

Lecture 18 and 19

Aggregate demand and aggregate supply analysis

Studying AD and AS enable us to

- ▶ Analyze the effect of monetary policy on output and prices.
- ▶ Explore how aggregate output and inflation are determined.



Meaning of AD and AS

- ▶ Aggregate demand (AD): is total amount of output demanded at different inflation rates, when all other variables are held constant.
- ▶ Aggregate supply (AS): is total amount of output that firms want to sell at different inflation rates.



AS curve in short and long run

AS curve differs in the short and long run
because prices and wages take time to adjust to
their long run level.



Long run AS curve (denoted by LRAS)

- ▶ The amount of output that can be produced in the economy in the long run is determined by 3 factors:

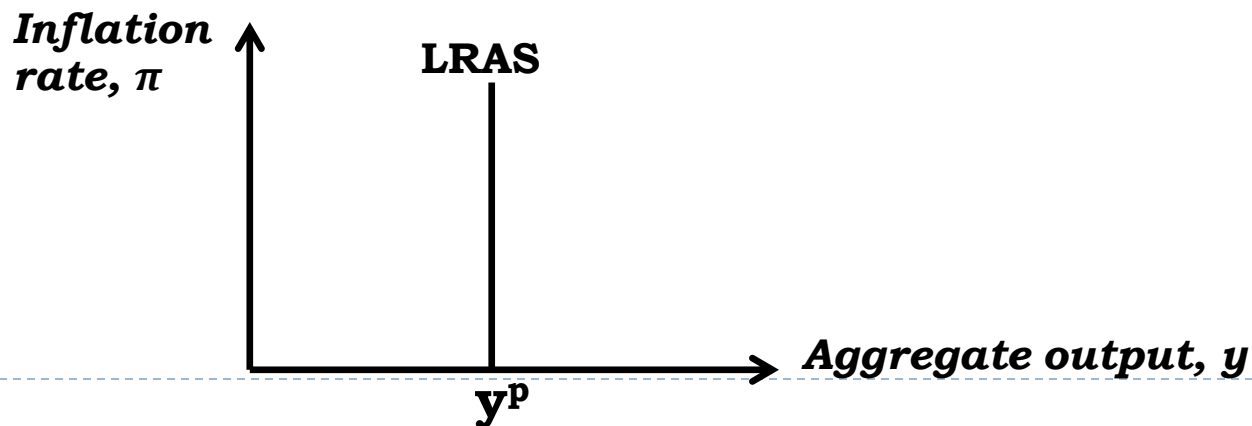
1. Amount of capital in the economy
2. Amount of labor supply at full employment
3. The available technology (put K&L to produce goods)

- ▶ Note: full employment $\neq$ zero unemployment
 - ▶ Full employment means the demand for labors equals the supply of labors (of which level of unemployment is above zero) $\rightarrow$ natural rate of unemployment
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LRAS curve

- ▶ Natural rate of unemployment is where economy gravitates in the long run.
- ▶ Natural rate of output (potential output) is the level of aggregate output produced at natural rate of unemployment. It is where economy settles in the long run for any inflation rates.
- ▶ The long run aggregate supply curve (LRAS) is thus vertical at potential output (y^p)

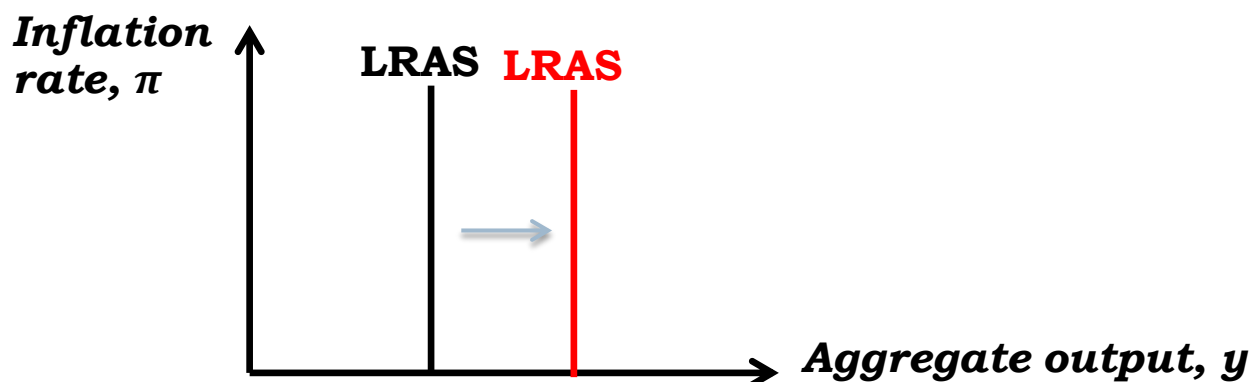


Shift in LRAS

1. When any of the 3 factors for LRAS $\uparrow \rightarrow$ potential output $\uparrow \rightarrow$ LRAS shift to the right.

However, these 3 factors grow fairly steadily over time. $\rightarrow$ LRAS is assumed to be fixed later.

2. When natural rate of unemployment $\downarrow \rightarrow$ labor is being more utilized $\rightarrow$ potential output $\uparrow \rightarrow$ shift LRAS to the right



Short run AS curve (denoted by AS)

- ▶ Short run AS curve is based on 3 factors that drive inflation
- ▶ **Factor (1) Expected inflation (π^e)**

Workers and firms care about wages in real term (in terms of goods and service that wages can buy).

When workers expect the price level $\uparrow$

→ workers will adjust nominal wages $\uparrow$ 1-for-1 with the $\uparrow$ in expected inflation, so that the real wages does not decrease.

→ overall inflation will also $\uparrow$ 1-for-1 because wages are the most important cost of producing goods and services.



AS curve

▶ **Factor (2) Output gap ($y - y^p$)**- the different between aggregate output and potential output.

▶ If $y > y^p \rightarrow$ output gap is high $\rightarrow$ inflation $\uparrow$

when output exceeds its potential level $\rightarrow$ very little slack in the economy $\rightarrow$ workers will demand $\uparrow$ wage and firm will take opportunity to $\uparrow$ price.

