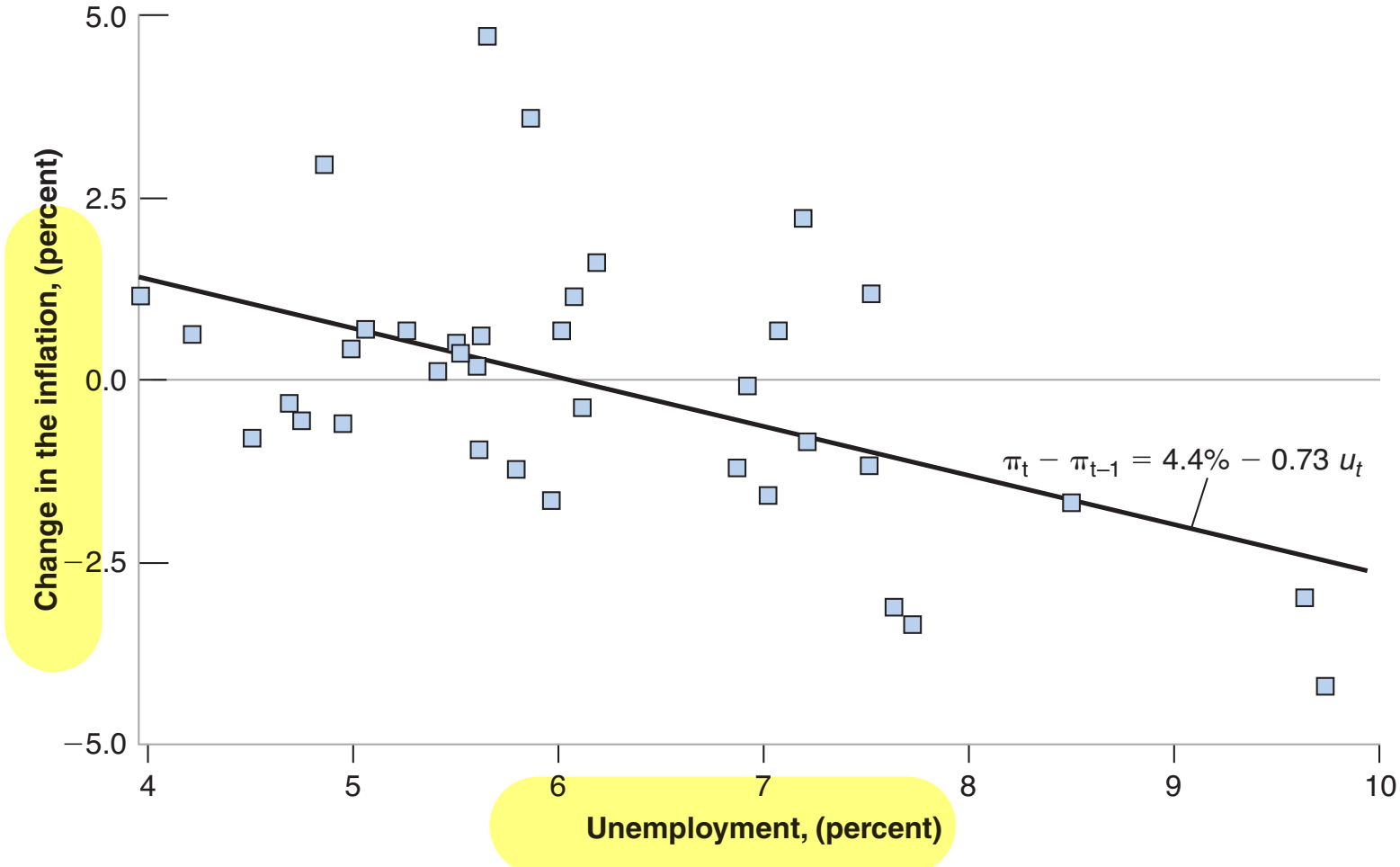
A coarse approximation:

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

Modified Phillips Curve

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

Modified Phillips Curve



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

Deriving the Phillips Curve II

The Philips Curve is now

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

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:

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

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

In words:

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

Anticipated inflation is built into wage demands

Deriving the Phillips Curve IV

- 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

In words:

unemployment rate = 1 - employment rate.

Recall the aggregate production function:

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

Relationship with unemployment II

or

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

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

Take a linear approximation:

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

Relationship with unemployment III

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:

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