

WY:

## The effect of Monetary policy

- 1) what happens to price level (inflation)
- 2) what happens to GDP (output)

### 1. AD / AS Analysis

#### 1.1 What is Aggregate Demand / Supply Curve

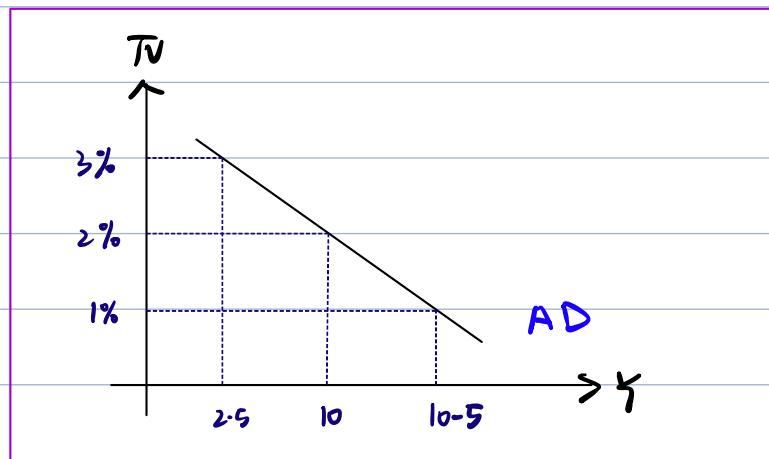
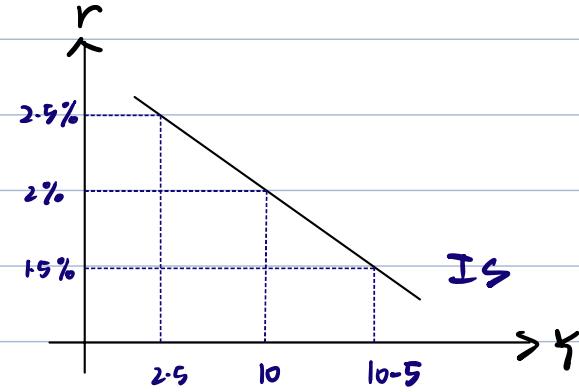
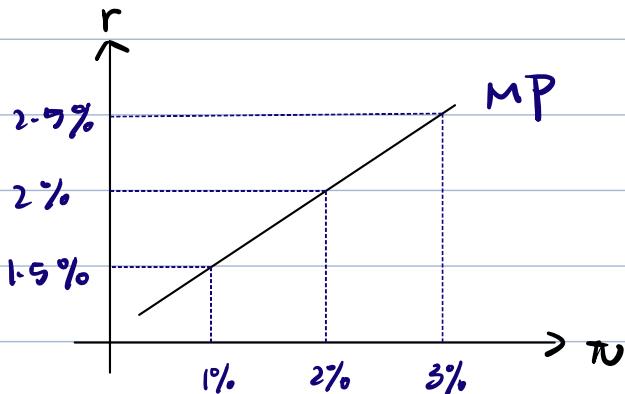
$$AD = Y \text{ and } TV$$

$$AS = Y \text{ and } TV$$

#### 1.2 How to derive aggregate demand curve

(1) From MP curve

(2) From IS curve



1-3 Main Mechanism of AD curve =

(1) Inflation ( $\pi$ )  $\uparrow$  implies interest rate ( $r$ )  $\uparrow$

$$\text{From MP} = r = F + \alpha \pi$$



Investment demand ( $I_d$ )  $\downarrow$

$$I = \bar{I} - d(r + \bar{f})$$



aggregate demand ( $\gamma_{ad}$ )  $\downarrow$

$$\gamma = \gamma_{ad} = C + I + G + NX$$

(2)  $\pi \uparrow \Rightarrow r \uparrow \Rightarrow$  Demand on domestic Assets  $\uparrow$



Demand for domestic currency



appreciation of exchange rate

$E \uparrow$



lower Export, higher import  
(lower Net Export)  $NX \downarrow$



aggregate demand  $\gamma_{ad} \downarrow$

## 1.4 Formula of AD Curve

$$AD: Y = \frac{\bar{A}}{1-c} - \left( \frac{d+x}{1-c} \right) (\bar{F} + \pi) \quad \text{where } =$$

$$\bar{A} = \bar{C} + \bar{I} + \bar{G} + \bar{N}x - d\bar{F} - \frac{c\bar{T}}{MPC}$$

changes in  $\bar{A}$  will shift AD due to changes in IS curve

fiscal policy changes  $\bar{A}$

change in  $\bar{F}$  will shift AD due to change in Monetary policy

## 1.5 Factors that shift AD to the right

(1)  $\downarrow \bar{F}$  (Monetary Policy easing)