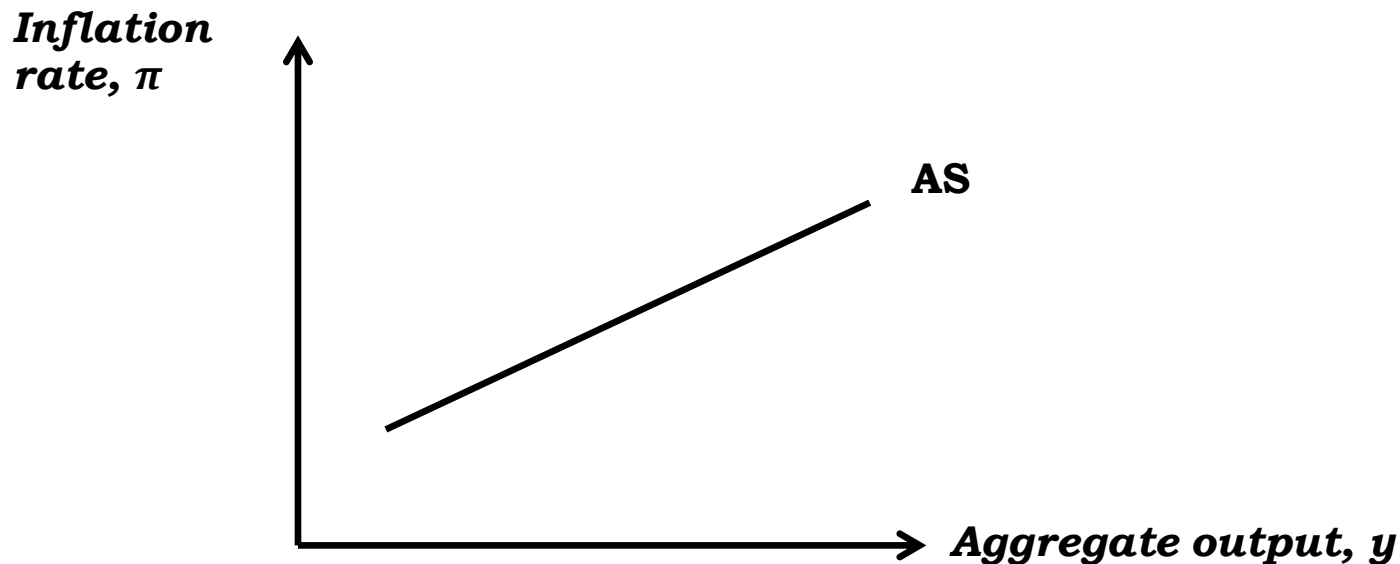
▶ If $y < y^p \rightarrow$ output gap is negative $\rightarrow$ inflation $\downarrow$

When output gap is negative $\rightarrow$ a lot of slack in the economy $\rightarrow$ worker will accept smaller increase in wages and firms will need to $\downarrow$ price to sell goods.



AS curve

- ▶ The higher is aggregate output (y)
 - the greater is the output gap ($y - y^p$)
 - the less slack in the economy
 - inflation $\uparrow$



AS curve

► Factor (3) Price (supply) shocks (ρ)

Occurs when there are shocks to the supply of goods and services produced in the economy that translated into price shocks.

It is shift in inflation that are independent of the amount of slack in the economy or expected inflation ex) oil supply shock, energy price shock.



AS curve

- ▶ Equation for short run aggregate supply curve:

$$\pi = \pi^e + \gamma (y - y^p) + \rho$$

- ▶ AS is upward sloping ($y \uparrow \rightarrow y - y^p \uparrow \rightarrow \pi \uparrow$)
 - ▶ γ is sensitivity of inflation to output gap
 - ▶ Equation implies that wages and price are sticky:
 - If $|\gamma|$ is higher, AS curve is steeper
 - Wages and prices are more flexible $\rightarrow$ the more inflation will respond to deviation of output from potential output.
 - If wages and prices are completely flexible, AS is vertical and identical to LRAS.
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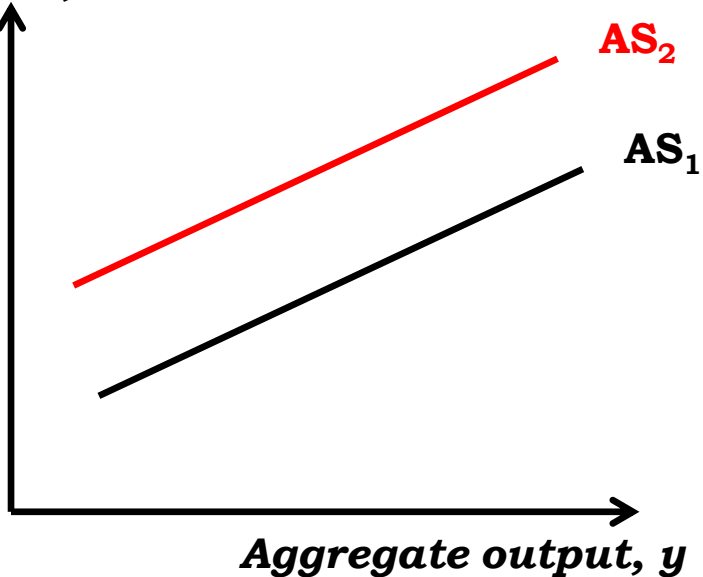


Shift in AS: factors 1 and 2

Equation for short run aggregate supply curve:

$$\pi = \underset{(+)}{\pi^e} + \underset{(+)}{\gamma} (y - y^p) + \underset{(+)}{\rho}$$

*Inflation
rate, π*



Factors causing shift in AS are
1. A rise in expected inflation
2. Unfavorable supply shocks that drive up price level



AS curve shift upward and to the left

Shift in AS: factor 3

Another factor for shift in AS is persistent output gap

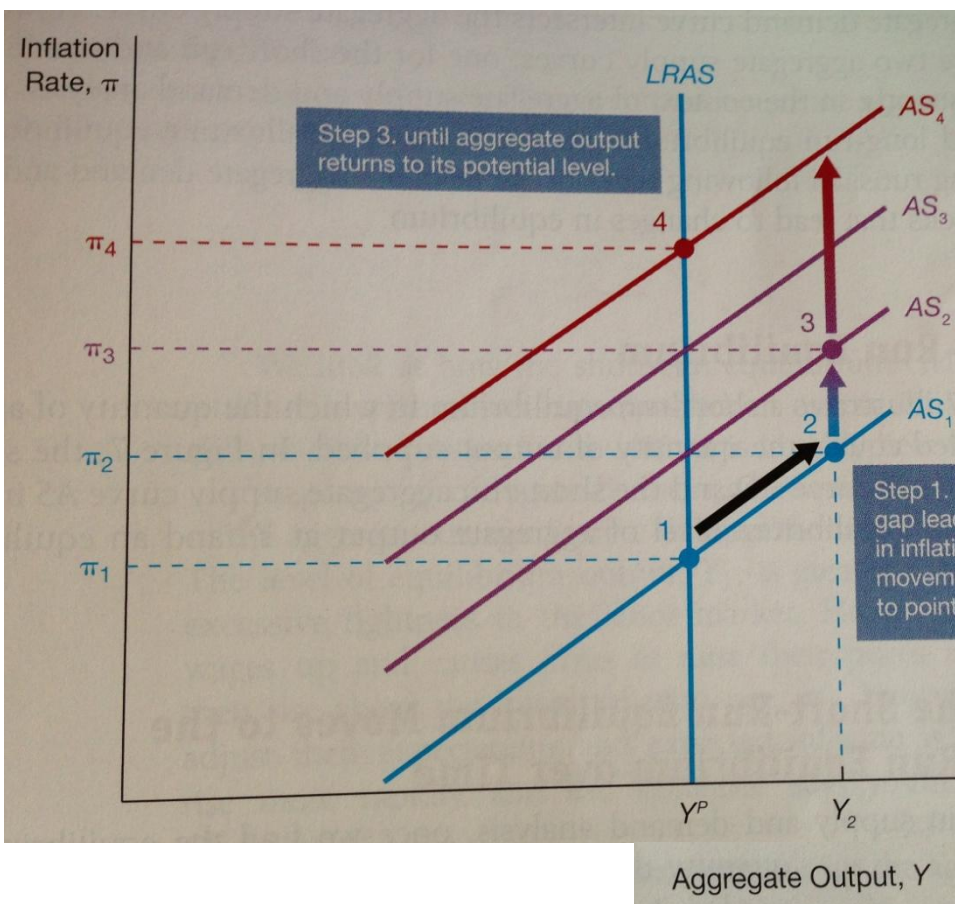
What happens if output gap $\uparrow$

Step 1: movement along AS

When output is above potential (at Y_2)
 $\rightarrow$ economy moves along AS_1 curve
from point 1 to 2 $\rightarrow$ inflation $\uparrow$ to π_2

