

# AS/AD Model

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Econ520

January 24, 2023

# Objectives

In this section you will learn

1. how to put IS/LM and labor market clearing together
2. how to derive aggregate supply and demand curves
3. how to analyze policies and shocks
4. why the economy tends towards potential output in the long run

Aggregate Supply (AS)

# Aggregate Supply

The aggregate supply curve is simply the labor market clearing condition

Recall

$$Y^s = F(W/P^e, z) \quad (1)$$

$$= F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right) \quad (2)$$

$F$  is upward sloping in  $W/P^e$ .

# Properties of AS

Holding constant  $P^e$ :  $Y \uparrow \implies P \uparrow$

Intuition:

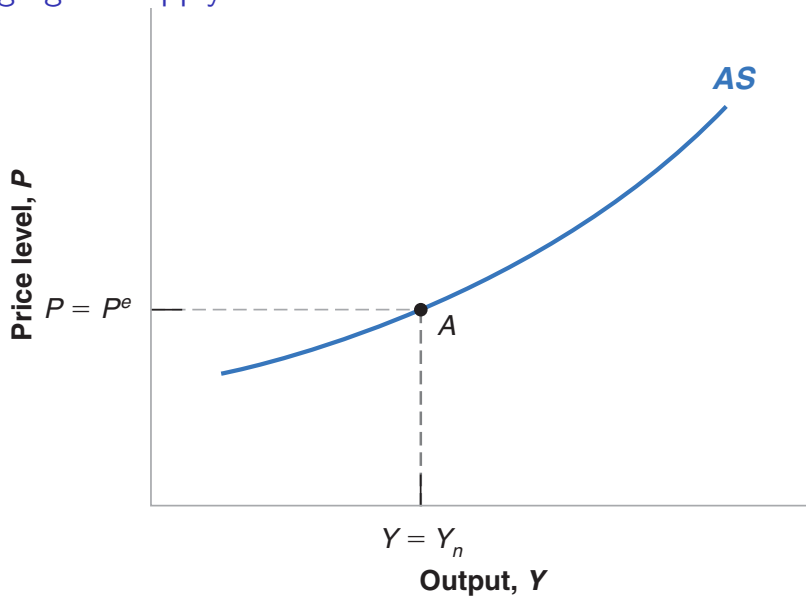
Holding constant  $Y$ :  $P^e \uparrow \implies P \uparrow$

Intuition:

When  $P = P^e$ :  $Y = Y_n$  and  $u = u_n$

these values define  $Y_n, u_n$ .

# Aggregate Supply



AS is upward sloping for given  $P^e$

# Shifters of AS

Labor market policies ( $z$ ); e.g., unemployment insurance

Production costs + competition ( $m$ ); e.g., oil prices

Price expectations ( $P^e$ )

Aggregate Demand (AD)



# Aggregate Demand

- ▶ AD combines IS and LM
- ▶ Recall:
  - ▶ IS:  $Y = C(Y - T) + I(Y, i) + G$
  - ▶ LM:  $M/P = YL(i)$
- ▶ Combine the two, so that  $i$  is eliminated

$$\mathbf{AD} : Y = Y(\underset{+}{M/P}, \underset{+}{G}, \underset{-}{T}) \quad (3)$$

- ▶ This is downward sloping:  $P \uparrow \implies Y \downarrow$
- ▶ Intuition: ...

# Deriving AD

The linear case:

► IS:  $Y = Y_0 + a_1 Y - a_2 i$

► LM:  $M/P = L_0 - \alpha i$

(assuming that money demand does not depend on  $Y$ )