(2)  $\uparrow \bar{C}$

(3)  $\uparrow \bar{I}$

(4)  $\uparrow \bar{G}$

(5)  $\downarrow \bar{F}$

(6)  $\downarrow \bar{N}x$

(7)  $\downarrow \bar{T}$

## 2. Aggregate Supply

2.1 keynesian assumption =  
Price and wages are sticky

2.2 Long Run Aggregate Supply (LRAS)

$$\frac{Y}{GDP} = \frac{F(K, L, A)}{\downarrow \text{capital} \quad \downarrow \text{labor}} \quad \text{Total Factor of productivity}$$

production Function

$$\boxed{\text{Potential Output } Y^P = LRAS}$$

2.2.1 In long Run = Labor ( $L^P$ ) is at full employment

Unemployment Rate = natural rate of unemployment rate  
 $\downarrow$  is unavoidable  $\downarrow$

4% ~ 5%

2 Types of natural unemployment:

(1) Frictional

unemployment



due to job search

(2) Structural

unemployment



due to structural changes

2.2.2 We can avoid cyclical unemployment

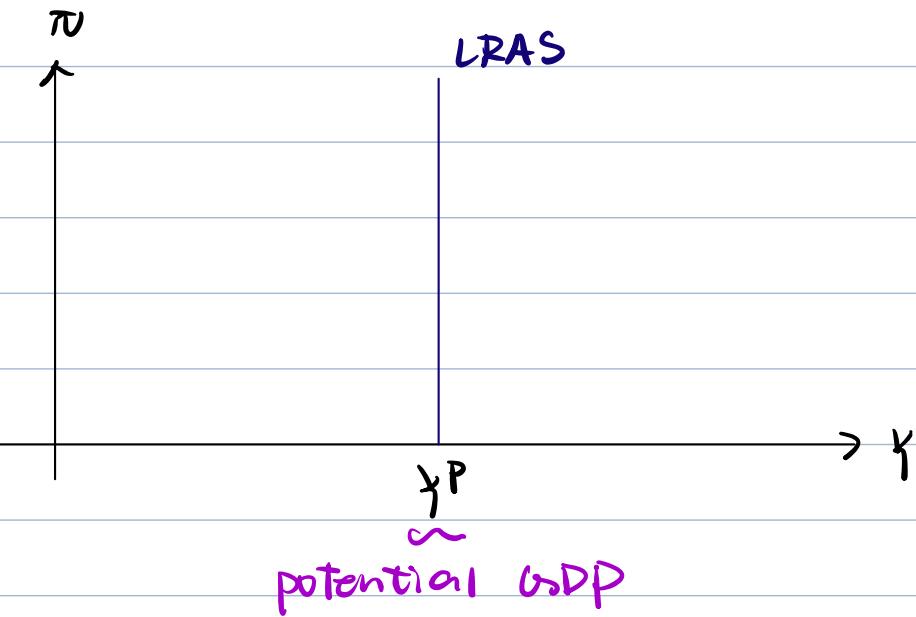


happens due to business cycle

In Long Run = cyclical unemployment = 0

In Short Run = cyclical unemployment might  $> 0$

But Monetary / Fiscal Policy will help to get rid of it



where unemployment rate = natural rate of unemployment  
(full employment)

## 2.3 Short Run Aggregate Supply

### 2.3.1 3 Factors generate inflation ( $\pi$ )

- { (1) Future inflation expectation ( $\pi^e$ )
- (2) Output gap
- (3) price and supply shock

## II) Future inflation expectation ( $\pi^e$ )

Price level ( $P$ )  $\uparrow \Rightarrow$  nominal wages ( $\underline{w_n} \uparrow$ )  
workers expect adjustment to  
nominal wages



inflation expectation ( $\pi^e \uparrow$ )

Since  $\underline{w_n} = \underline{w_r} + \underline{\pi^e}$   
nominal wages  $\downarrow$  expected inflation  
real wages (in terms of goods and services)

If we keep real wage ( $w_r$ ) constant  
 $\uparrow (\pi^e)$  will  $\Rightarrow \uparrow \underline{(w_n)}$

wages are important production cost



So increase in nominal wage will increase the production cost through inflation expectation channel.