Step 2: AS curve shift up

- A persistent output gap will cause AS shift up by affecting expected inflation.
- If $y_2 > y^p$, output gap remain persistently positive at point 2 $\rightarrow \pi \uparrow \rightarrow \pi^e \uparrow \rightarrow$ AS shift up to AS_2 and then to AS_3
- AS will stop shift when economy reach point 4 where the output gap is zero.
(no further reason to shift as economy is at potential, output gap disappear, π and π^e stop rising)

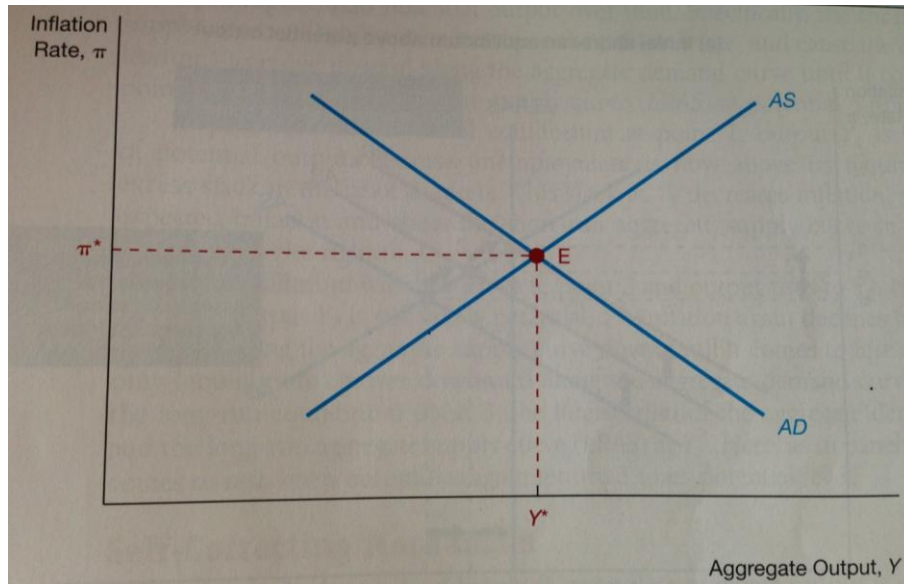


Equilibrium in aggregate demand and supply analysis



Short run equilibrium in the economy

- ▶ Short run equilibrium occurs when all markets are simultaneously in equilibrium where $AD = AS$.



Y^* is equilibrium output level,

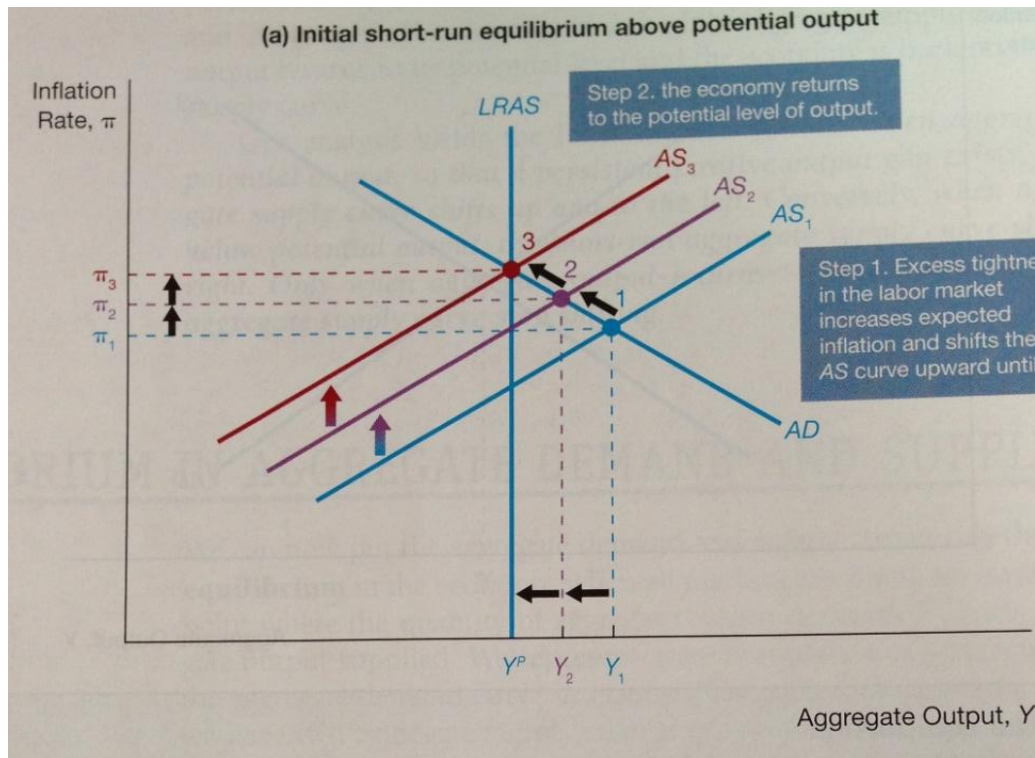
π^* is equilibrium inflation rate.

- ▶ If $Y^* \neq Y^p$, short run equilibrium will move over time.
- ▶ If the current level of inflation changes from initial level, AS curve will shift as wages and prices adjust to new expected rate of inflation.

How SR equilibrium moves to LR equilibrium?

Case 1: SR equilibrium output is initially above potential output

If initial equilibrium is at point 1



As $y_1 > y^p$ $\rightarrow$ excessive tightness in labor market $\rightarrow$ positive output gap at y_1 drives wages $\uparrow \rightarrow$ firm $\uparrow$ prices at a more rapid rate $\rightarrow$ inflation $\uparrow$ above $\pi_1 \rightarrow \pi^e \uparrow \rightarrow$ AS shift up to $AS_2 \rightarrow$ reach new equilibrium at point 2 $\rightarrow$ move up along AD curve $\rightarrow$ output $\downarrow$ to y_2

As $y_2 > y^p$ $\rightarrow$ the same process Continues until reach AS_3 where $AS=LRAS$ at y_p where output is at potential (point 3) $\rightarrow$ no further pressure on inflation to rise $\rightarrow$ no further tendency for AS to shift.

How SR equilibrium moves to LR equilibrium?

