

INTERMEDIATE MACROECONOMICS

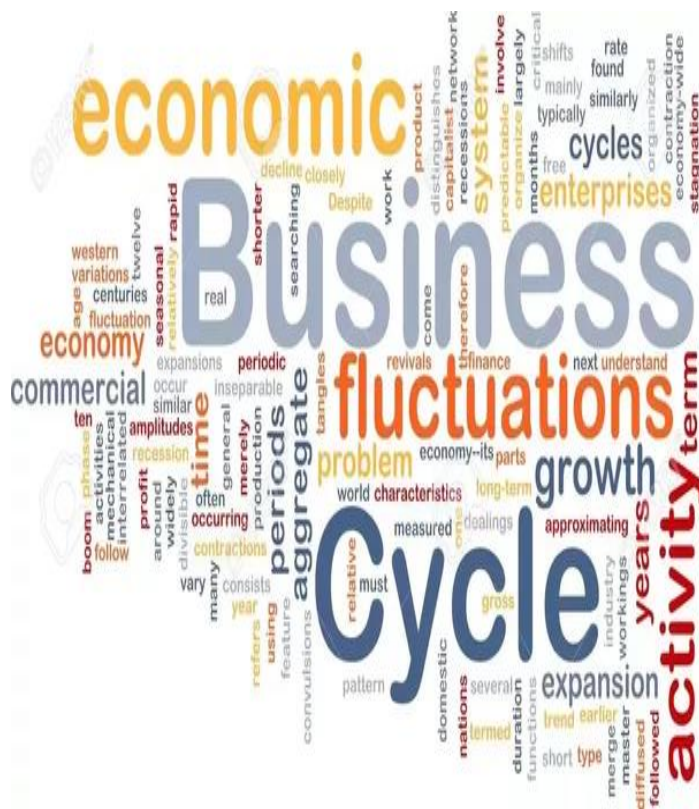
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Thammasat University

AGENDA



- Long-run macroeconomy
- Foundation of AD
- Foundation of AS
- AD-AS equilibrium and business cycles

WHAT WE DO IN THIS PART?

- We will first start with discussing about long-run macroeconomy.
- In particular, what determine the so called **“potential output”** and **“natural rate of unemployment”**
- Laid out some important ingredients of **market-clearing model** for understanding the long-run macroeconomy.

AGGREGATE PRODUCTION FUNCTION

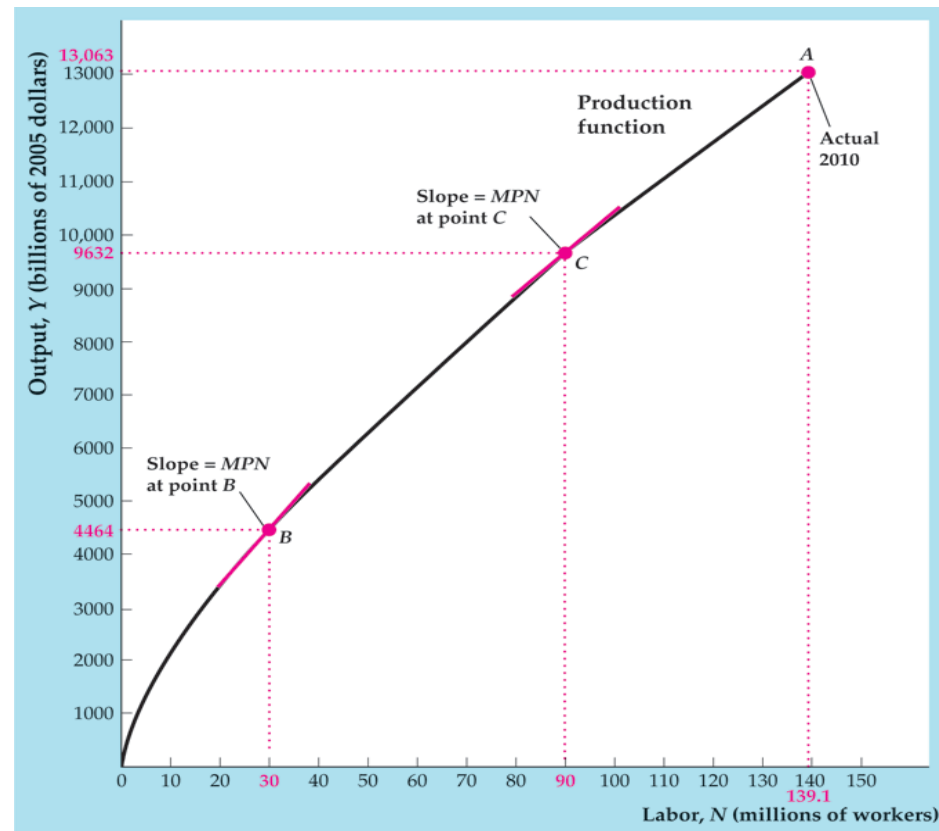
- To understand about the long-run macroeconomy, economists typically build their concepts upon the idea of **aggregate production function**.
- Aggregate production function $Y = z * F(K, N)$
 - Y = Output = Real GDP
 - K = Capital stock
 - N = Labor
 - Z = Total factor productivity (the effectiveness with which capital and labor are used)

AGGREGATE PRODUCTION FUNCTION OVER THE BUSINESS CYCLE ANALYSIS

- Over the course of business cycles, capital stock is treated as fixed (or, disregarded)
 - In the very long-run analysis, capital stock will be evolving over time; we will come back to discuss about this issue later (when we talk about long-run growth theory)
- Analytical representation of aggregate production function is therefore to focus on the relationship between output and labor input.

THE SHAPE/CURVE OF PRODUCTION FUNCTION

- The shape of the production function
 - Marginal product of labor, $MPN = \Delta Y / \Delta N$
 - Equal to slope of production function graph (Y vs. N)
 - MPN always positive
 - Diminishing marginal productivity of labor

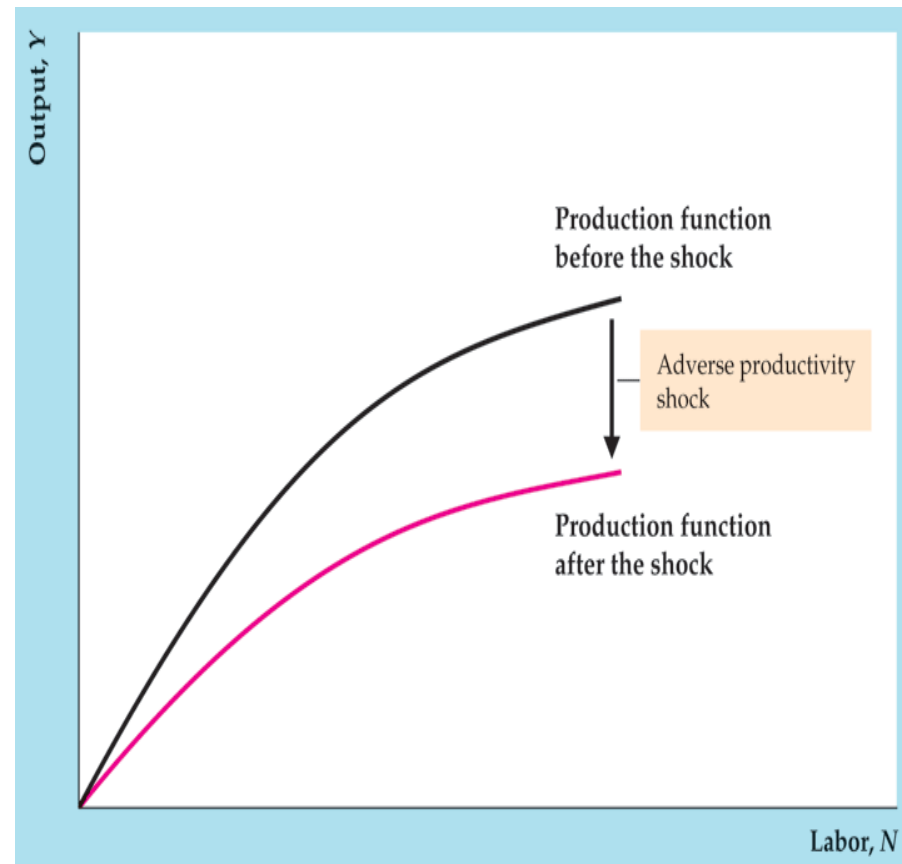


THE PRODUCTION FUNCTION: SUPPLY SHOCKS

- Supply shocks
 - Supply shock = productivity shock = a change in an economy's production function
 - Supply shocks affect the amount of output that can be produced for a given amount of inputs
 - Shocks may be positive (increasing output) or negative (decreasing output)
 - Examples: weather, inventions and innovations, government regulations, oil prices

THE PRODUCTION FUNCTION: SUPPLY SHOCKS

- Negative (adverse) shock: Usually slope of production function decreases at each level of input (for example, if shock causes parameter Z to decline)
- Positive shock: Usually slope of production function increases at each level of output (for example, if parameter Z increases)



WHAT IS THE LEVEL OF TOTAL OUTPUT PRODUCED BY THE MACROECONOMY?

- Given the aggregate production function, the total output produced will be determined by the **level of labor input utilization!**
- The level of labor utilization is determined by two forces: **labor market demand** and **labor market supply**

THE DEMAND FOR LABOR: FRAMEWORK

- How much labor do firms want to use?
 - Assumptions
 - Hold capital stock fixed—business cycle analysis
 - Workers are all alike
 - Labor market is competitive
 - Firms maximize profits
- Mathematically, firm chooses for **optimal level of workers (N)** that maximizes profit.

$$\pi = P * Z * F(\bar{K}, N) - WN$$

Comparing the Benefits and Costs of Changing the Amount of Labor

To maximize profits, the firm should:	Increase employment if, for an additional worker	Decrease employment if, for the last worker employed
Real terms	$MPN > w$ ($MPN > W/P$)	$MPN < w$ ($MPN < W/P$)
Nominal terms	$P \times MPN > W$ ($MRPN > W$)	$P \times MPN < W$ ($MRPN < W$)

MPN = marginal product of labor

P = price of output

$MRPN$ = marginal revenue product of labor = $P \times MPN$

W = nominal wage

w = real wage = W/P

LABOR MARKET DEMAND

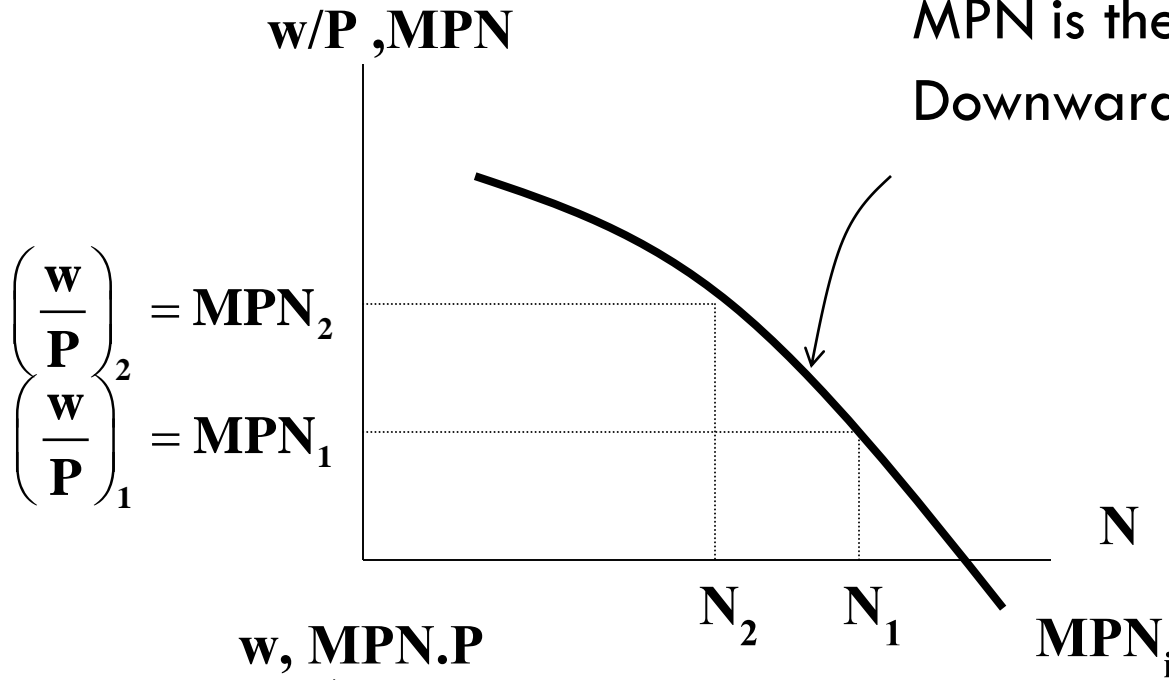
□ Standard optimality condition indicates that the optimal workers hired can be given by