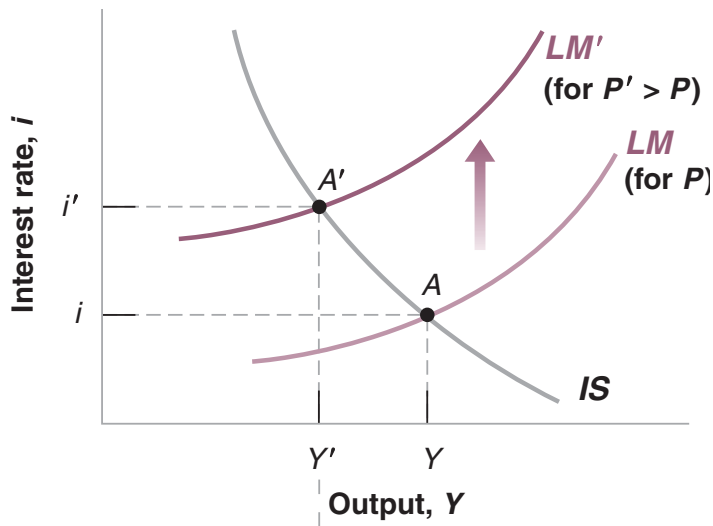
LM:  $i = (L_0 - M/P)/\alpha$

AD

$$Y(1 - a_1) = Y_0 - a_2(L_0 - M/P)/\alpha \quad (4)$$

$$Y = \frac{Y_0 + a_2(M/P - L_0)/\alpha}{1 - a_1} \quad (5)$$

## Deriving AD Graphically



Trace out intersection of IS/LM as  $P \uparrow$ .

# AD Shifters

- ▶ Anything that shifts IS or LM left shifts AD left (towards lower  $Y$ )
- ▶ Examples
  - ▶ IS:  $G \downarrow, T \uparrow, C_0 \downarrow$
  - ▶ LM:  $M \downarrow$
- ▶ These are exactly the shocks that reduce  $Y$  in the short-run model
- ▶ AD really collects all short-run equilibria, one for each  $P$ .

Equilibrium

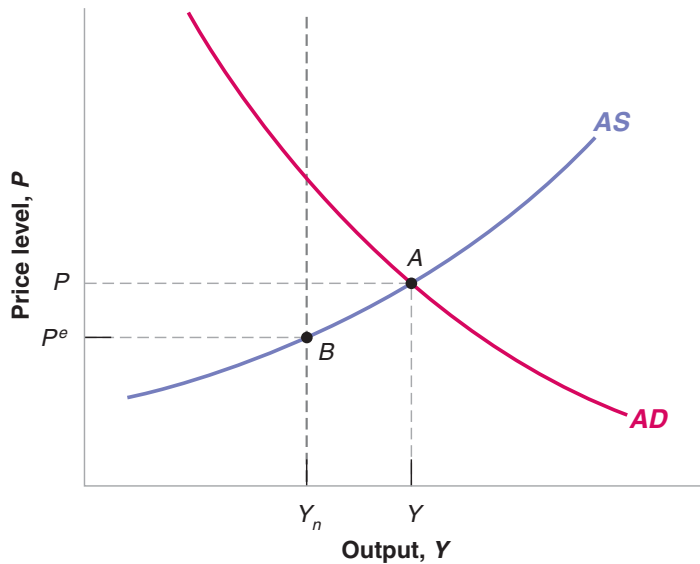
## Equilibrium summary

Curve	Equation	Shifters
AS	$Y = F\left(\frac{P}{P^e} \frac{1}{1+m}, z\right)$	$m \uparrow, P^e \uparrow, z$
AD	$Y = C(Y - T) + G + I(Y, i)$ $M/P = YL(i)$	$M/P \uparrow, G \uparrow, T \downarrow$

Short run:  $P^e$  given.