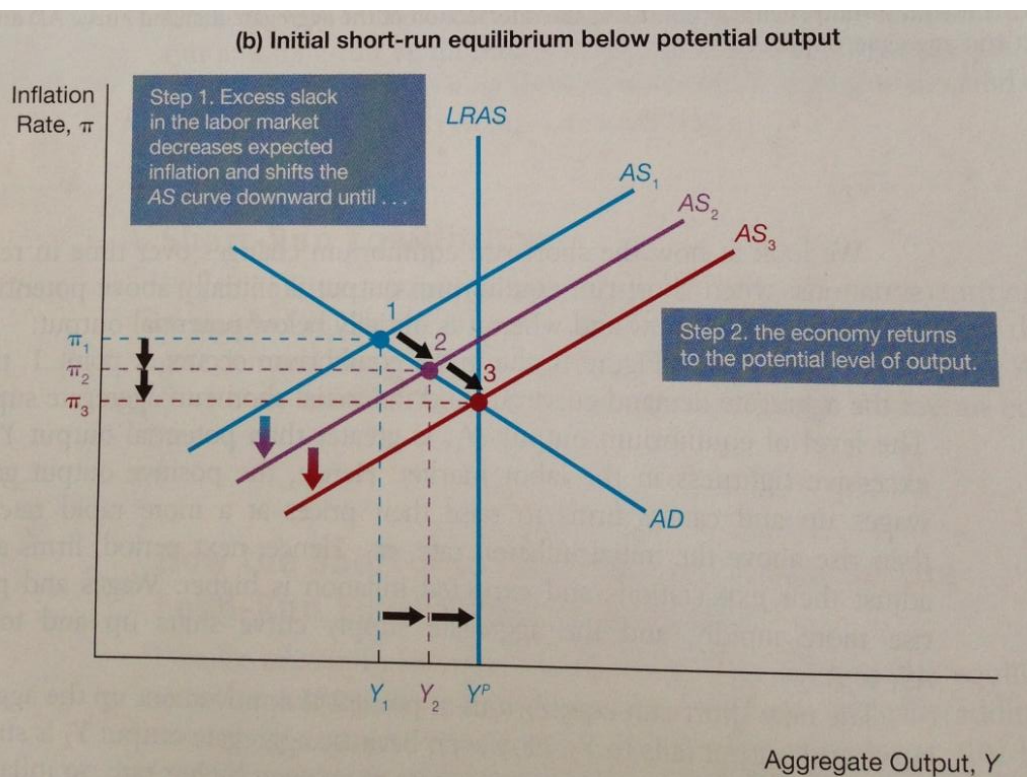
- ▶ This implies that economy will not remain at the level of output higher than potential output over time.
- ▶ Short run aggregate supply curve (AS) will shift to the left → raise the inflation rate → cause the economy (equilibrium) to move upward along the AD curve until it reaches LRAS at potential output Y_p



How SR equilibrium moves to LR equilibrium?

Case 2: SR equilibrium output is initially below potential output

If initial equilibrium is at point 1



As $y_1 < y^p$ $\rightarrow$ unemployment is above its natural rate $\rightarrow$ excess slack in the labor market $\rightarrow \pi \downarrow \rightarrow \pi^e \downarrow \rightarrow$ AS shift to the right to $AS_2 \rightarrow$ equilibrium move to point 2, Output $\uparrow$ to Y_2

As $y_2 < y^p$ $\rightarrow \pi \downarrow$ from its value last period $\rightarrow$ shift AS down until it rest At $AS_3 \rightarrow$ economy move downward along AD until it reach long run equilibrium at point 3, where $AD=LRAS$ at Y_p

The economy comes to rest when output returned to potential level.

Self correcting mechanism

- ▶ Self correcting mechanism: regardless of where output is initially, it returns eventually to potential output.
- ▶ The mechanism occurs because the AS shift up or down to restore the economy to the long-run equilibrium at full employment (aggregate output at potential) over time.



Changes in Equilibrium

- 1. Aggregate demand shock**
- 2. Aggregate supply shock (LR and SR)**



1. Aggregate demand shock

- ▶ Positive demand shock that cause rightward shift in AD:

1. Autonomous easing of MP ($\downarrow$ real interest rates at any given inflation rate)
 2. Increase in government purchase
 3. Decrease in taxes
 4. Increase in net export
 5. Increase in autonomous consumption expenditure
 6. Increase in autonomous investment
 7. Decrease in financial friction
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Positive demand shock