- Firms hire workers using the **real productivity rule:**

$$MPN = \frac{W}{P}$$

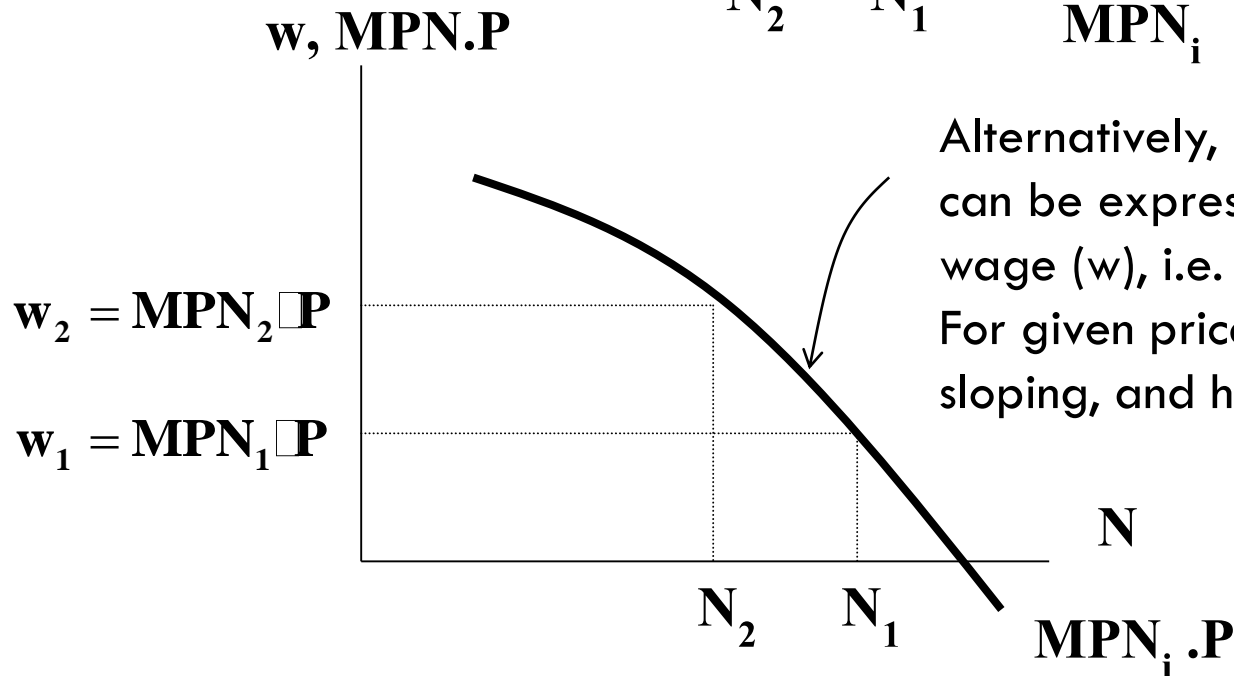
- Firms hire workers using the **nominal value of productivity rule:** $P * MPN = W$

MPN is the **labor demand curve**;
Downward sloping in real wage



$$N^d = f\left(\frac{w}{P}\right)$$

(-)



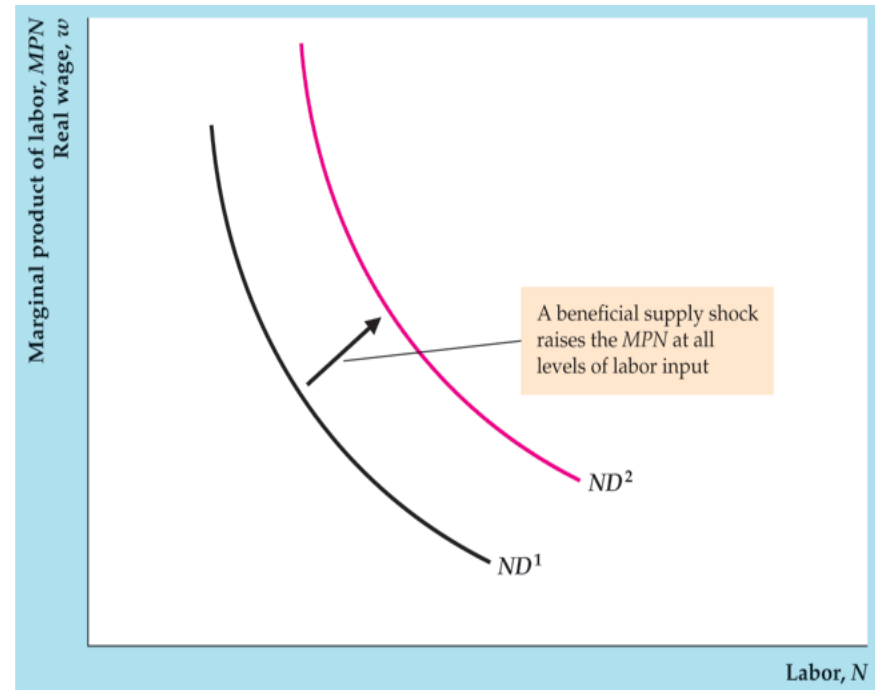
Alternatively, labor demand curve can be expressed in terms of nominal wage (w), i.e. the VMP curve. For given prices, VMP curve is downward sloping, and hence labor demand curve.

THE DEMAND FOR LABOR

- The marginal product of labor and the labor demand curve
 - Labor demand curve shows relationship between the real wage rate and the quantity of labor demanded
 - It is the same as the *MPN* curve, since $w = MPN$ at equilibrium
 - So the labor demand curve is downward sloping; firms want to hire less labor, the higher the real wage

THE DEMAND FOR LABOR

- Factors that shift the labor demand curve
 - **Supply shocks:** Beneficial supply shock raises MPN , so shifts labor demand curve to the right; opposite for adverse supply shock
 - **Size of capital stock:** Higher capital stock raises MPN , so shifts labor demand curve to the right; opposite for lower capital stock



Note: A change in the wage causes a movement along the labor demand curve, not a shift of the curve

LABOR MARKET SUPPLY

- Where does the supply of labor come from?
 - Households supply labor force to the market.
- Theorem for labor market supply emerges from foundation of individual labor supply, i.e. the **consumption-leisure model**.

CONSUMPTION-LEISURE MODEL

- Key features of consumption-leisure model
 - Households choose for two things: **consumption level (C) and leisure (L)**
 - Households **preference set is** defined over the **two-object bundles (C,L)** and can be represented **by a utility function**
 - Households choose for optimal “C” and “L” that maximize the utility subject to budget constraint;
 $P \cdot C = W \cdot (1-t) \cdot N = W \cdot (1-t) \cdot (24-L) - T$ or

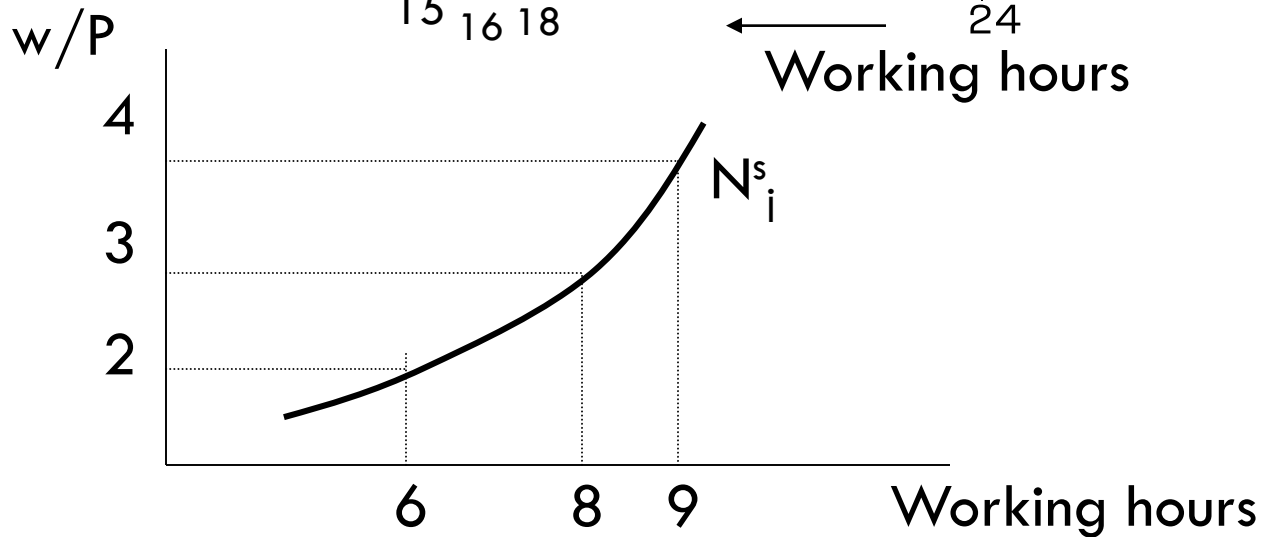
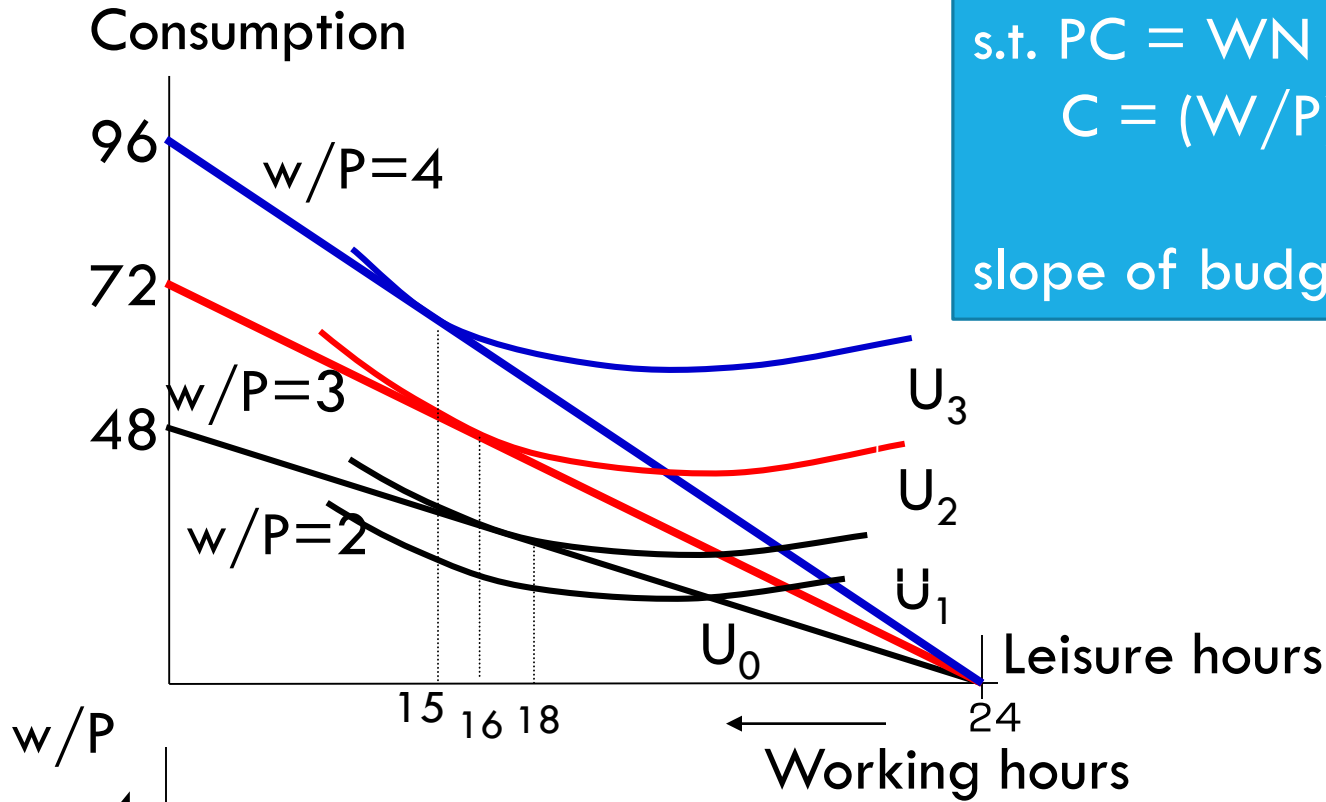
Consumption – Leisure problem