## (2) Output gap

$$\text{Output gap} = \underbrace{Y}_{\text{Current GDP}} - \underbrace{Y^P}_{\text{Potential GDP}}$$

① If  $Y > Y^P$ : positive output gap

正产出缺口表明经济过热，需求超过了经济能够稳定供应的水平。

为满足这些需求，企业会增加生产，从而需要更多的工人。这种现象导致劳动力需求大幅上升。

劳动力市场中的工人数（劳动力供给）是相对固定的，尤其在短期内无法快速增加。因此，当企业大量招工时，劳动力市场上的可用工人数相对减少，形成了所谓的“紧缩的劳动力市场”——即更多的工作岗位，而适合这些岗位的工人相对不足。



tight labor market

(More jobs, less workers)



workers demand higher wages

Since wages are most important cost of production,  
production cost ( $W_n$ ) ↑, it needs to be reflected in  
Price ( $P$ ) ↑

So firm will increase price ( $P$ ) ↑  $\Rightarrow$  inflation ( $\pi$ ) ↑

② If  $y < y_p$  = Negative output gap



- 负产出缺口意味着经济处于萎缩状态，需求不足，经济未能达到其潜在产出水平。
- 消费者和企业的支出下降，导致对商品和服务的需求减少。企业的销售额下降，为了适应降低的需求，企业会减少生产活动。
- 随着生产的减少，企业不需要那么多的劳动力来维持运营。因此，企业会停止招聘，甚至可能解雇一些员工，导致劳动力市场上的工作岗位减少。



Slack labor market  
(More workers, less jobs)



Demand lower wages



So firms will decrease price ( $p$ )  $\Rightarrow$  inflation ( $\pi$ ) ↓

### (3) price and supply shock

Ex: restriction of supply of oil



↑ Price of oil



↑ Price of other goods and Services



↑ inflation ( $\pi$ )

The logic =

↑ prices of imported goods that are used as input



↑ price of goods and Services



↑ inflation ( $\pi$ )

Ex: Strong labor union will negotiate



↑ wage ( $w$ )



↑ cost of production



↑ P



↑ inflation ( $\pi$ )

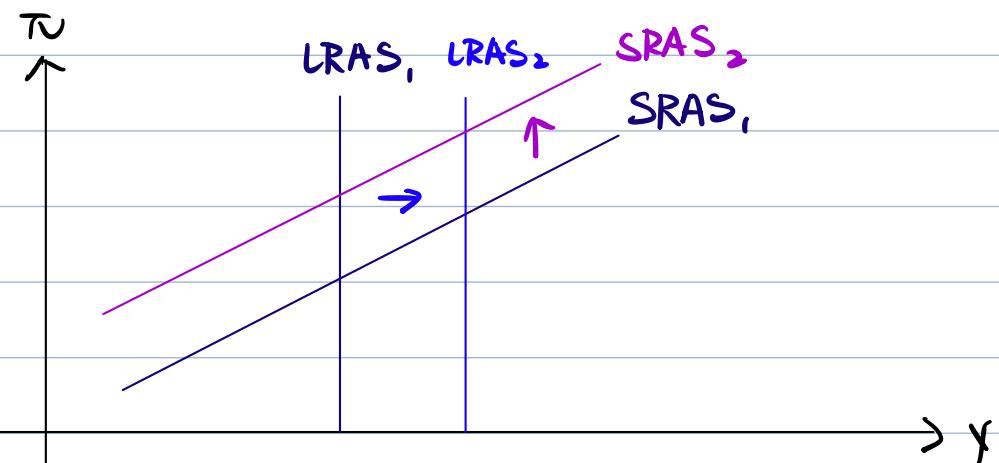
## 2.3.2 Formula of Short-Run Aggregate Supply (SRAS)

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

↓      ↓  
inflation expectation      output gap

Sensitivity of  $\pi$  to output gap

$$\begin{cases} \gamma = 0 & \text{inflation } (\pi) \text{ insensitive to the output gap} \\ \gamma = 1 & \text{inflation } (\pi) \text{ sensitive to the output gap} \end{cases}$$