Initial long run equilibrium at point 1

Positive demand shock

People become more optimistic so $\uparrow \bar{c}$ and $\uparrow \bar{i}$

AD shift right to AD_2

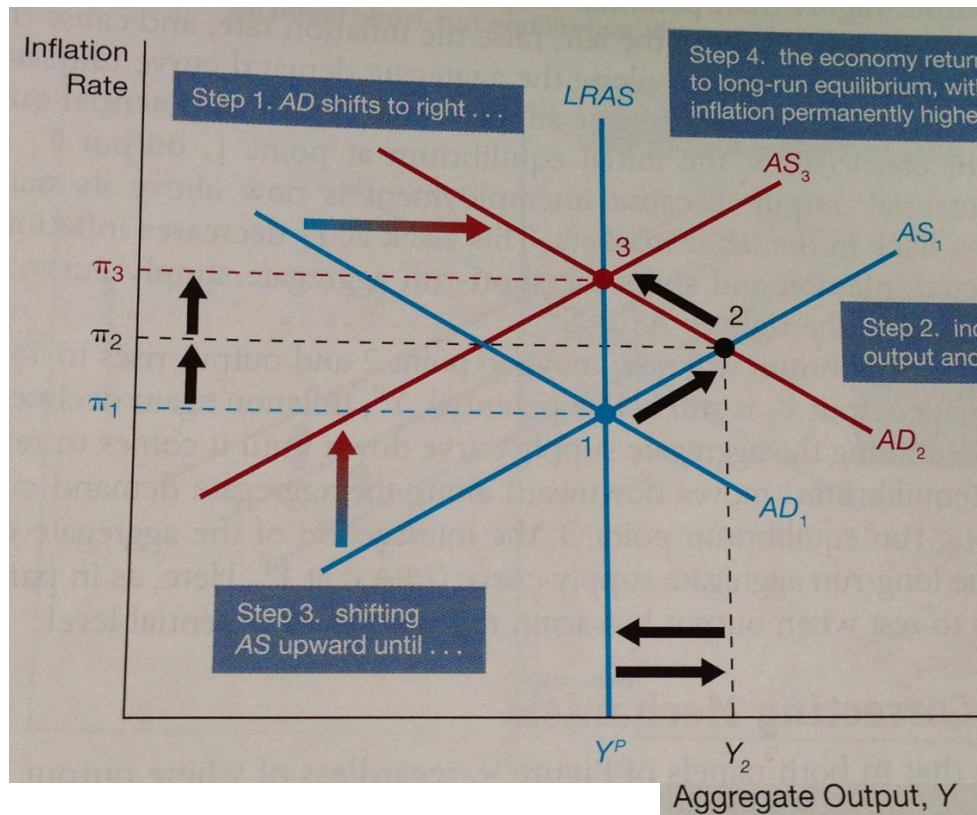
economy move up along AS_1 to point 2

Output and inflation $\uparrow$ to Y_2 and π_2

Since $Y_2 > Y^P \rightarrow \pi^e \uparrow \rightarrow$ AS shift up to AS_3

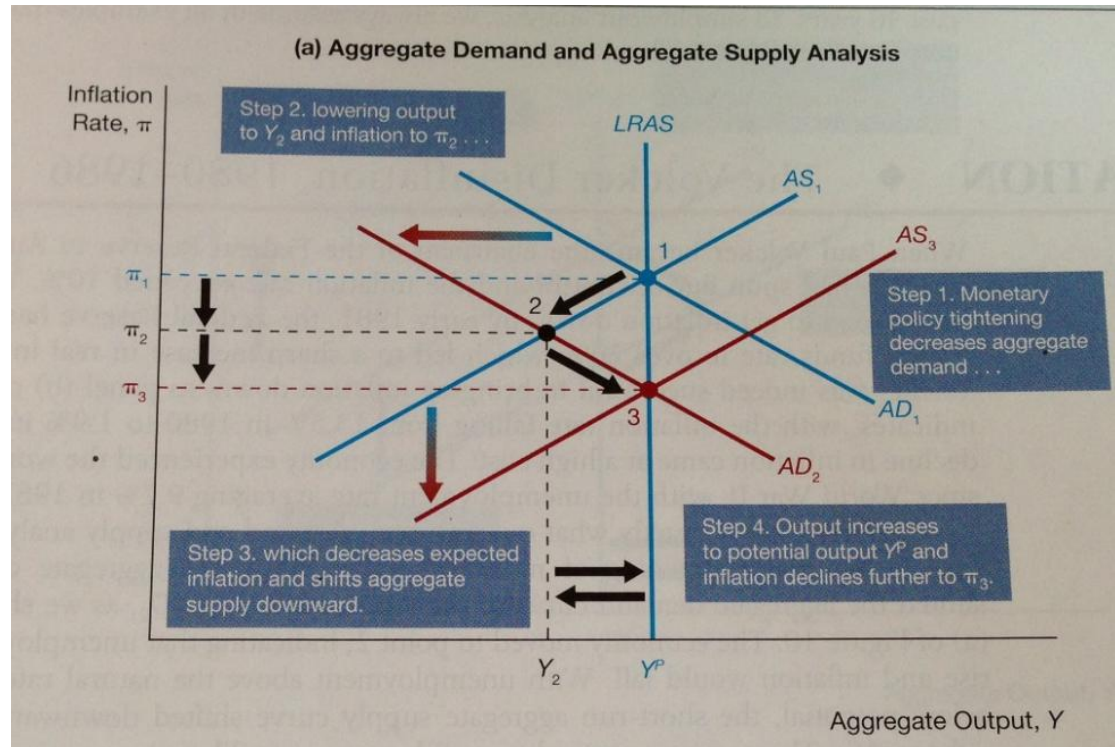
economy move up along AD_2 to point 3

Achieve LR equilibrium at π_3 and Y^P



Although initial shock raise both inflation and output, the ultimate long run effect is only a rise in inflation because output returns to its initial level at Y^P

Application: the Volker's disinflation (1980-86)



An autonomous tightening of MP

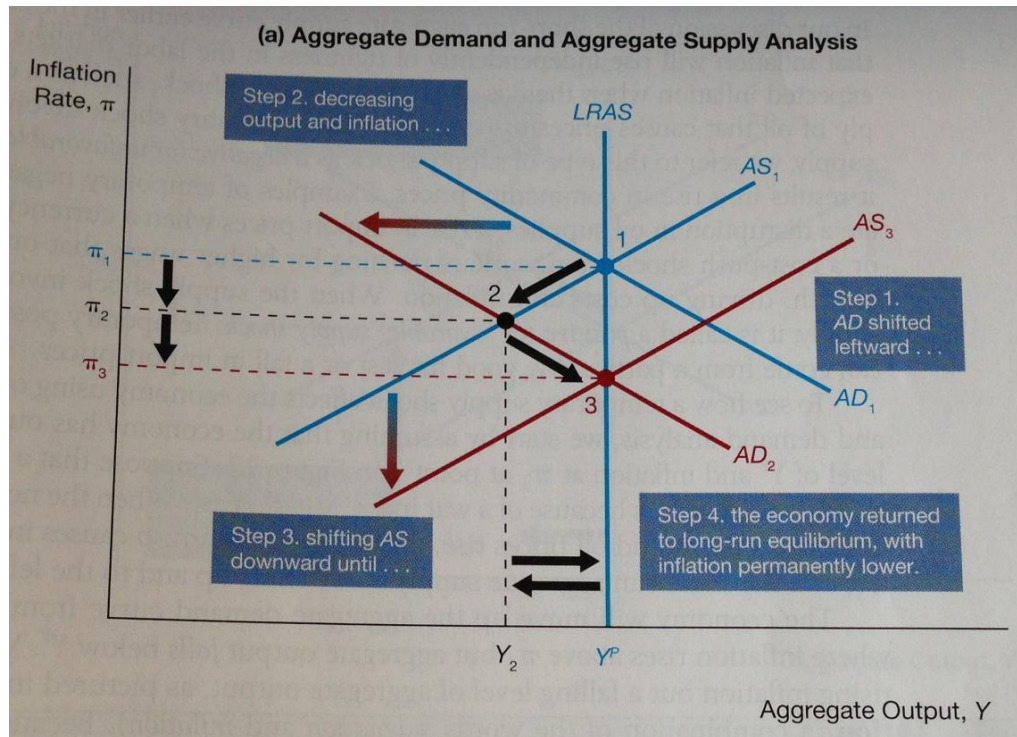
Consequently

1. inflation $\downarrow$,
2. Output only $\downarrow$ in short run but rise back to potential output.
3. Unemployment rate only $\uparrow$ in short run and move toward natural level.

(b) Unemployment and Inflation, 1980–1986

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
1980	7.1	13.5
1981	7.6	10.3
1982	9.7	6.2
1983	9.6	3.2
1984	7.5	4.3
1985	7.2	3.6
1986	7.0	1.9

Application: Negative demand shock (2001-04)



3 negative shocks to AD (↓ consumption and investment) due to

- Tech bubble burst: stock market fell sharply.
- 9-11 attack: weaken consumer and business confidence.
- Enron bankruptcy: interest rate on corporate bond ↑, more expensive to finance investment

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
2000	4.0	3.4
2001	4.7	2.8
2002	5.8	1.6
2003	6.0	2.3
2004	5.5	2.7

2. Aggregate supply (price) shock: temporary

- ▶ There are 2 types of supply shocks

Temporary supply shocks: LRAS curve doesn't shift

Permanent supply shocks: LRAS curve shift

- ▶ For a temporary supply shocks:

1. Inflation will rise independently of tightness in the labor market or of increases in expected inflation.

2. productive capacity in the economy does not change, so Y_p and LRAS remain stationary

- ▶ Example of temporary supply shocks are:

1. negative shocks: oil supply disruption, import price $\uparrow$ when currency depreciate, cost push shock from workers pushing higher wages that outpace productivity growth.

2. positive shocks: good harvest, a fall in import price.