$$\text{Max } U(C,L)$$

$$\text{s.t. } PC = WN = W(24-L)$$

$$C = (W/P) (24 - L)$$

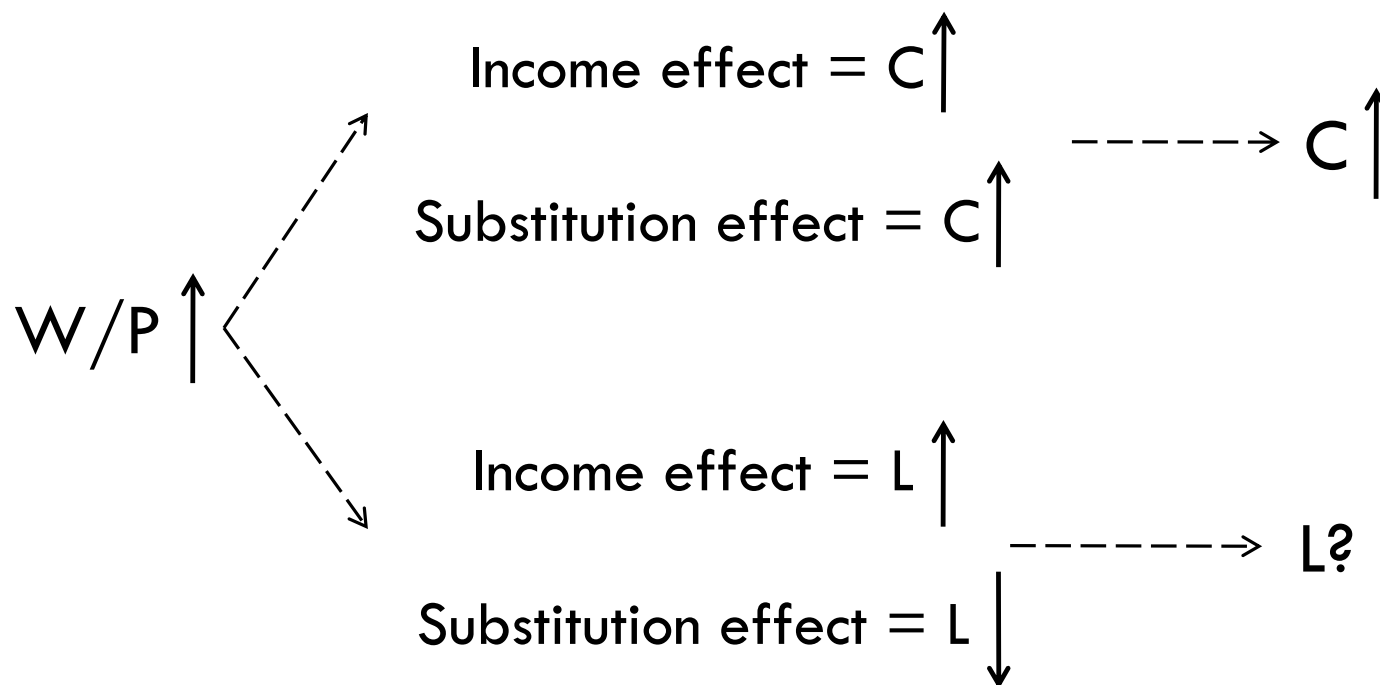
slope of budget line = W/P



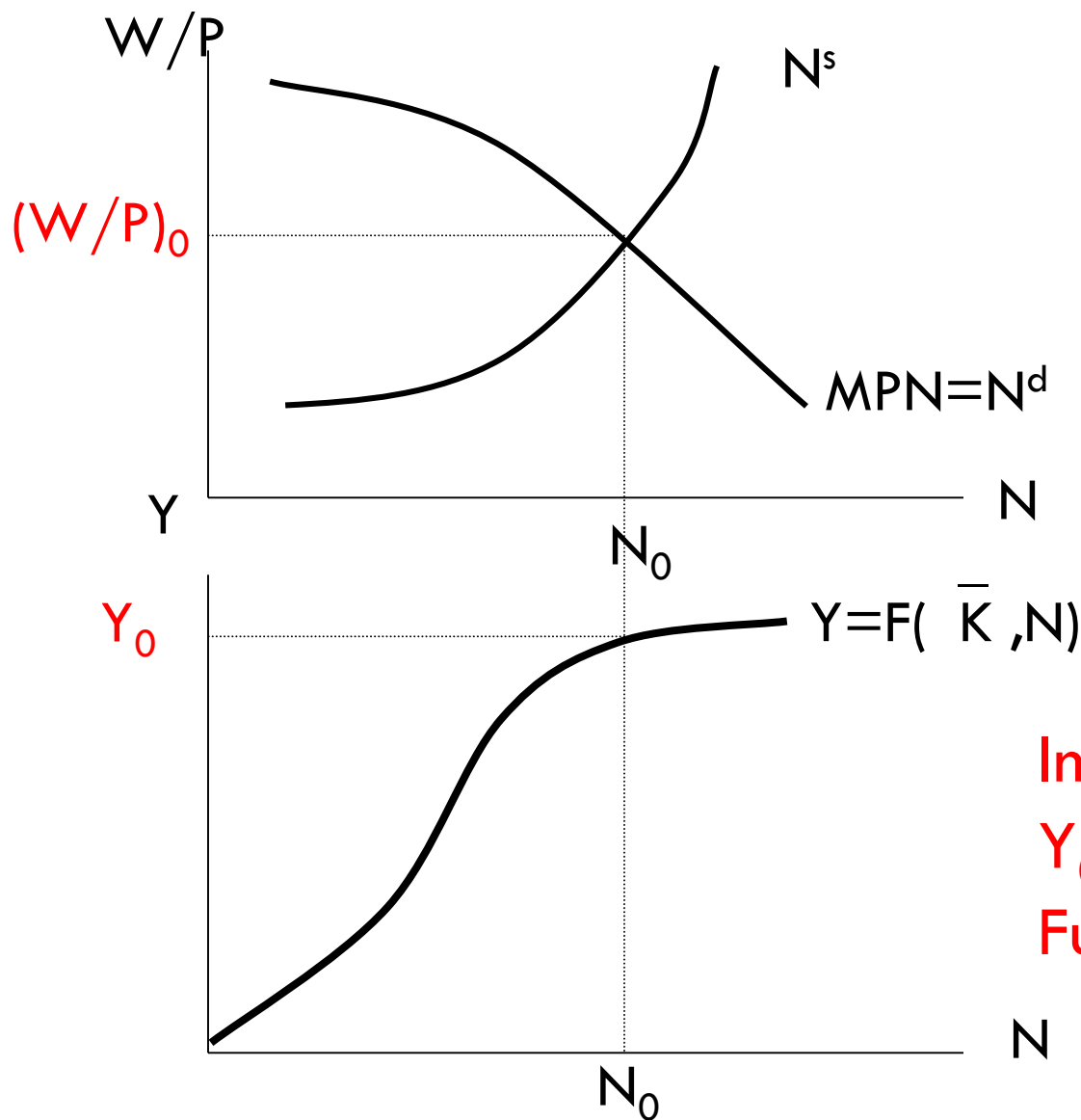
$$N^s = g\left(\frac{w}{P}\right)$$

(+)

UPWARD SLOPING LABOR SUPPLY: THE DOMINATION OF SUBSTITUTION EFFECT



Equilibrium of labor market and optimal production level

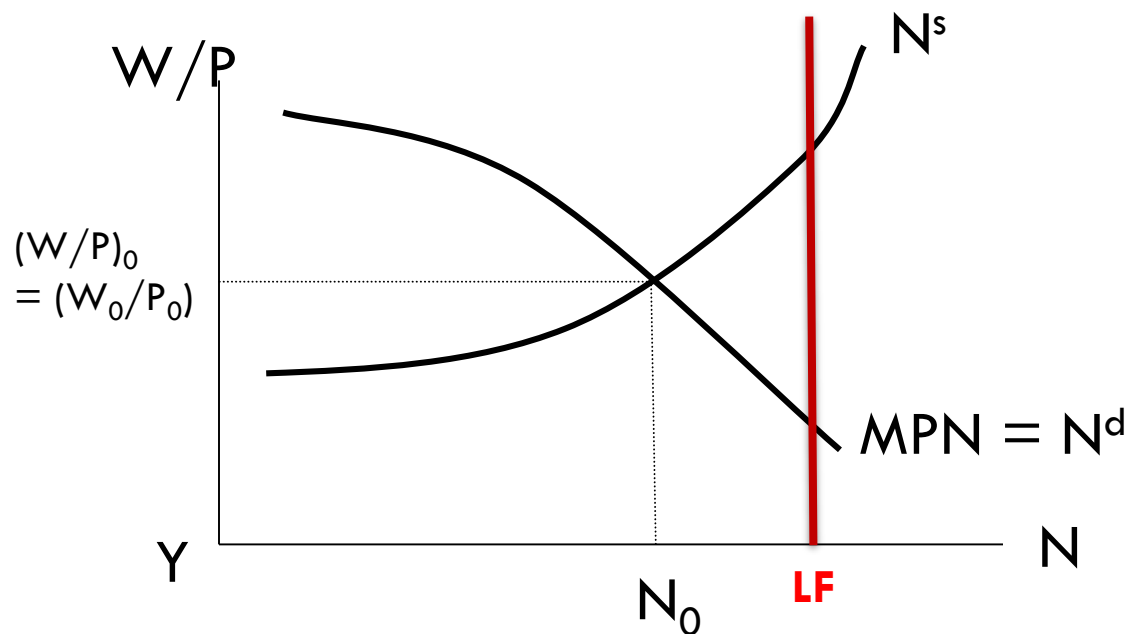


In macroeconomics,
 $Y_0 =$ Potential output or
Full-employment output.

POTENTIAL OUTPUT OR FULL EMPLOYMENT OUTPUT

- Typically treated as “**trend**” of macroeconomy or “the **time-being maximum capacity of the macroeconomy**”
- The level of output that would exist if markets have the perfect adjustment in wages and prices
- Determined by the factors affect demand for labor and supply for labor in the labor market
- Later on, we will be using this concept to represent the foundation of long-run aggregate supply

Equilibrium of labor market and Natural rate of unemployment



Suppose $(W/P)_0$ is the market-clearing real wage.

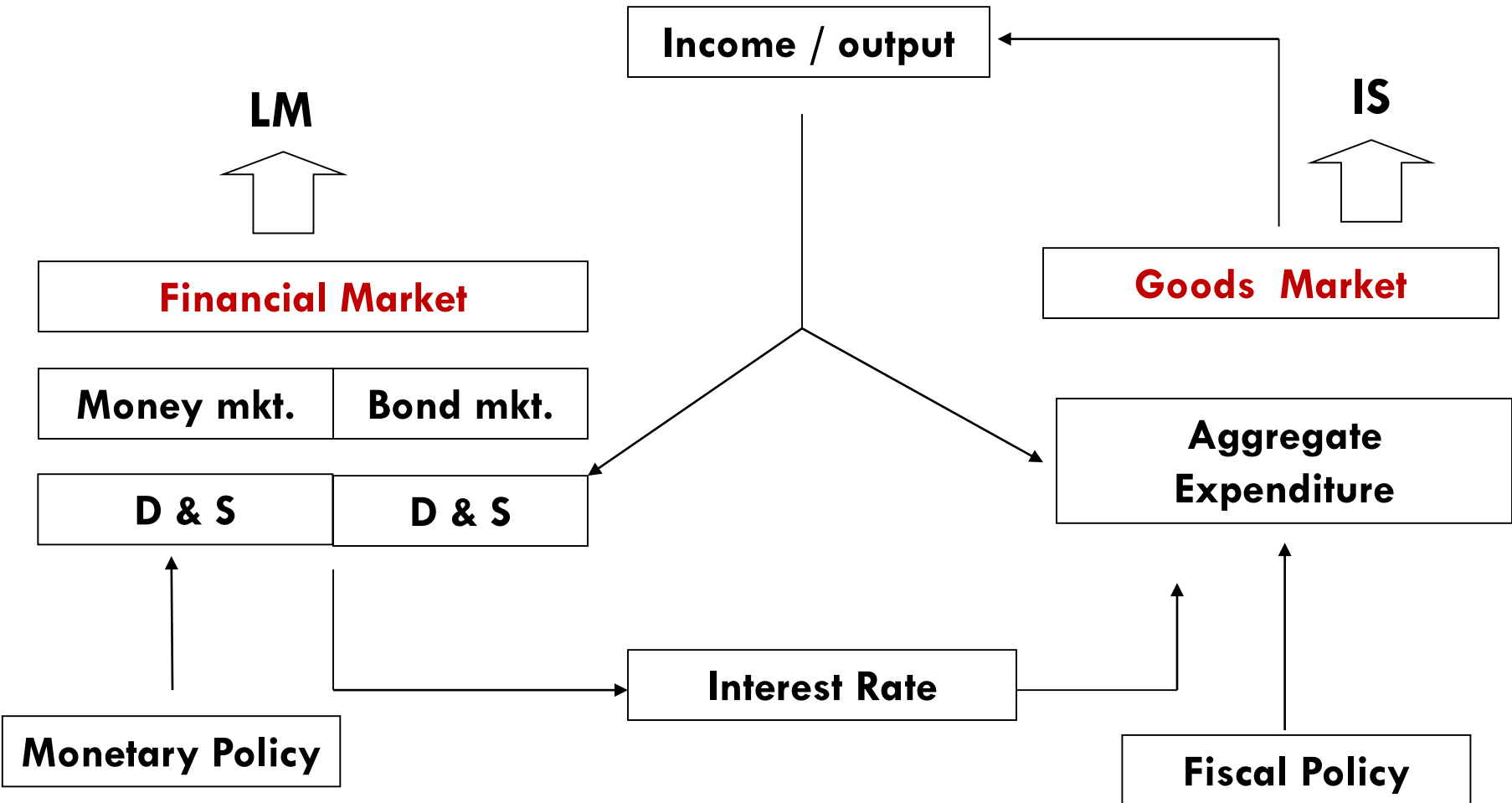
Assuming fixed labor force (LF)

Unemployment rate = $(LF - N_0)/LF$

Following the long-run framework, unemployment rate is determined by fundamental drivers of demand and supply for labor.