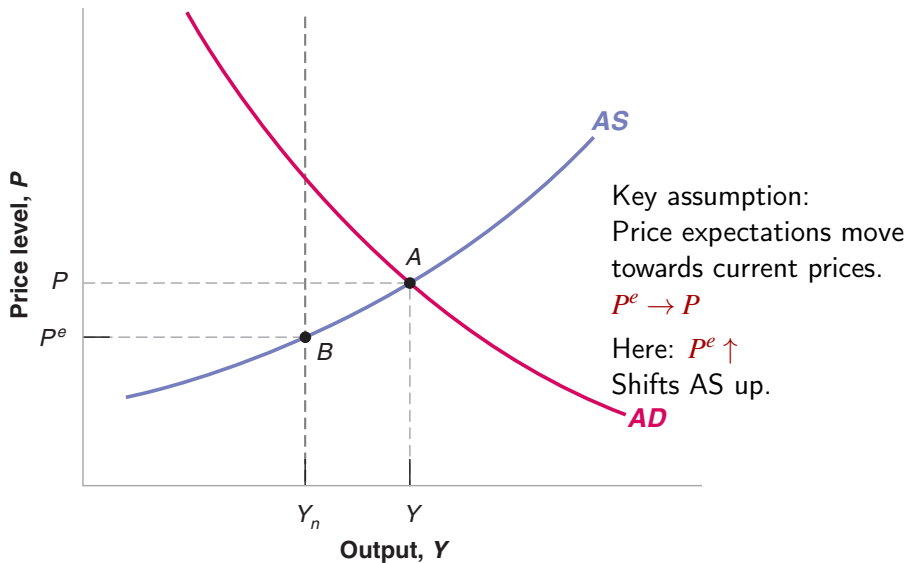
Medium run:  $P^e \rightarrow P$ .

## Short-run Equilibrium



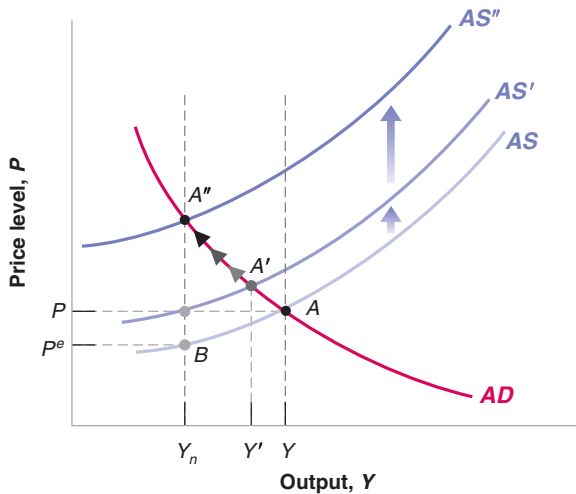
Clear all markets for a given  $P^e$

## Transition Towards Medium-run





## Transition Towards Medium-run



Expectations adjust  
towards  $P^e = P$   
AS shifts up  
 $Y \rightarrow Y_n$

# Analyzing the Model

1. Start with the medium run:
  - 1.1 vertical supply:  $Y = Y_n$
  - 1.2 on the point of the AD curve where  $P = P^e$
2. Apply a shock
  - 2.1 find the new medium run ( $P^e = P$ )
  - 2.2  $Y_n$  only changes if  $m$  or  $z$  were shocked
  - 2.3 find the new short-run ( $P^e$  unchanged)
3. Transition
  - 3.1 AS curve shifts towards new medium run equilibrium

# Thinking about Expectations

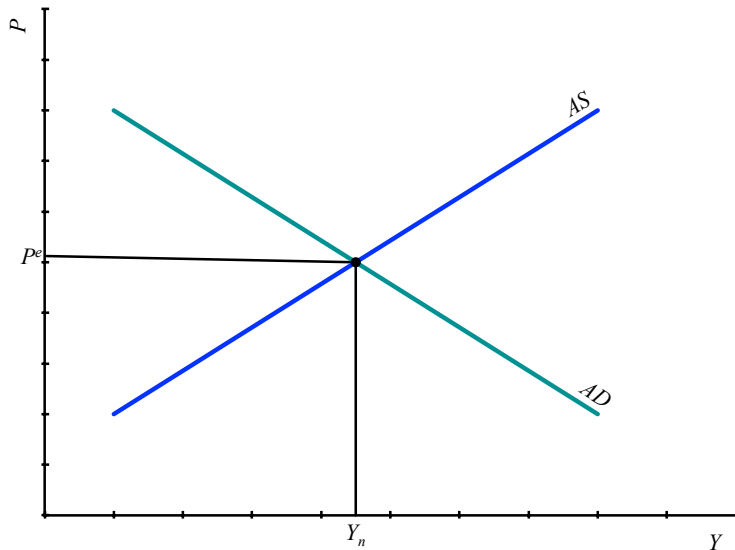
What we have here is a form of **adaptive expectations**.