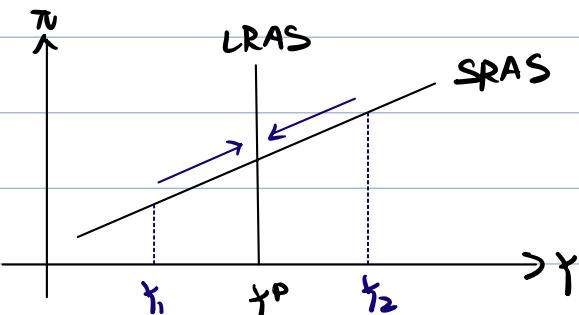


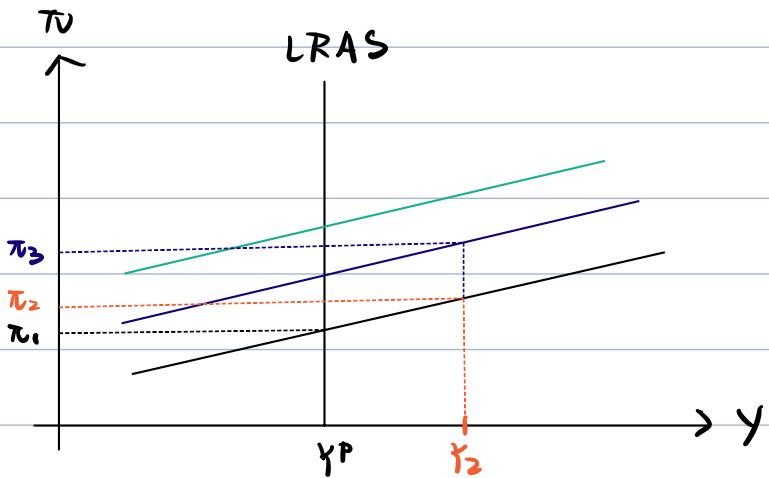
Shift in LRAS =  $\gamma = F(K, L, A)$

$\uparrow K, \uparrow L, \uparrow A$  shift LRAS right

Shift in SRAS =

$$\begin{cases} \pi^e = \uparrow \pi^e \Rightarrow \uparrow w \Rightarrow \uparrow p \Rightarrow \uparrow \pi \Rightarrow \text{shift SRAS up (left)} \\ \text{Price / Supply Shock} = \uparrow p \Rightarrow \uparrow \pi \Rightarrow \text{shift SRAS up (left)} \\ \text{Persistent output gap} = \uparrow \pi^e \Rightarrow \text{shift SRAS up (left)} \end{cases}$$





persistent output gap ( $y - y_P$ )

will affect inflation expectation curves

↓

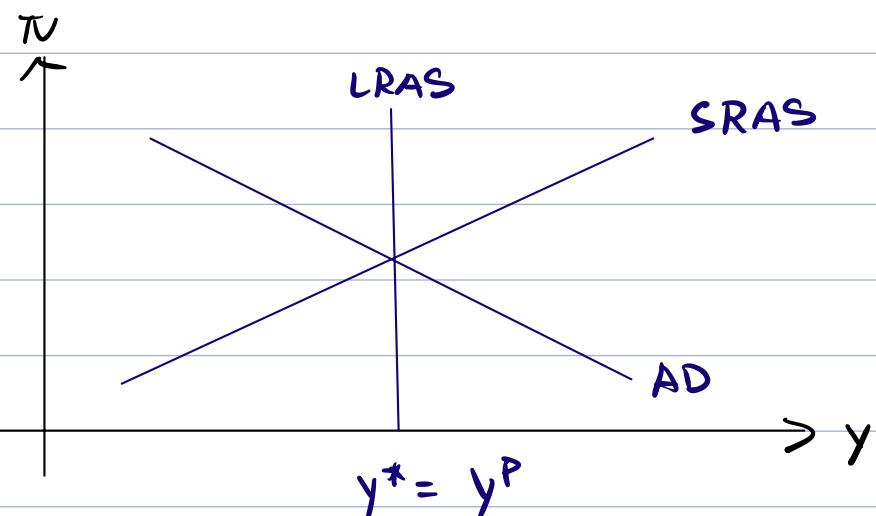
Suppose the Economy produces  $y_2$ , ( $y_2 > y_P$ )