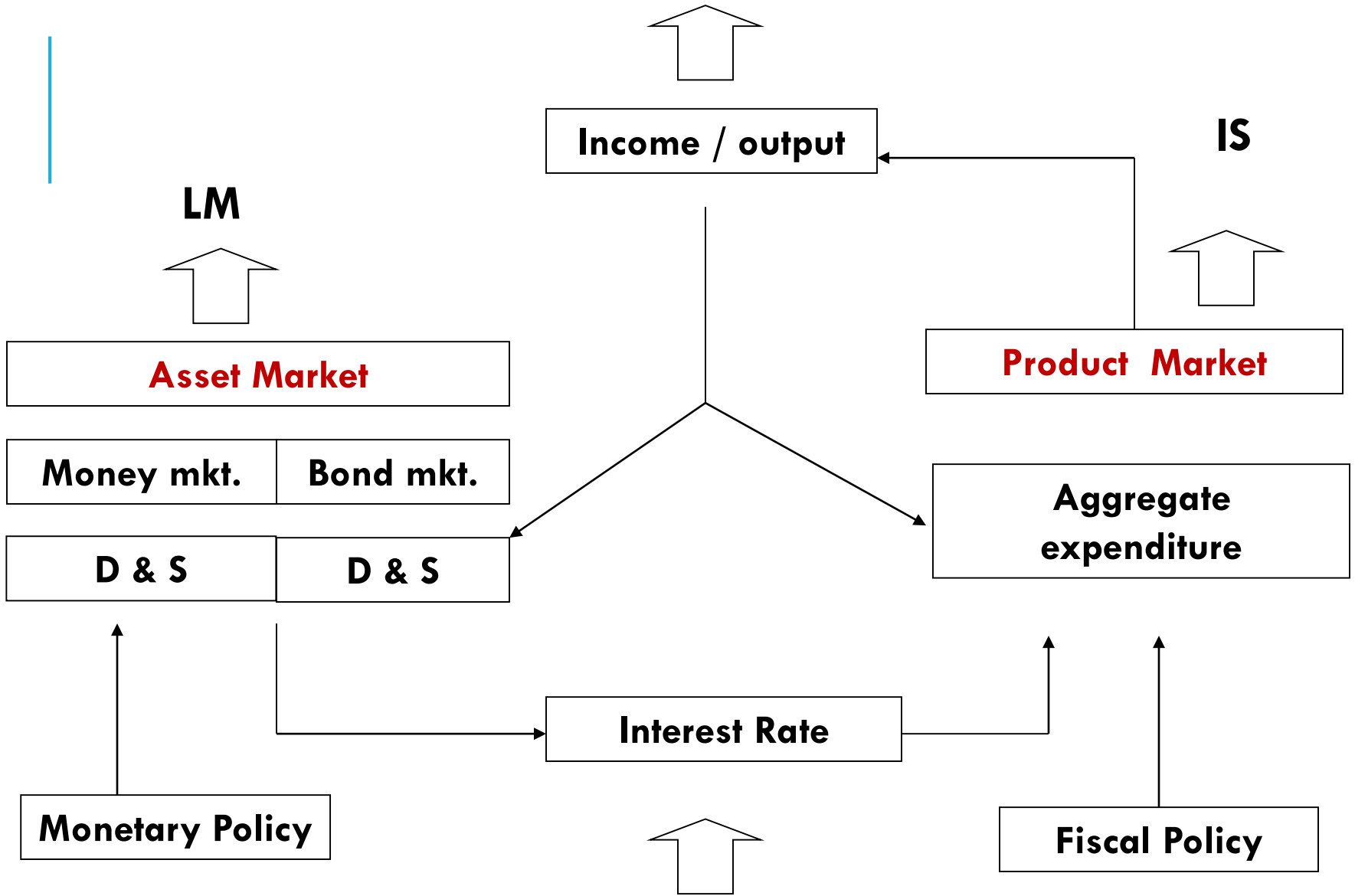
FOUNDATION OF AD

THE IS-LM MODEL AND AGGREGATE DEMAND: A QUICK REVIEW



Key assumption: price fixed

Aggregate demand



Price can be adjusted

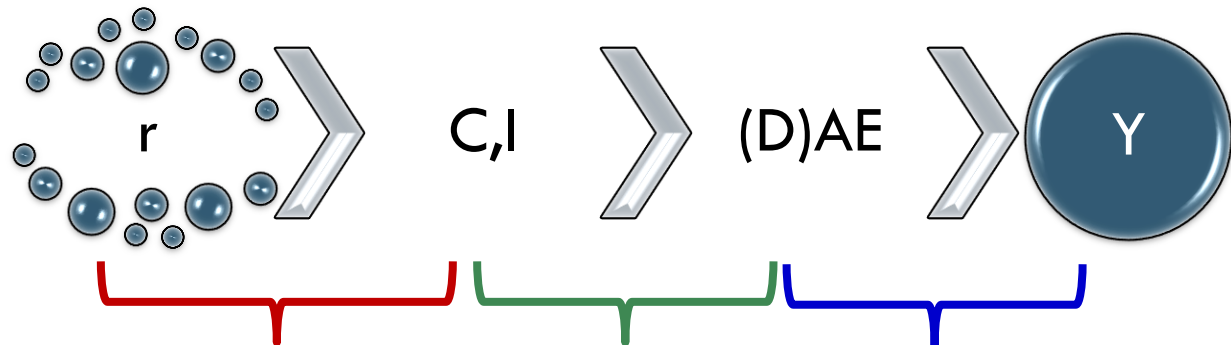
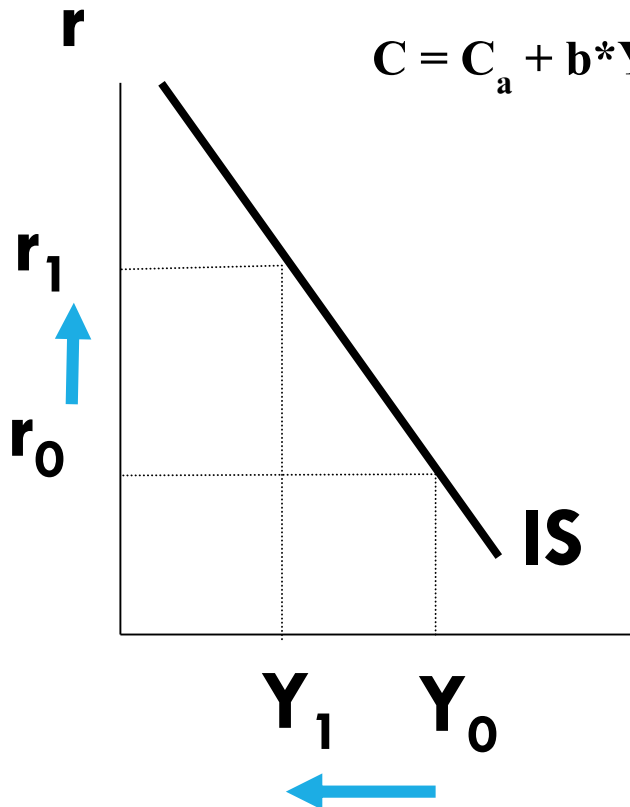
IS CURVE

- Equilibrium relationship between “ r ” and “ Y ” that put the good market under the equilibrium condition, i.e. $Y = AE$.
 - Assuming **closed-economy**.
- **IS curve is downward sloping.** Why?

IS CURVE: WHY DOWNWARD SLOPING?

- (D)AE is determined by “**income**” and “**non-income factors**”
 - real interest rate is one of them.

$$C = C_a + b * Y_d - e * r \qquad I = I_a - i_1 r + i_2 Y$$

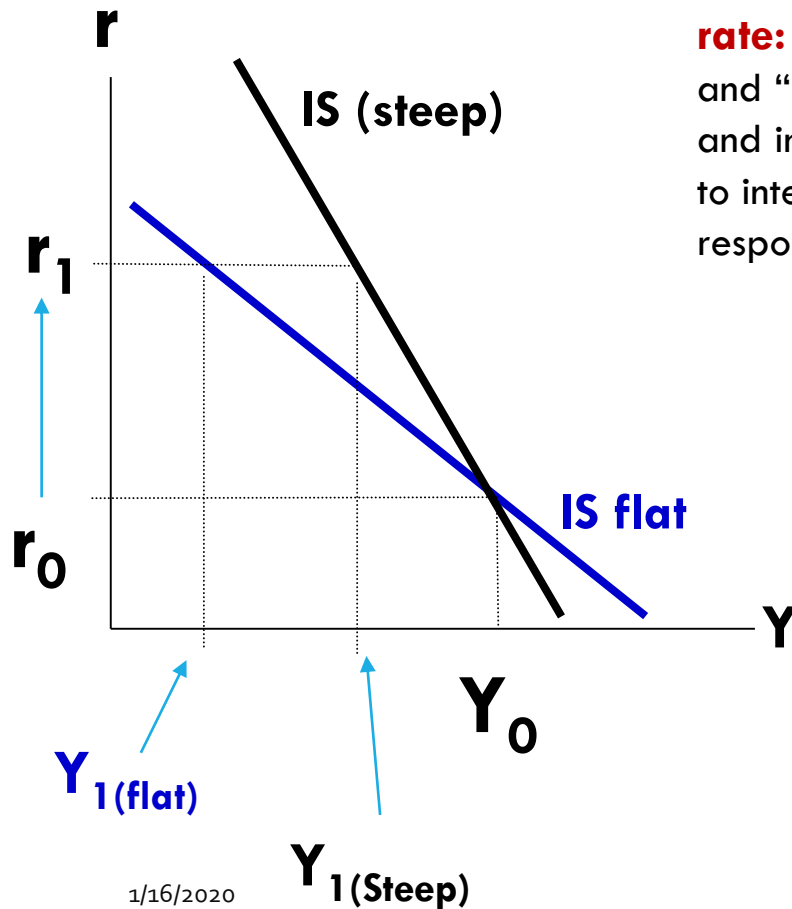


When (real) interest rate increases (r_0 to r_1), investment and consumption will decrease.

Lowering in the investment and consumption causes a drop in aggregate spending (AE).

Change in AE would change the output, based on the multiplier effect. Hence, output would drop (Y_0 to Y_1).

IS CURVE: SLOPE



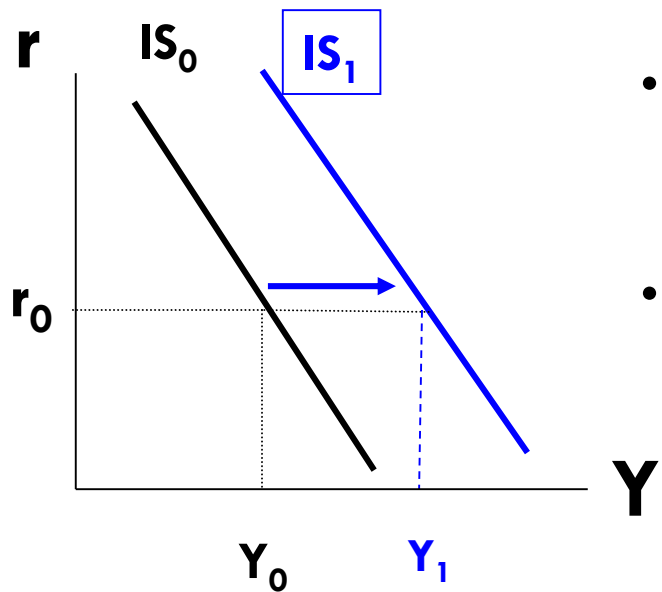
- Sensitivity of AE to interest rate: Interest rate effect:** If "e" and "i1" are high, both consumption and investment are highly sensitive to interest rate. Output is likely to respond more; **IS curve is flat.**

$$C = C_a + b \cdot Y_d - e \cdot r;$$

$$I = I_a - i_1 r + i_2 Y$$

- Sensitivity of Y to AE: multiplier effect:** If "b" and "i2" are high, one-time change in spending cause a large multiplier effect. Hence, output will be responding more; **IS curve is flat.**

IS CURVE: SHIFTING THE CURVE



- IS curve is derived under Ceteris Paribus.
- Changes in the exogenous factors can be diagrammatically captured by a **horizontal shift** of the IS curve.
- The size of horizontal shift depends on the “**multiplier effect**” of the changing factors.