- ▶ Workers target  $P^e = P$
- ▶ When they underpredict, they revise expectations upwards.

What would be a better way of modeling expectations?

# Applications

Monetary Expansion:  $M \uparrow$



# Monetary Expansion

Medium run:

Short run:

Transition:

- ▶ AS shifts toward  $Y_n$ .

# Monetary Expansion

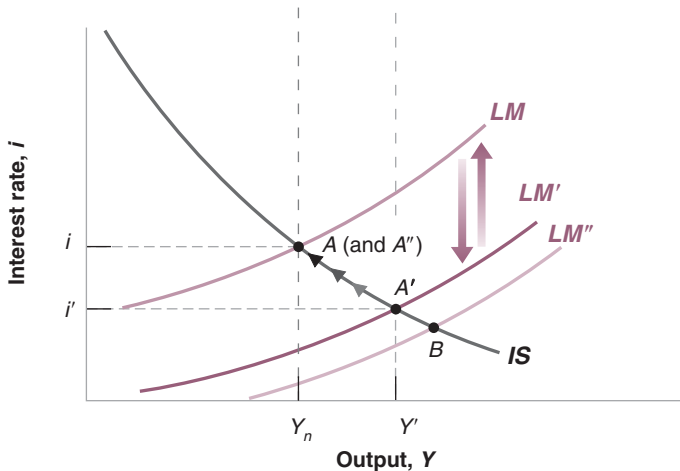
## Result

Money is neutral in the medium run:

- ▶  $M$  affects prices, but not any real variables
- ▶ Doubling  $M$  doubles  $P$

This is why we may ignore money in the long-run growth analysis.

# Intuition



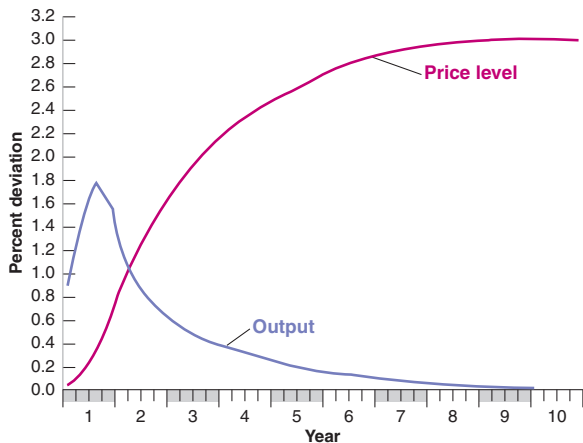
$M \uparrow \Rightarrow i \downarrow \Rightarrow I \uparrow$

With fixed  $P$ :  $A \rightarrow B$   
(IS/LM)

$P \uparrow$  dampens the  
short-run effect



# Empirical Evidence



Estimated macro models imply:

- ▶ the peak effect of monetary policy hits after nearly 1 year
- ▶ it takes several years for the real effects to wear off

# Why Monetary Policy Is Hard

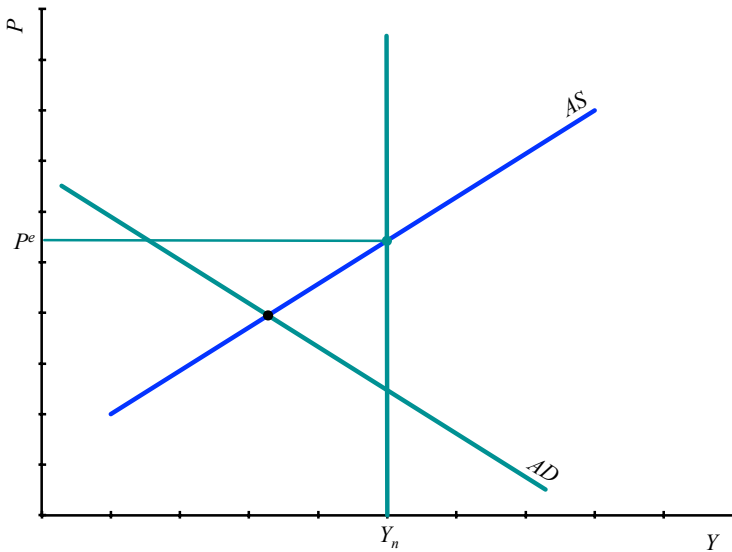
Suppose the economy is hit by an adverse AD shock

The Fed counters by expanding  $M$

There is a long lag between the increase in  $M$  and the shift in  $AD$

What happens?