decision makers will adjust their inflation expectations

↓

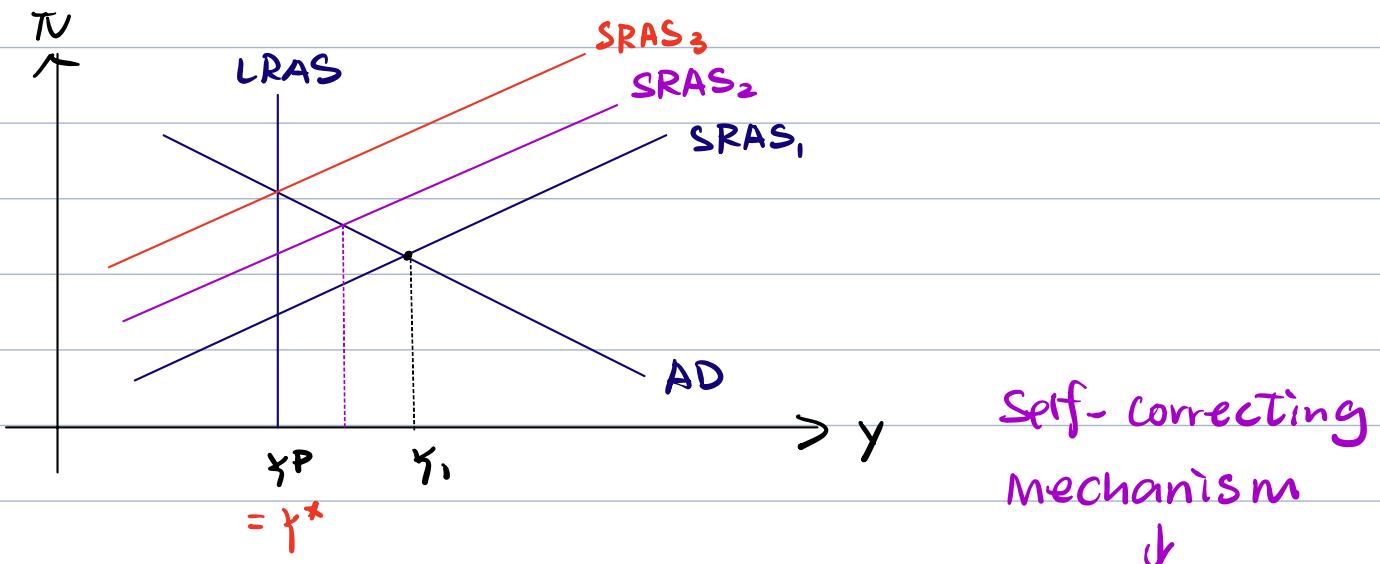
The process will continue if there's no intervention

## 2.4 Equilibrium



If  $\gamma \neq \gamma^P \Rightarrow$  not in long-run Equilibrium  
 the Short-run Equilibrium will move

## # Policy Analysis



$y_1 > y^P =$  positive output gap



tight labor market



w ↑



cost of production ↑



P ↑



$\pi^t$

current inflation is high,

$\Downarrow$

firm will think that future

$\pi^e \uparrow$

inflation will also be high



SRAS will shift up

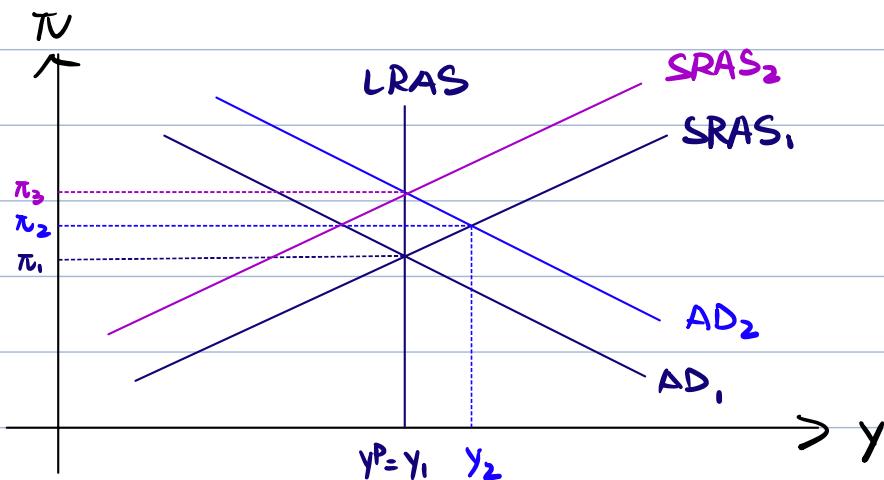
↓

By the Self-correcting mechanism =  
 the Economy will correct by itself through inflation  
 expectation channel. SRAS will shift up and up  
 to the LRAS Equilibrium level if there's no intervention