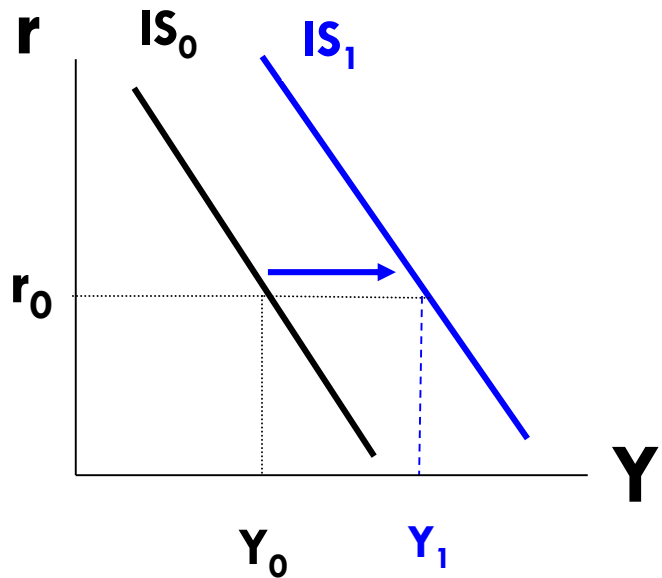
Multiplier	Value
C_a	$\frac{1}{1 - mpc - mpi}$
I_a	$\frac{1}{1 - mpc - mpi}$
G	$\frac{1}{1 - mpc - mpi}$
T	$-\frac{mpc}{1 - mpc - mpi}$

$$C = C_a + b \cdot Y_d - e \cdot r;$$

$$I = I_a - i_1 r + i_2 Y$$

G; T

IS CURVE: SHIFTING THE CURVE



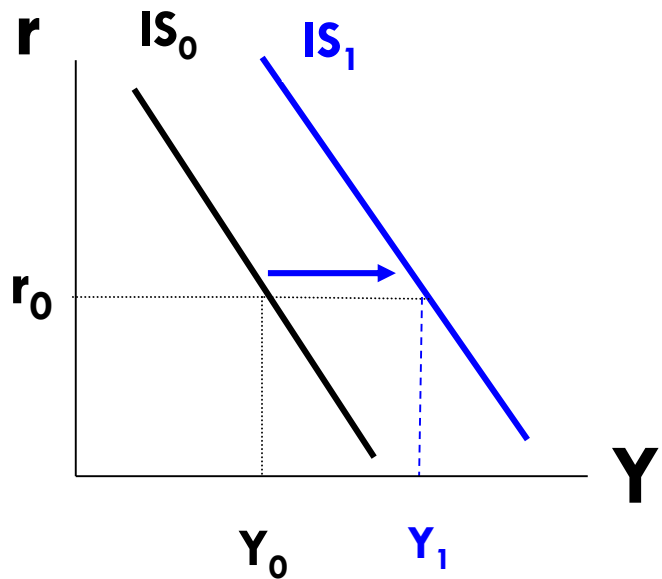
- **Question to discuss:**

For the same amount of the change, which one would produce a bigger shift of IS curve, T or G?

increase in G

Decrease in T

IS CURVE: SHIFTING THE CURVE

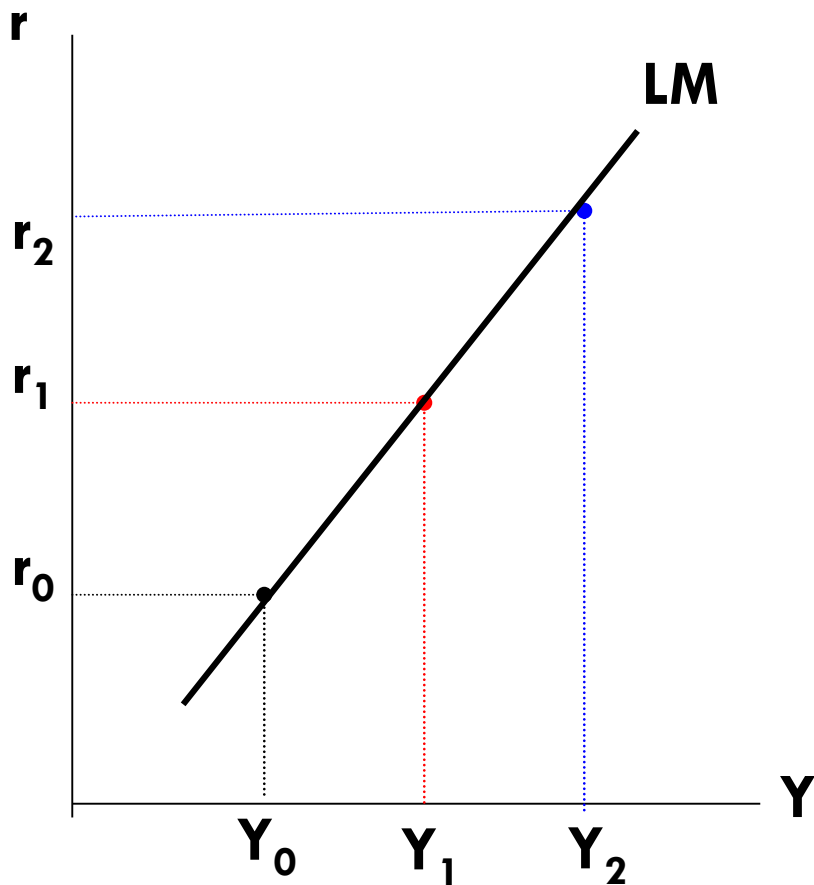


- **Question to discuss:**

Does the size of horizontal shift have any relationship with the slope of IS curve? Why?