# Why Monetary Policy Is Hard



# Why Monetary Policy is Hard

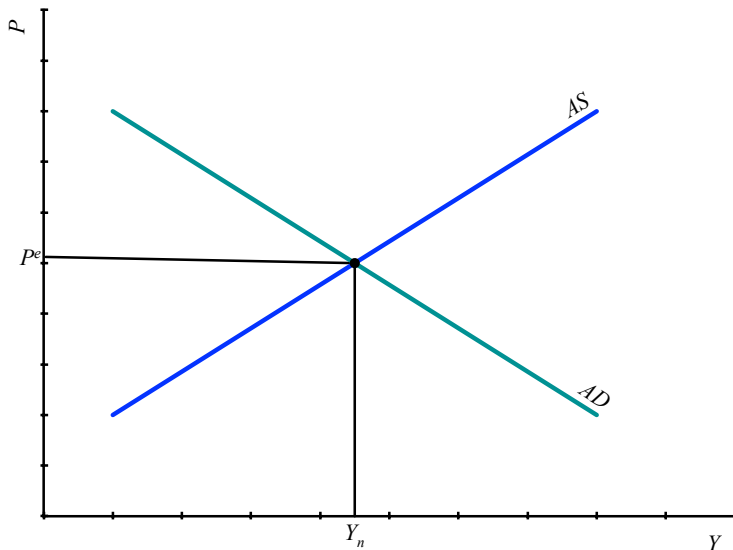
Policy options:

1. Do nothing
2. Raise  $M$  to shift the short-run equilibrium to  $Y_n$
3. Raise  $M$ , but by less

Note: This is why we may want some trend inflation.

# The Role of Expectations

What does an anticipated monetary expansion look like?



# The Role of Expectations

## Key point

Unanticipated monetary policy has real effects.

Anticipated monetary policy just changes prices.

This is an overstatement.

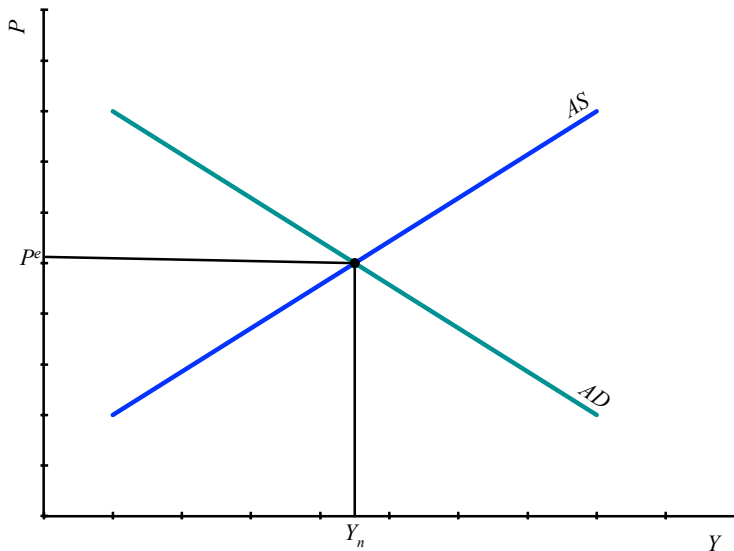
- ▶ In reality, not all prices will adjust ahead of time.

But:

- ▶ In the long run, monetary policy is neutral.
- ▶ Even in the short run, anticipated monetary policy is weak.

# Deficit Reduction

The shock:  $G \downarrow$ .