However, we do not know how long it takes to the  
 long-run Equilibrium level  $\Rightarrow$  gov prefers intervention

## 2.5 AD Shock

### i) Positive AD Shock



Positive AD Shock = AD Shifts Right

↓

Result = ①  $y(y_2) \uparrow$  ②  $\pi(\pi_2) \uparrow$

↓

In the new SR Equilibrium =

$y_2 > y^* =$  tight labor market  $\Rightarrow w \uparrow \Rightarrow p \uparrow \Rightarrow \pi \uparrow \Rightarrow \pi^e \uparrow$

↓

SRAS  $\uparrow$

In the new long-run Equilibrium =

$$\pi = \pi^* , Y = Y^*$$

$$(\pi^* > \pi_1)$$

↓

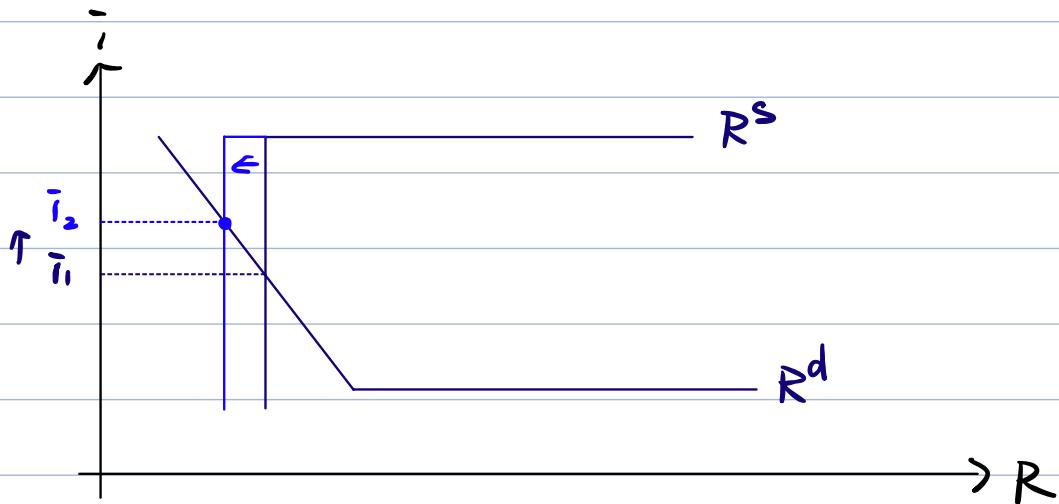
Result = positive AD will lead to higher inflation ( $\pi^* \uparrow$ )

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Real-world Example = (The Volcker Disruption)

1.  $\pi > 10\%$  in the US
2. US want to ↓ inflation ( $\pi^*$ )
3. In 1981, the Fed ↑ policy rate 20 %

▷ In the Federal Fund Market



CB can conduct open-market sale to ↑ policy rate

↓

Shift  $R^s$  to the left

"Contractionary Monetary Policy"

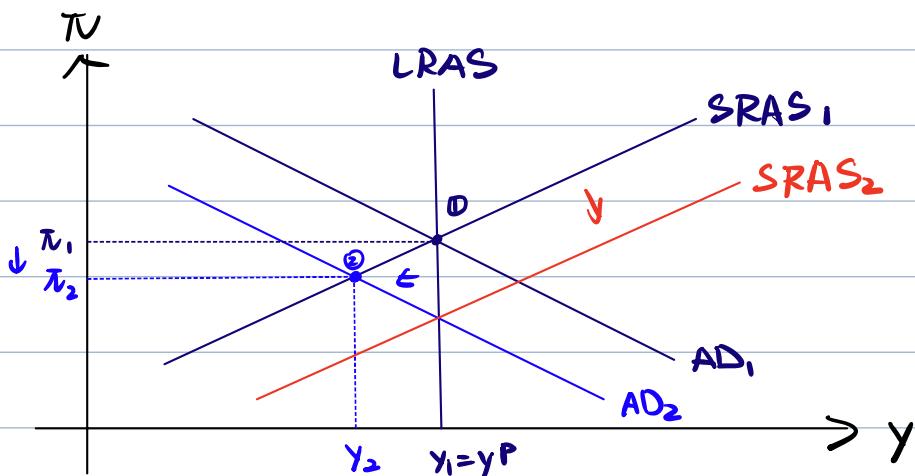
Result = policy rate (short-term nominal rate) ↓