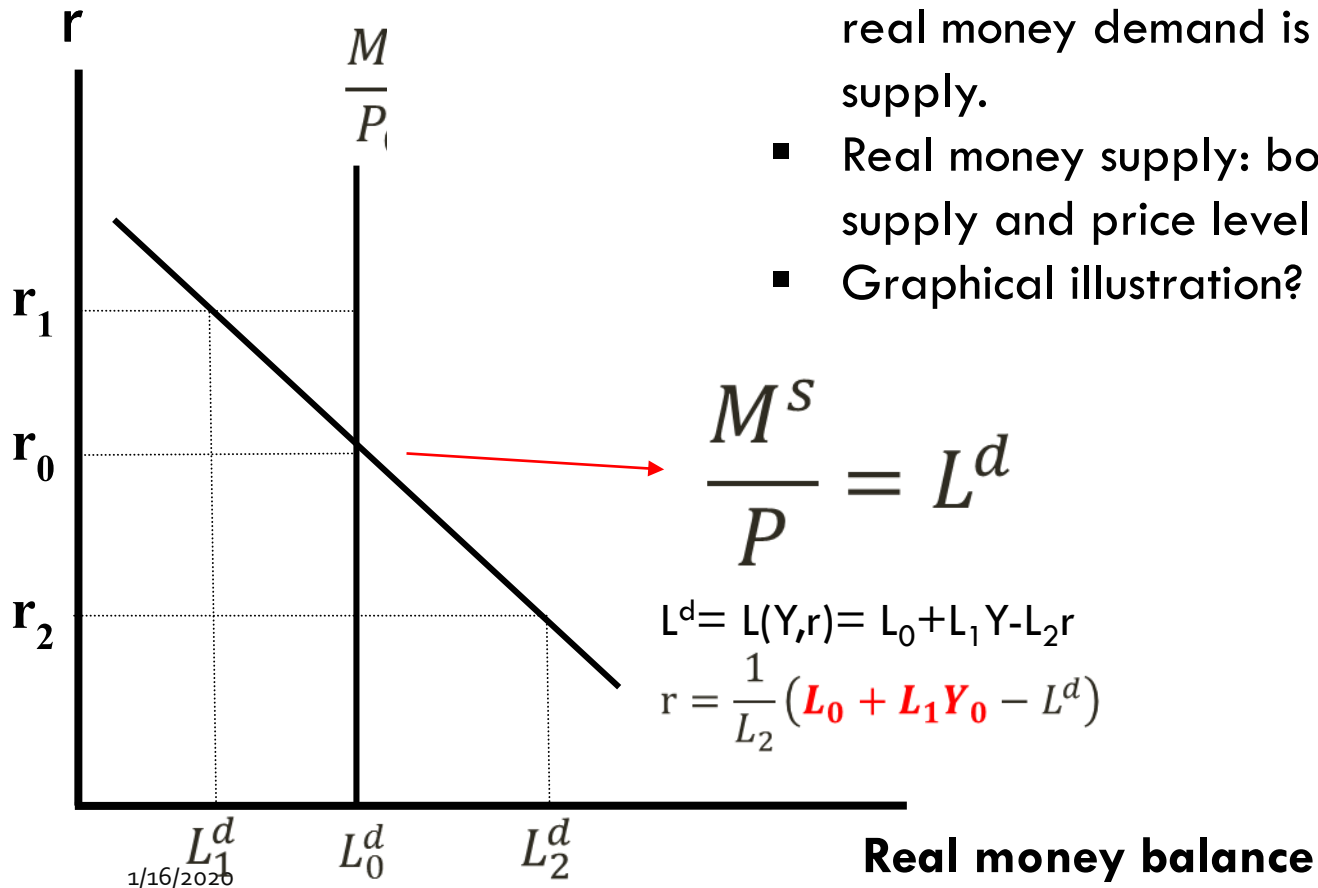
Answer is "depend", but why? **Think!**

LM CURVE



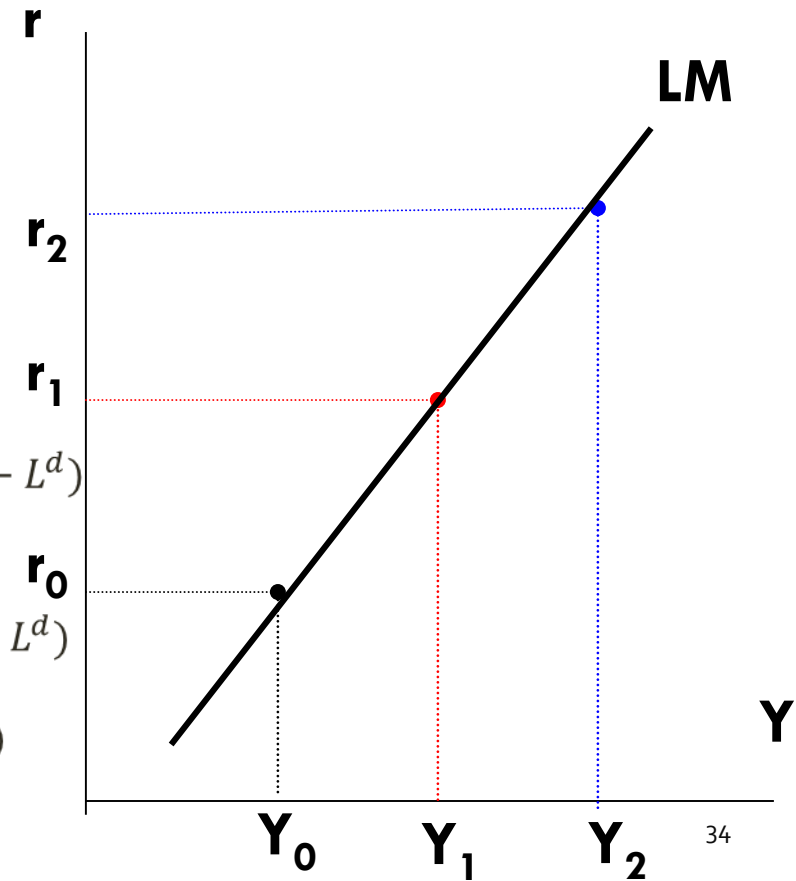
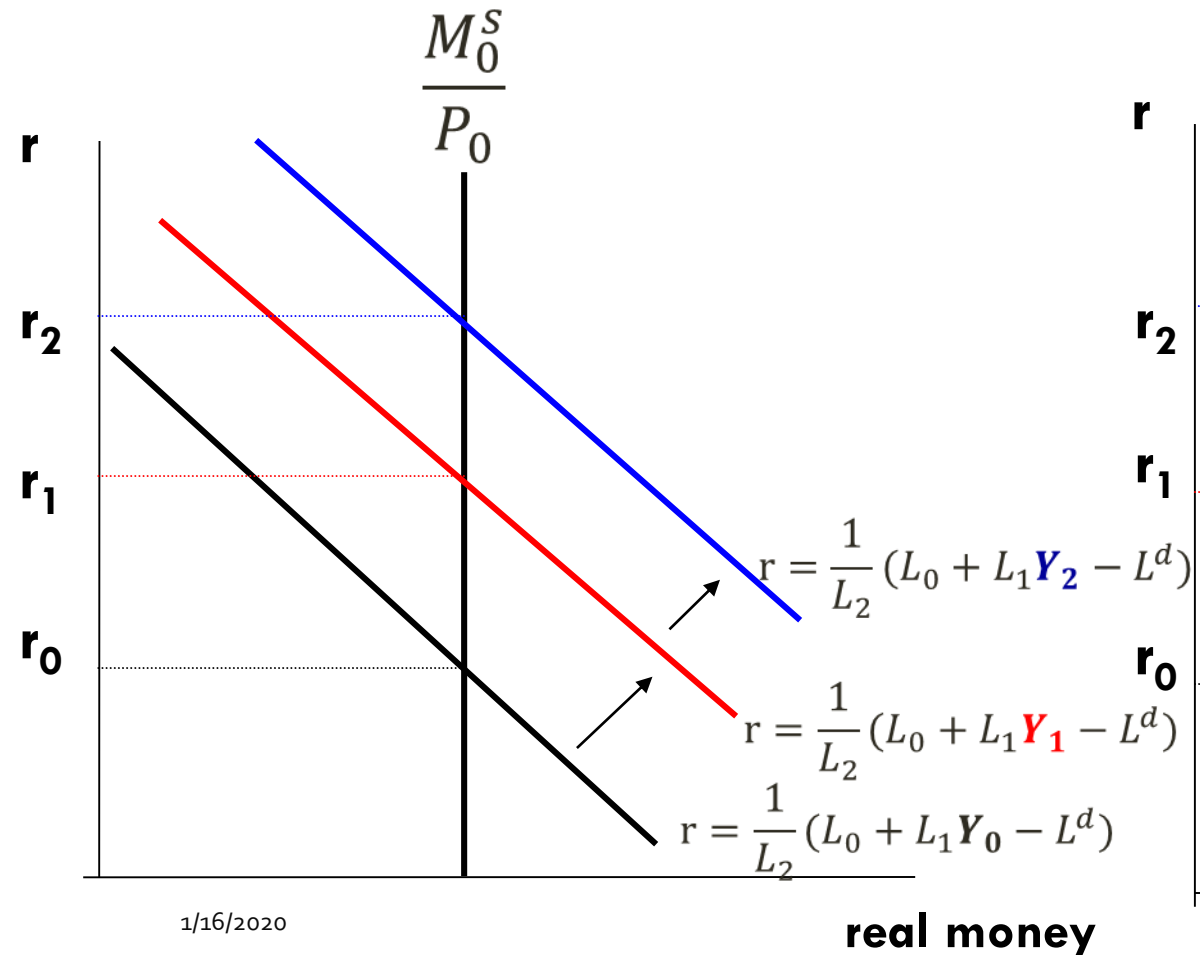
- Pairs of “ r ” and “ y ” that put the money market into equilibrium condition
- LM curve is upward sloping. Why?

THE MONEY MARKET AND LIQUIDITY PREFERENCE THEOREM



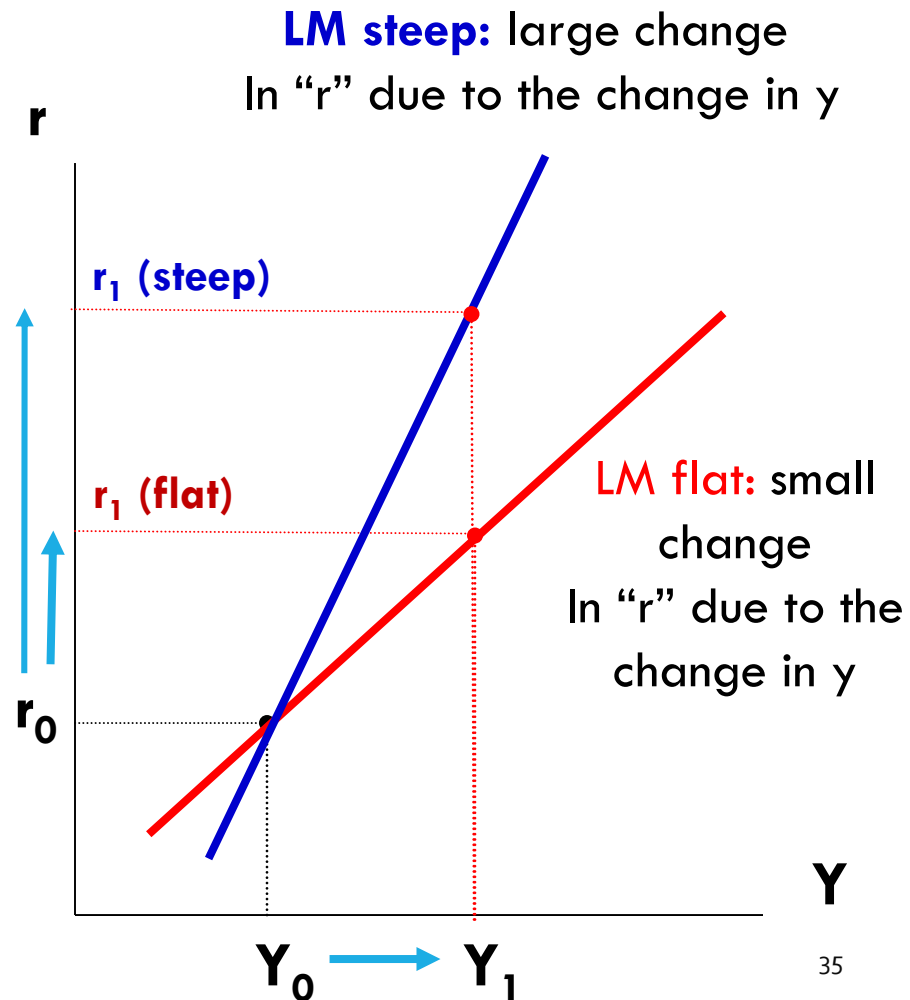
- Equilibrium in the money market occurs when real money demand is equal to real money supply.
- Real money supply: both nominal money supply and price level are treated as given.
- Graphical illustration?

LM CURVE: DERIVATION

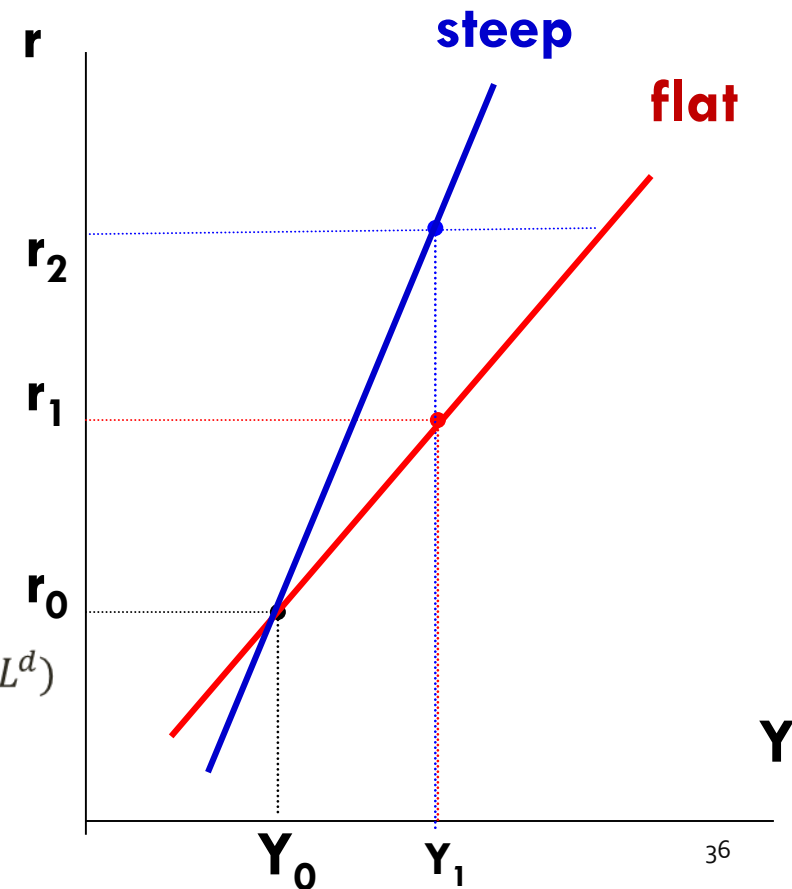
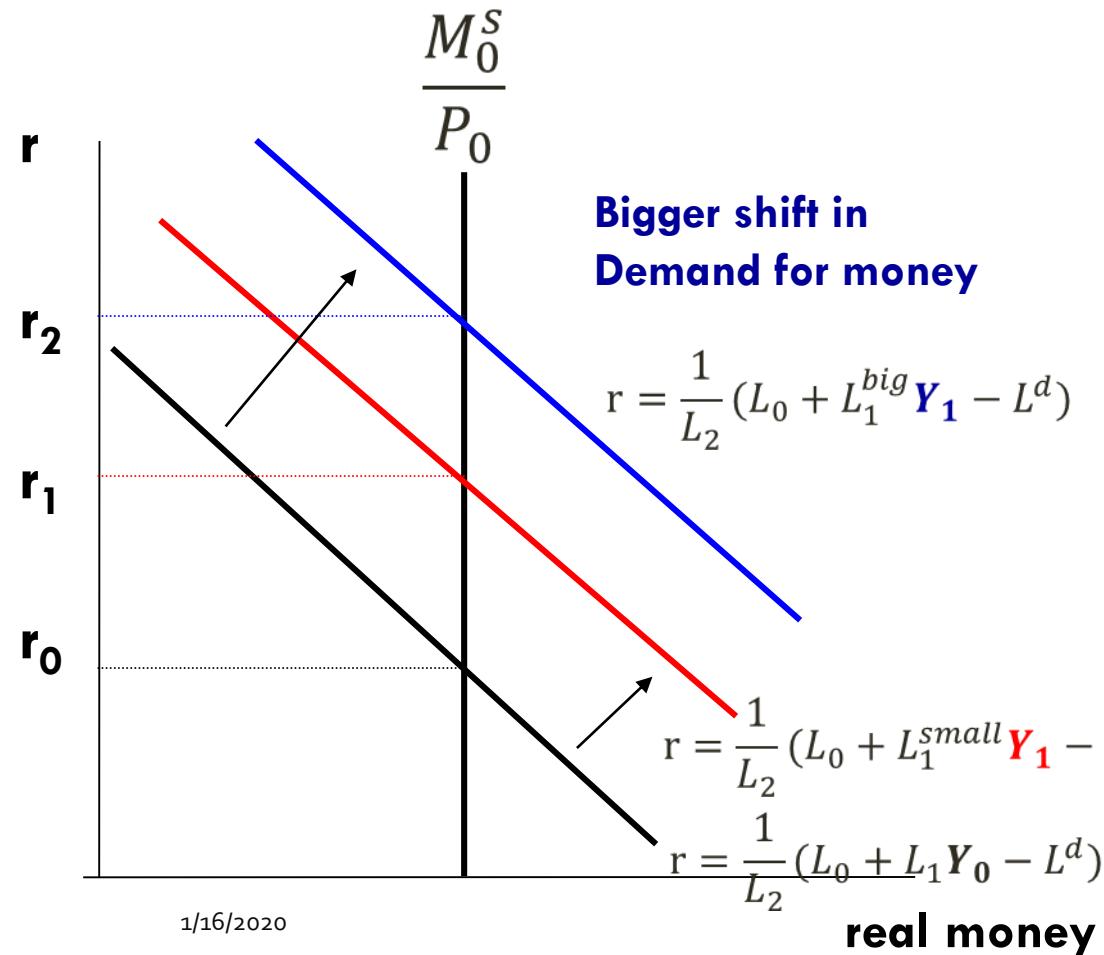


LM CURVE: SLOPE?