# Deficit Reduction

Medium run:

- ▶ AS:
- ▶ AD:

Short run:

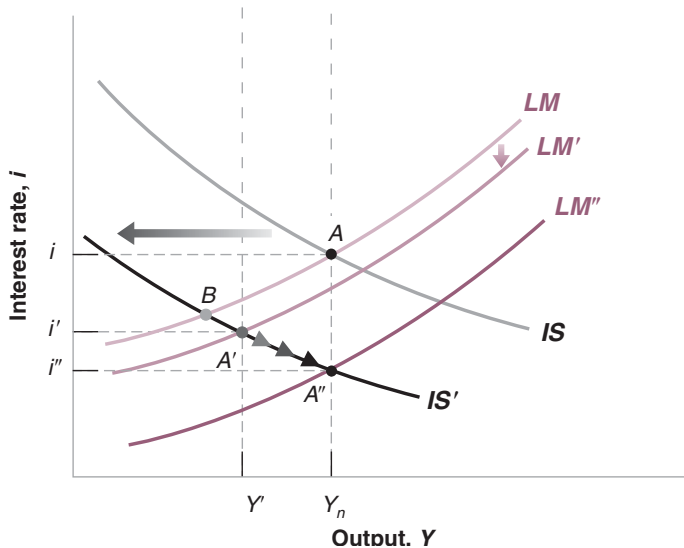
- ▶ AS:
- ▶ AD:

Transition:

- ▶ AS shifts towards  $Y_n$



# Deficit Reduction



With fixed  $P$ :  $A \rightarrow B$ .

Short run:

$G \downarrow \Rightarrow P \downarrow \Rightarrow$

$M/P \uparrow \Rightarrow i \downarrow$

Medium run:

$P \downarrow \Rightarrow LM \downarrow$

# Deficit Reduction

Short run:

- ▶  $Y \downarrow$
- ▶  $I$  ambiguous ( $Y \downarrow$  but  $i \downarrow$ )

Medium run:

- ▶  $Y$  returns to natural level
- ▶  $I \uparrow$ : crowding in

Long run:

- ▶  $K \uparrow \implies Y \uparrow$

This is the source of current disagreement: how to trade off the short run pain against the long run gain.

# Summary

	Short run			Medium run		
	$Y$	$i$	$P$	$Y$	$i$	$P$
$M \uparrow$	$\uparrow$	$\downarrow$	$\uparrow$	$-$	$-$	$\uparrow$
$G \uparrow$	$\uparrow$	$\uparrow$	$\uparrow$	$-$	$\uparrow$	$\uparrow$

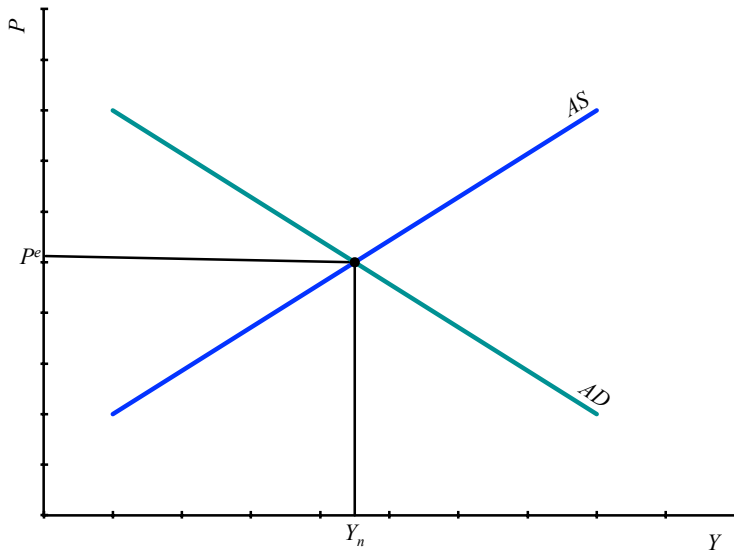
Short-run effects of shocks differ from medium-run effects.

Intuition: In the short run, wages do not fully adjust (b/c  $P^e$  is sticky).

# Adverse Supply Shock

- ▶ Example: permanent increase in the price of oil
- ▶ Main effect: given wages, prices must rise
- ▶ Model as increase in markup:  $m \uparrow$ .