$$r = r + \pi$$

通货膨胀率 ( $\pi$ ) 通常在短期内不会迅速发生变化。通货膨胀的变化需要时间，它反映的是商品和服务价格的广泛上升趋势。因此，在名义利率上升的短期内，通货膨胀率保持相对稳定或没有立刻跟随名义利率的变化。因此，当名义利率提高，而通货膨胀率暂时不变时，实际利率必然会上升。

- ①  $r \uparrow$ ,  $\pi$  won't change in SR  $\Rightarrow r \uparrow$
- ②  $r \uparrow = \text{cost of borrowing} \uparrow \Rightarrow AD \downarrow \Rightarrow \pi \downarrow$

## 2) In the AS / AD Equilibrium



①	$\underline{r_i} \Rightarrow \underline{r_p} \Rightarrow \underline{\pi}$	$\Rightarrow AD \text{ shift left}$
	Short-Term nominal rate	Short-Term real interest rate inflation

result:  $y_2 < y^P$

②

$\downarrow$   
slack labor market  $\Rightarrow w \downarrow \Rightarrow p \downarrow \Rightarrow \pi \downarrow \Rightarrow \pi^e \downarrow$

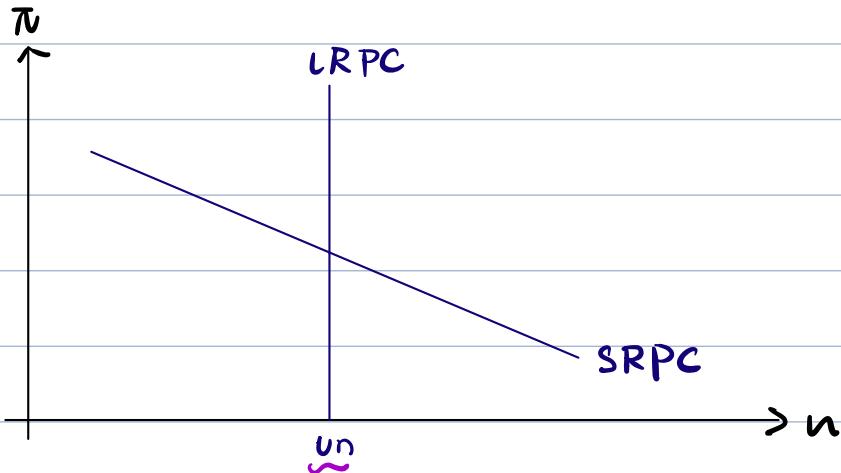
SRAS shifts down

3. Phillips curve (relationship between  $\pi$  and  $u$ )

To Derive SRAS

Inflation unemployment

| y



natural rate of unemployment

( $y = y^P$  when  $u = u_n$ )

### 3.1 Formula of Phillips curve:

$$\pi = \pi^e - \frac{w}{\downarrow \text{weight / sensitivity}} (u - u_n) + \frac{P}{\downarrow \text{Price Shock}}$$

Inflation expectation

Unemployment gap

### 3.2 Increase in $\pi^e \Rightarrow$ SRPC will shift up ↑

$$\text{"Okun's Law": } (u - u_n) = -\frac{1}{2} (y - y^P) \quad (2)$$

1 unit reduction in output gap will reduce the unemployment gap by 1/2

# we can combine (1) + (2) to derive SRAS =

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

3.3 Show that Phillips curve is directly linked to Short-Run Supply curve

(1) Phillips Curve =  $\pi = \pi^e - w(v - v_n) + P$   
 $\pi = \pi^e - w[\underline{-\frac{1}{2}(y - y_p)}] + P$

↓ Okun's Law:  $v - v_n = -\frac{1}{2}(y - y_p)$

$$\pi = \pi^e + 0.5w(y - y_p) + P$$

Let  $\gamma = 0.5w$ ,

$$\boxed{\pi = \pi^e + \gamma(y - y_p) + P}$$

"SRAS Equation"