- **Flat** v.s. **Steep** LM curve
- Two factors: L1 and L2.
 1. How much does the change in income affect the transaction demand for money? (L1)
 2. How sensitive does the speculative demand respond to interest rate? (L2)

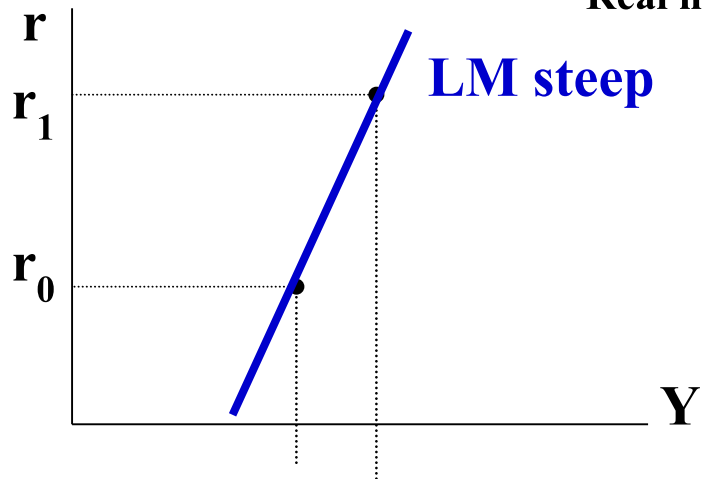
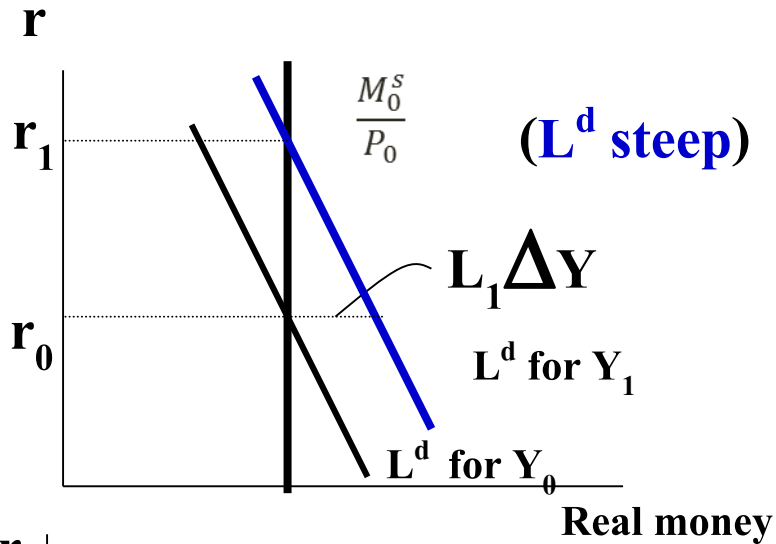


LM CURVE: SLOPE?



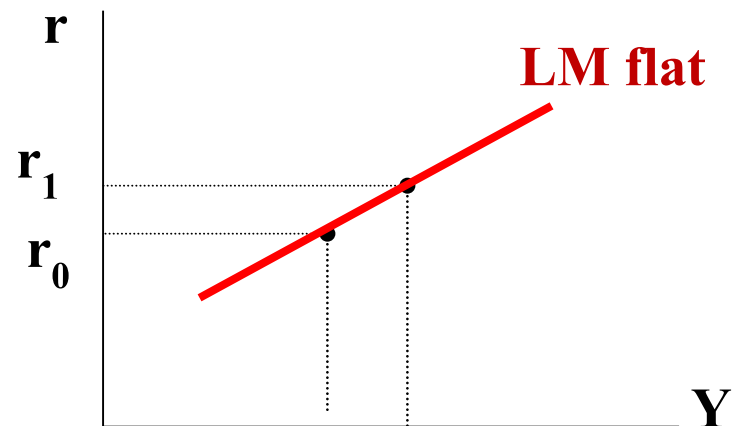
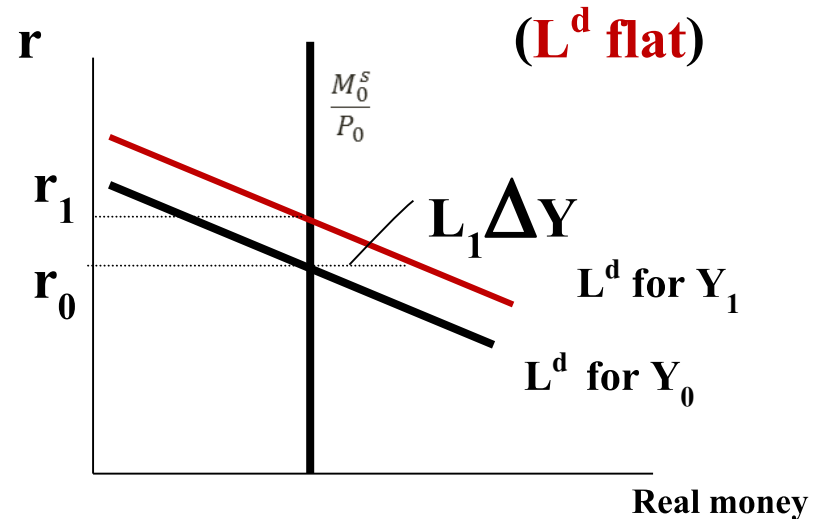
LM curve: Slope?

Highly inelastic L^d to r (L_2 small)



1/16/2020 Y_0 Y_1

Highly elastic L^d to r (L_2 big)



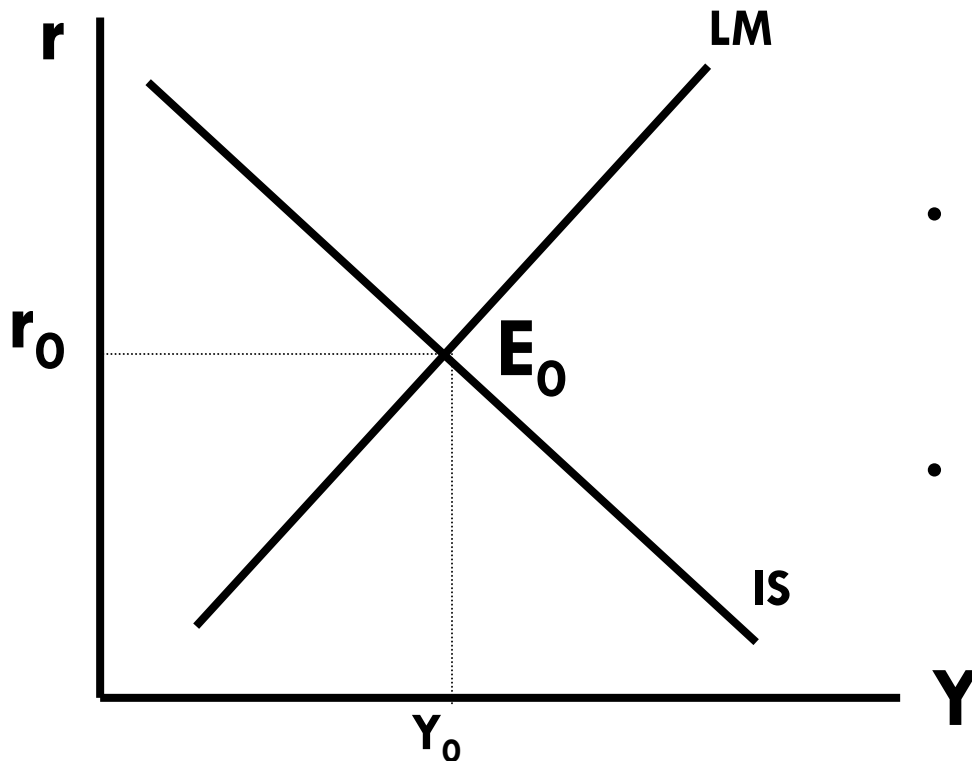
Y_0 Y_1

LM CURVE: SHIFT?

- Exogenous variations in demand for money (L_o)
- Change in the level of real money supply
 - Nominal money supply changes
 - Price changes

Question: Does the panic in banking sector affect LM curve?
How? Why?

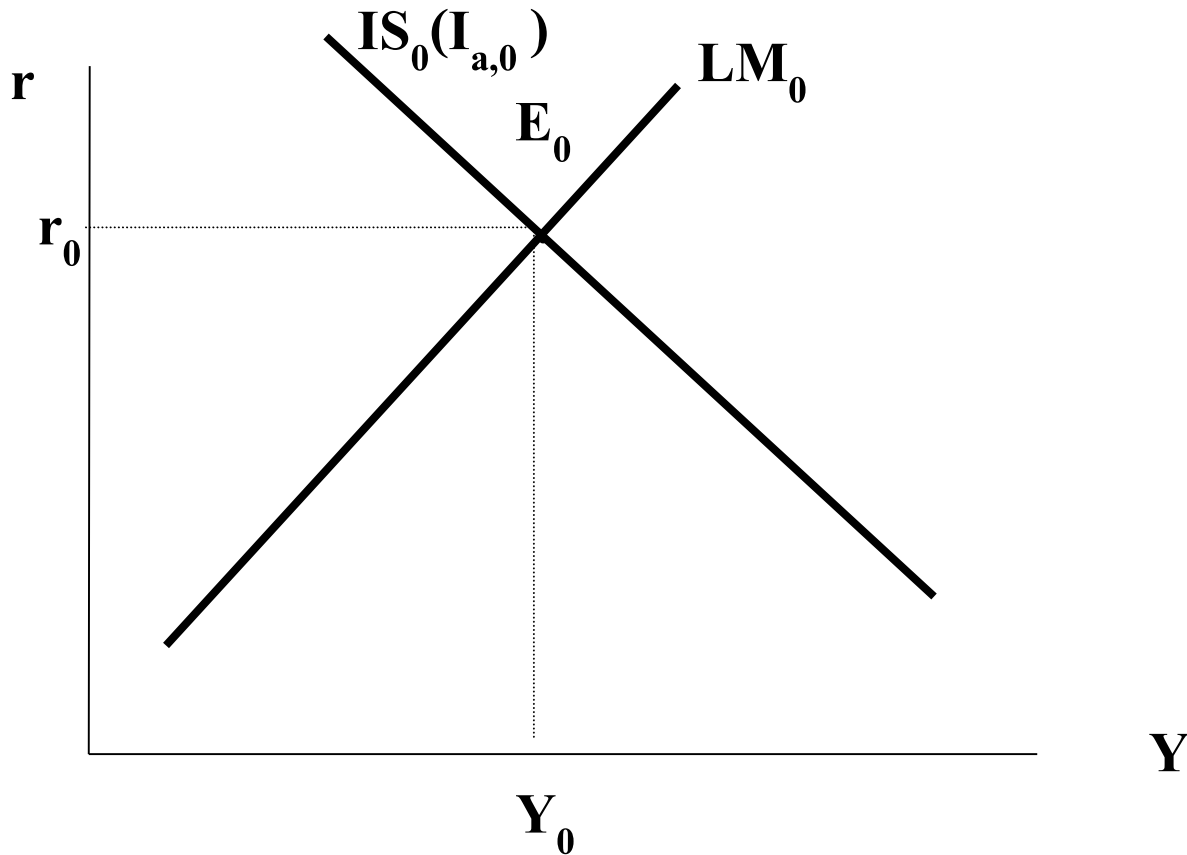
EQUILIBRIUM ANALYSIS UNDER THE IS-LM MODEL



- General equilibrium occurs when **both goods and money market are in the equilibrium.**
- Equilibrium situation can be attained at the intersection point between IS and LM curve.
- E_0 will always be the equilibrium if factors that determine IS and LM curve remain the same.

QUESTION:

NEGATIVE SHOCKS ON AUTONOMOUS INVESTMENT SPENDING



EXERCISE:

ANALYZE SHOCKS WITH THE IS-LM MODEL

Use the *IS-LM* model to analyze the effects of

1. a boom in the stock market that makes consumers wealthier.
2. after a wave of credit card fraud, consumers using cash more frequently in transactions. (Odds number)

For each shock,

- a. use the *IS-LM* diagram to show the effects of the shock on Y and r . Explain the mechanism.
- b. determine what happens to C , I , and the unemployment rate.

CASE DISCUSSION 1: THE U.S. RECESSION OF 2001

- During 2001,
 - 2.1 million people lost their jobs, as unemployment rose from 3.9% to 5.8%.
 - GDP growth slowed to 0.8% (compared to 3.9% average annual growth during 1994-2000).
- Took a couple of years before the recession ended.