## Adverse Supply Shock



# Adverse Supply Shock

Medium run:

Short run:

Transition: AS shifts towards  $Y_n$ .

# Stagflation

Demand shocks: output and prices move together.

Supply shocks: output and prices move against each other.

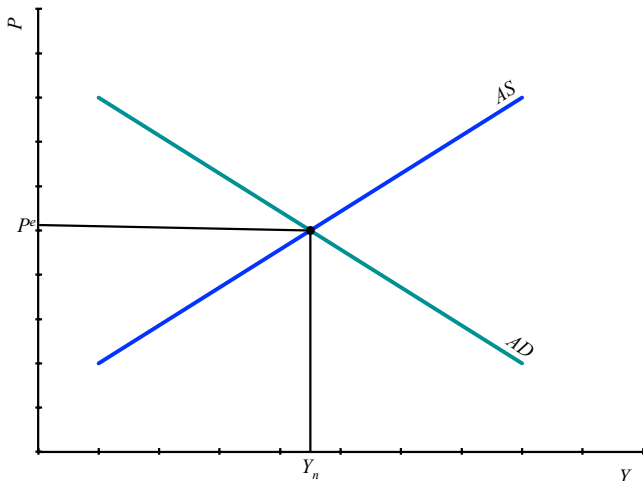
Stagflation:

- ▶ adverse supply shock creates **stagnation** and **inflation**.

# Stabilization Policy

How should policy respond to recessions?

Case 1: Adverse demand shock





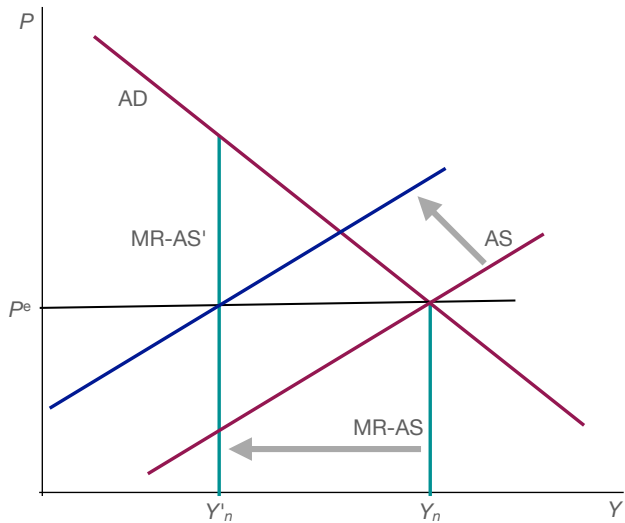
# Stabilization Policy

Case 2: Adverse supply shock

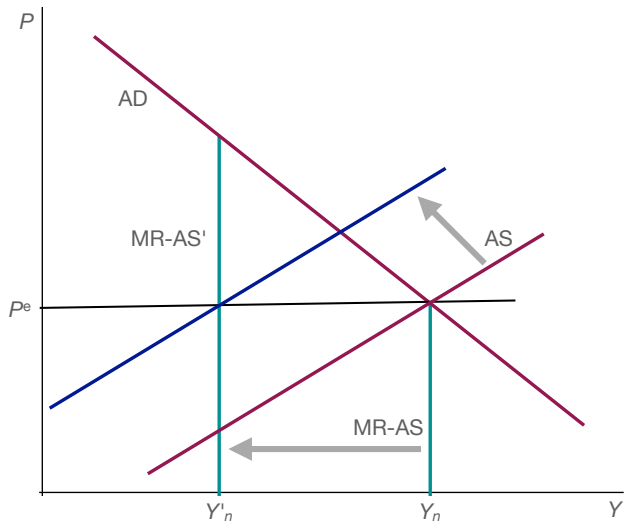
Two policy options:

1. Stabilize prices
2. Stabilize output

# Stabilizing Prices



# Stabilizing Output



# Stabilization Policy

What happens if policy makers misdiagnose the source of the shock?

Historical examples?

# Reading

Blanchard/Johnson, Macroeconomics, 6th ed, ch. 7