Temporary negative supply shock

Initial long run equilibrium at point 1

Temporary negative supply shock

ex) wars in middle east

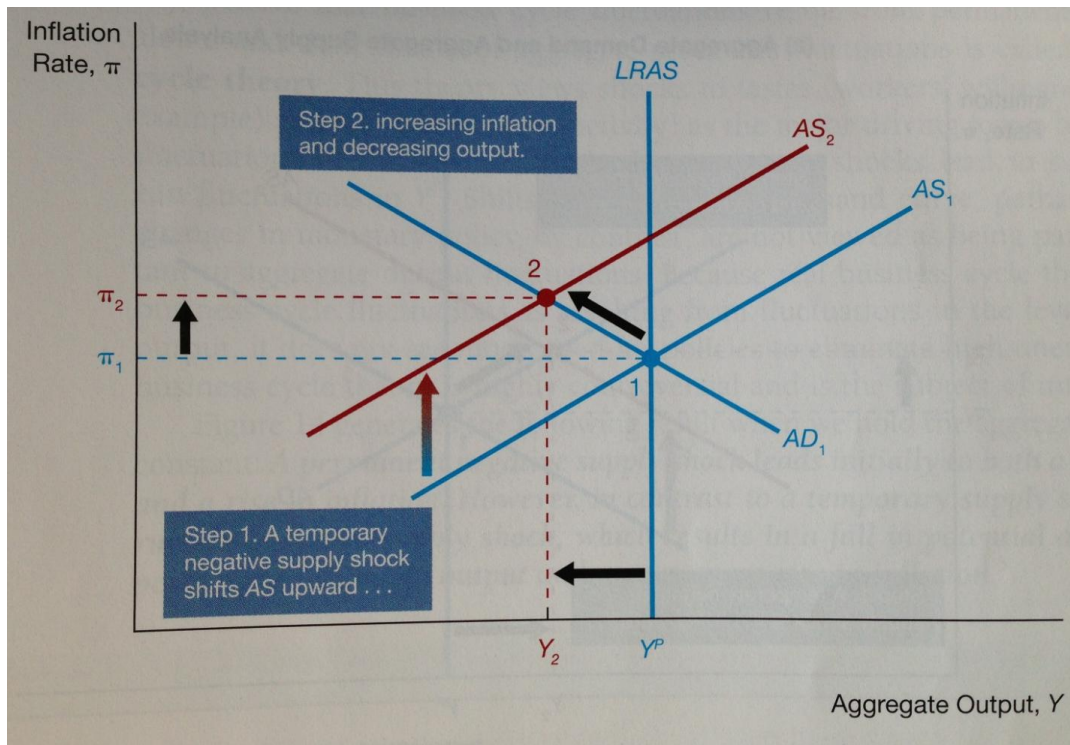
Oil price $\uparrow \rightarrow \rho \uparrow \rightarrow \pi \uparrow$ above $\pi_1 \rightarrow AS$ shift left to AS_2

economy move up along AD to point 2

Inflation $\uparrow$ above π_1 but aggregate output $\downarrow$ (to Y_2) below $Y^P \rightarrow$ Stagflation

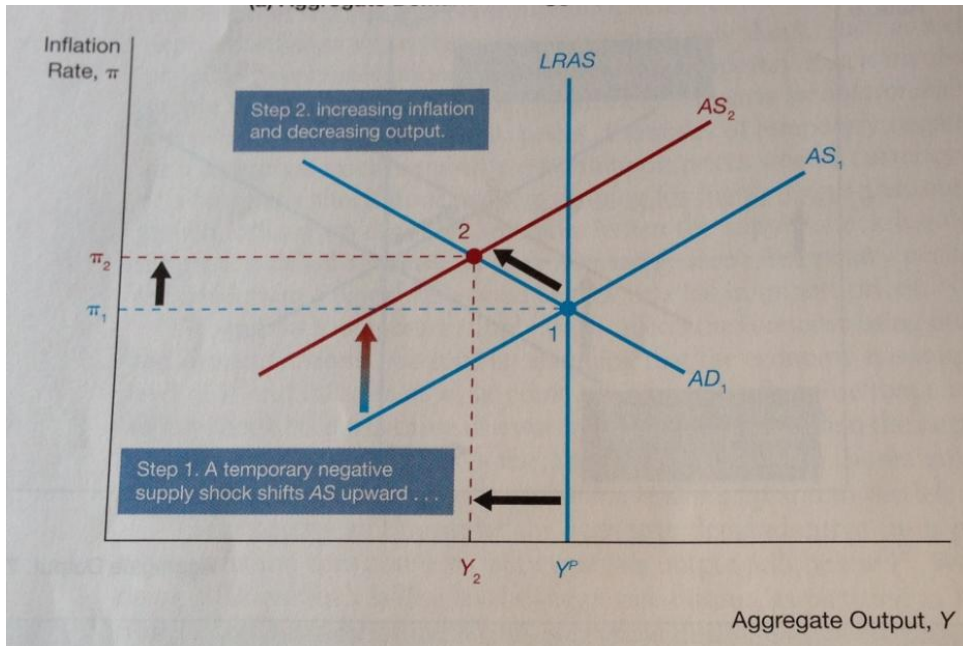
Since $Y_2 < Y^P \rightarrow \pi \downarrow \rightarrow AS_2$ shift back to AS_1

economy slide down AD and return to LR equilibrium at point 1



Although a temporary negative supply shock leads to leftward shift in short-run aggregate supply curve, which raises inflation and lowers output initially, the ultimate long run effect is that output and inflation are unchanged

Application: Negative supply shock (1973-75 and 1978-80)



Temporary negative supply shocks from:

1. quadrupling oil prices: oil embargo from Arab and Israel war (1973), OPEC restrict oil production.
 2. sharp $\uparrow$ food price from series of world crop failure.
 3. Wage $\uparrow$ push by workers
- After termination of US wage and price control.

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
1973	4.8	6.2
1974	5.5	11.0
1975	8.3	9.1
1978	6.0	7.6
1979	5.8	11.3
1980	7.1	13.5

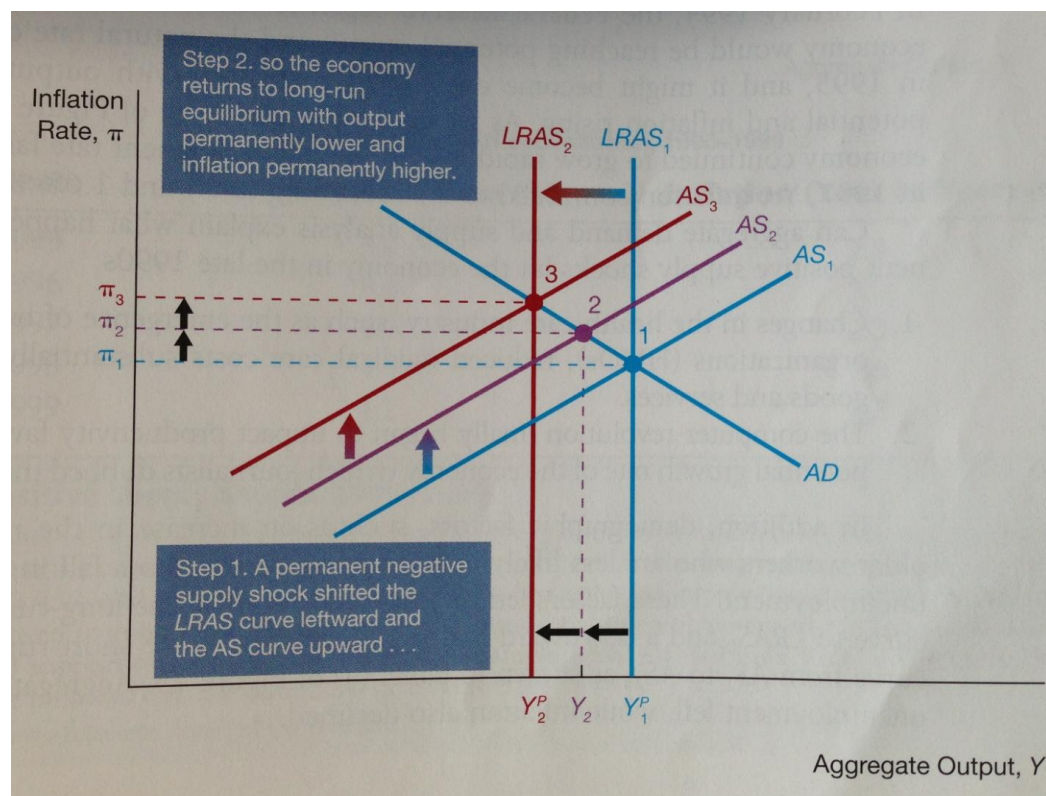
Permanent negative supply shock

Initial long run equilibrium at point 1

Permanent negative supply shock
LRAS shift left

Ex) ill-advised regulation ($\downarrow$ productivity)

Price $\uparrow \rightarrow \pi \uparrow \rightarrow AS_1$
shift left to AS_2

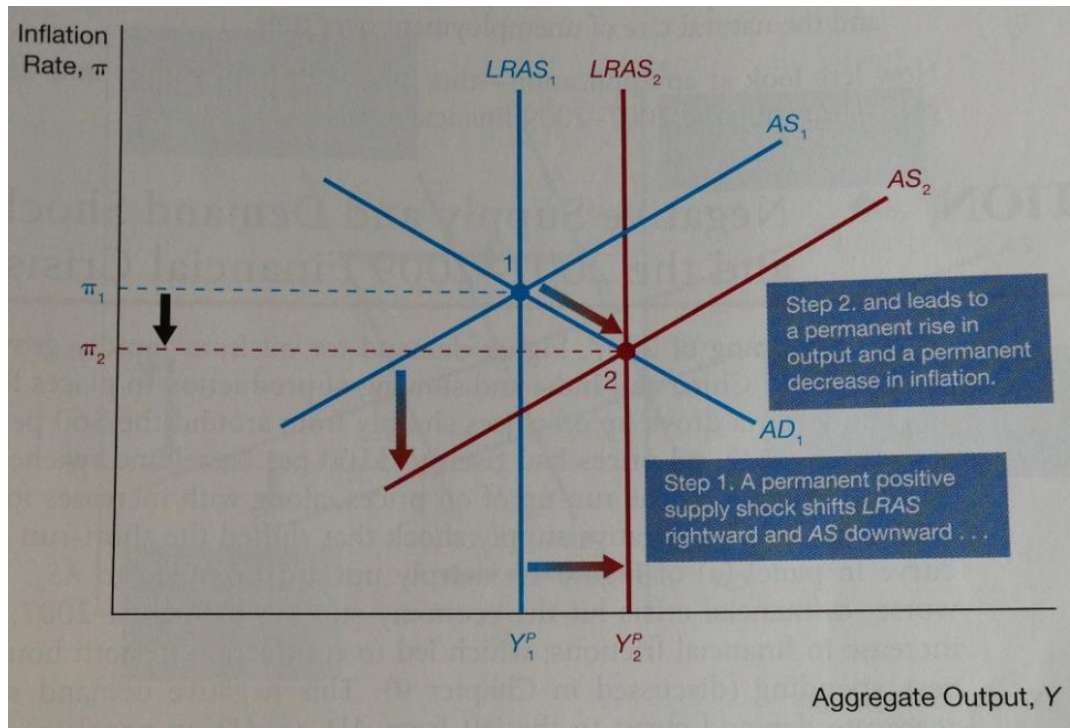


$Y_2 < Y_2^P \rightarrow$ positive output gap $\rightarrow$ upward pressure on inflation $\rightarrow AS_2$ shift to the left reaching AS_3

Equilibrium at point 3 (zero output gap, no upward pressure on inflation)

A permanent negative supply shock leads to a permanent fall in potential output and a permanent rise in inflation

Positive supply shocks (1995-99)

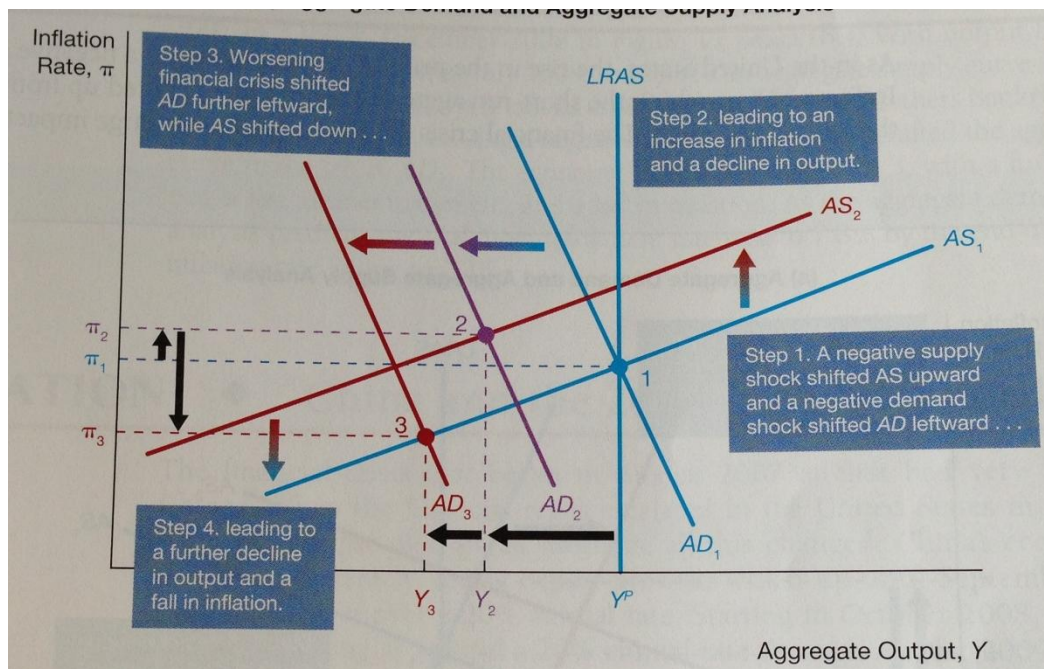


Permanent positive supply Shocks:

1. Improving health care industry (reduce healthcare cost)
2. Computer revolution ($\uparrow$ productivity)
3. Demographic factor: older workers are less likely to be unemployed $\rightarrow$ natural rate of unemployment $\downarrow$

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
1995	5.6	2.8
1996	5.4	3.0
1997	4.9	2.3
1998	4.5	1.6
1999	4.2	2.2

US negative supply and demand shocks and the 2007-09 crisis



2007: commodity and oil price shock

$AS_1 \rightarrow AS_2$

2007: US financial crisis $\rightarrow$ sharp $\uparrow$ in financial friction, $\downarrow$ spending

$AD_1 \rightarrow AD_2$

2008: oil price $\downarrow$ sharply

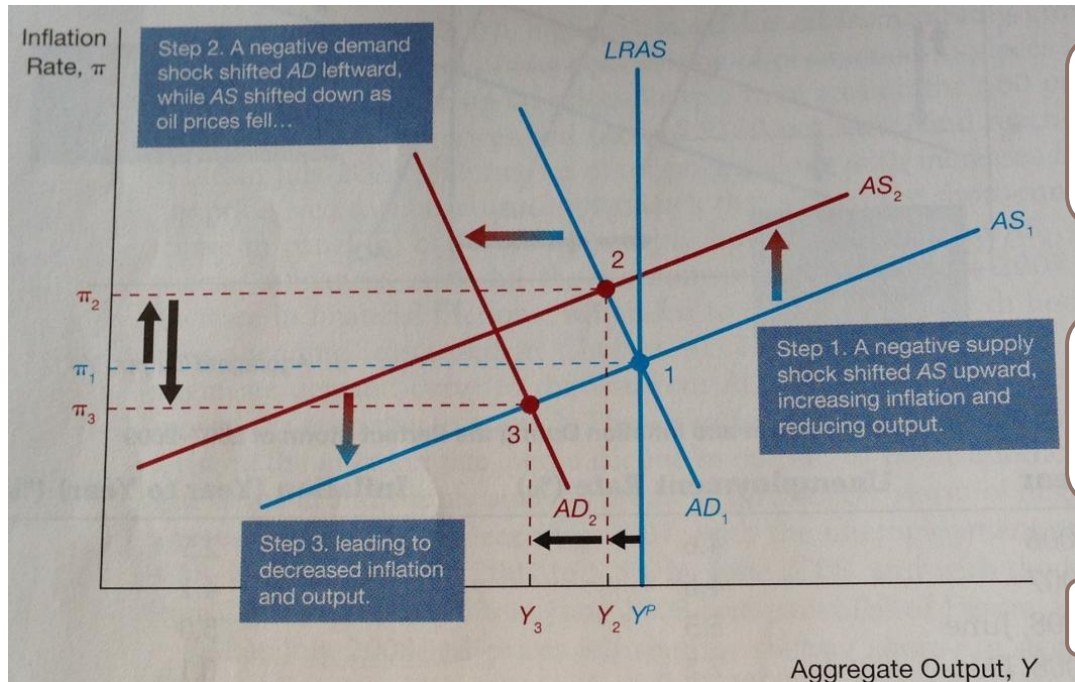
$AS_2 \rightarrow AS_1$

2008: Lehman bankruptcy

$AD_2 \rightarrow AD_3$

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
2006	4.6	2.5
2007	4.6	4.1
2008, June	5.5	5.0
2008, Dec.	7.2	0.1
2009, June	9.5	-1.2
2009, Dec.	10.0	2.8

UK and the 2007-2009 financial crisis



2007: commodity and oil price shock

$AS_1 \rightarrow AS_2$

No immediate direct impact from US crisis (move from 1 to 2)

Movement along AD_1

$$Y_2 < Y_2^P \rightarrow \pi \uparrow$$

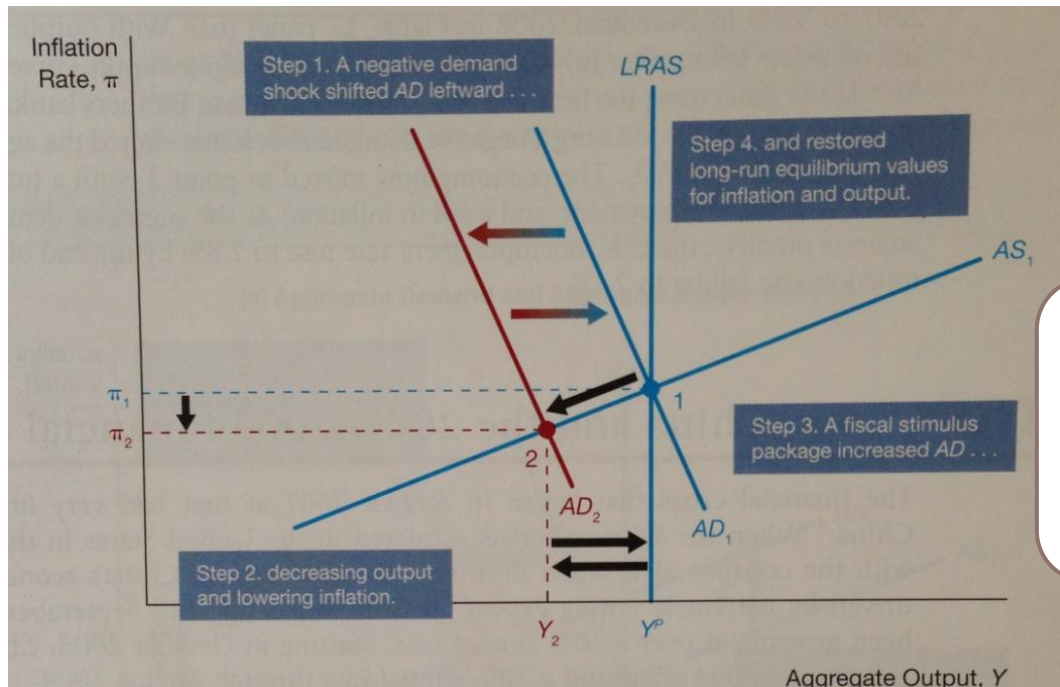
$AS_2 \rightarrow AS_1$

Year	Unemployment Rate (%)	Inflation (Year to Year) (%)
2006	5.4	2.3
2007	5.3	2.3
2008, June	5.3	3.4
2008, Dec.	6.4	3.9
2009, June	7.8	2.1
2009, Dec.	7.8	2.1

Lehman bankruptcy affect spending worldwide (move to 3)

$AD_1 \rightarrow AD_2$

China and the financial crisis, 2007-09



**Worldwide spending ↓
→ collapse of export**

$AD_1 \rightarrow AD_2$

**Did not wait for self
correcting mechanism
but use massive fiscal
stimulus package and
autonomous ease of MP**

$AD_2 \rightarrow AD_1$

Year	Output Growth (%)	Inflation (Year to Year) (%)
2006	11.8	1.5
2007	12.4	4.8
2008, June	11.2	7.9
2008, Dec.	4.4	3.9
2009, June	11.1	-1.1
2009, Dec.	10.4	-0.3

***Chinese economy weathered
financial crisis remarkably
well.***