CASE DISCUSSION 1 : THE U.S. RECESSION OF 2001

Dot-com bubble

From Wikipedia, the free encyclopedia

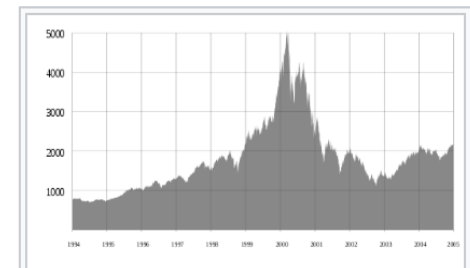
The **dot-com bubble** (also known as the **dot-com boom**,^[1] the **tech bubble**,^[2] and the **Internet bubble**) was a historic period of excessive speculation mainly in the United States that occurred roughly from 1994 to 2000, a period of massive growth in the use and adoption of the Internet.^[3]

The **Nasdaq Composite stock market index**, which included many Internet-based companies, peaked in value on March 10, 2000, before crashing. The burst of the bubble, known as the **dot-com crash**, lasted from March 11, 2000, to October 9, 2002.^{[3][4]} During the crash, many **online shopping** companies, such as **Pets.com**, **Webvan**, and **Boo.com**, as well as communication companies, such as **Worldcom**, **NorthPoint Communications** and **Global Crossing**, failed and shut down.^{[5][6]} Others, such as **Cisco**, whose stock declined by 86%,^[6] and **Qualcomm**, lost a big portion of their market capitalization but survived, and some companies, such as **eBay** and **Amazon.com**, lost value but recovered quickly.

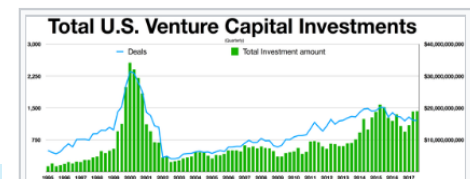
Contents [hide]

- 1 Prelude to the bubble
- 2 The bubble
 - 2.1 Spending tendencies of dot-com companies
 - 2.2 Bubble in telecom
- 3 Bursting of the bubble
- 4 Aftermath

Mechanism of the crisis through using the IS-LM model. What brought the economy downfall?



The **NASDAQ Composite** index spiked in the late 1990s and then fell sharply as a result of the dot-com bubble.

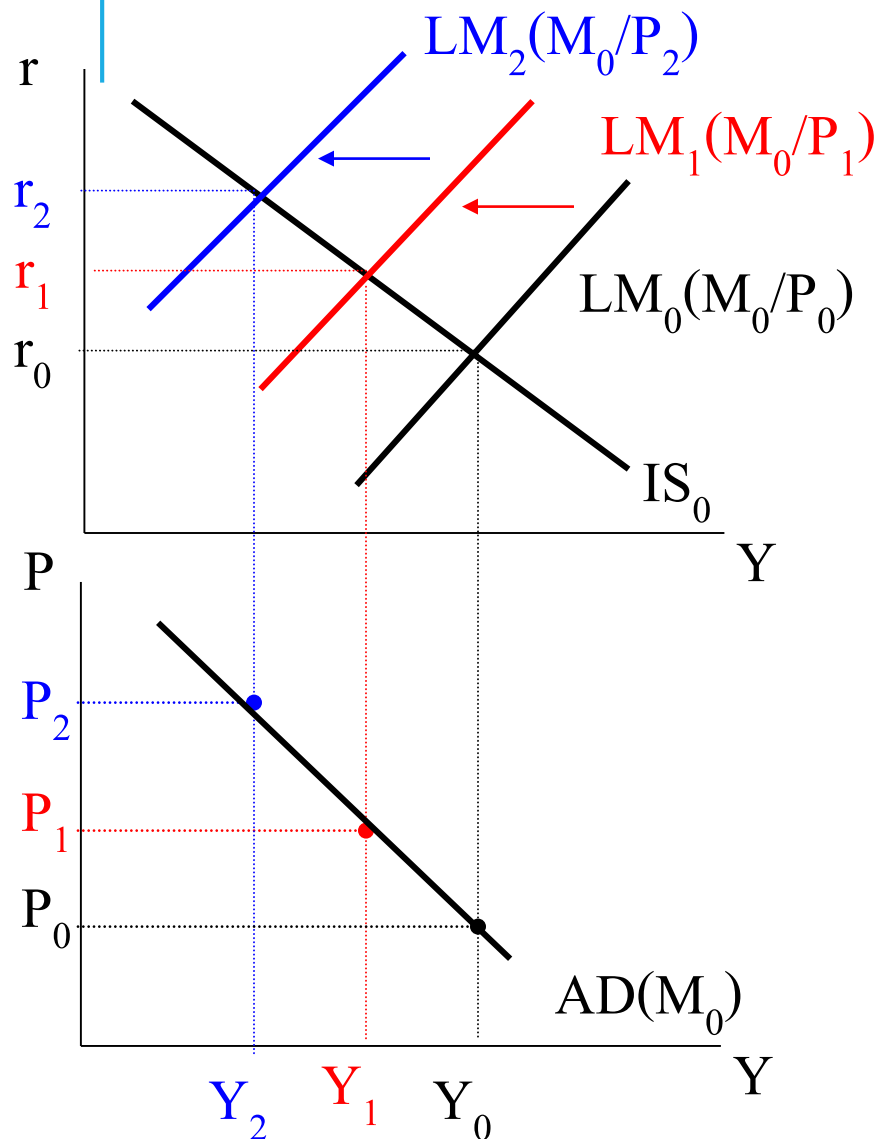


Quarterly U.S. venture capital investments, 1995–2017

AGGREGATE DEMAND

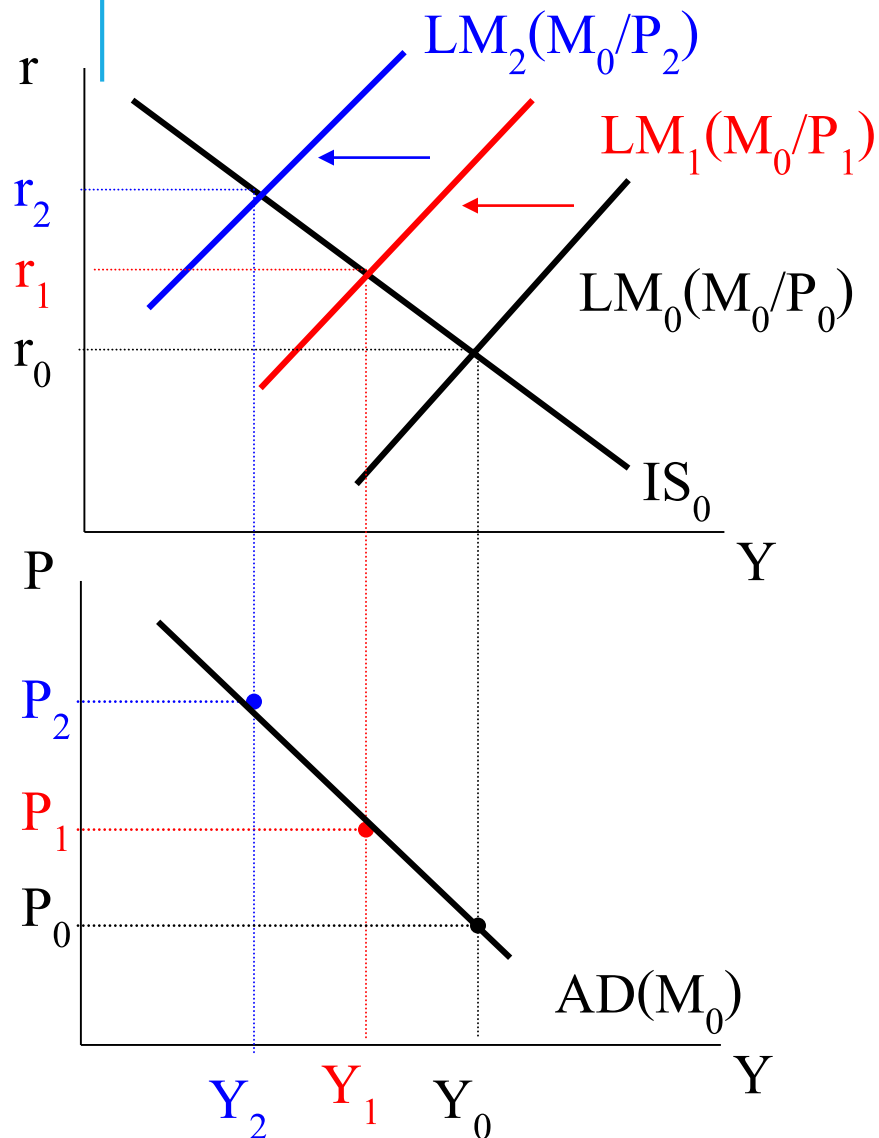
- IS-LM model was built on the assumption that *price is fixed.*
- What if price can be adjusted? How would this affect behavior of aggregate output?
- The relationship that links between “price” and “income” obtained from the IS-LM model is called the aggregate demand relationship.
- Aggregate demand curve is downward sloping in price. (why?)

AGGREGATE DEMAND: DERIVATION



- Suppose that nominal money supply (M_0) is fixed
- Initial IS-LM equilibrium is r_0, y_0 (associated with P_0).
- Now consider two alternative scenarios:
 $P_2 > P_1 > P_0$
- Given the two scenarios, one knows that
 $(M_0/P_2) < (M_0/P_1) < (M_0/P_0)$
- Graphically, rising price causes real money supply to drop; LM curve shifted left: $LM_0 \rightarrow LM_1 \rightarrow LM_2$
- AD curve **can be derived** from the equilibrium of the IS-LM model; downward sloping curve.

AGGREGATE DEMAND: DERIVATION



- Intuitively,

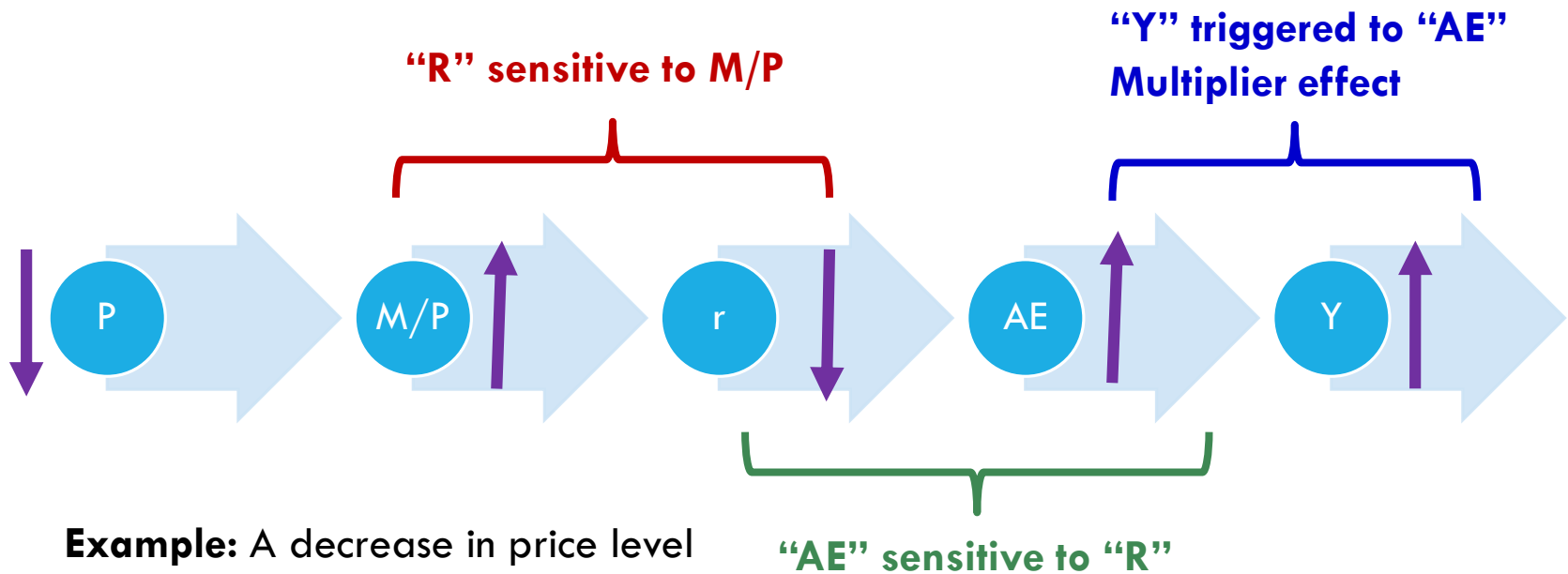
Rising price leads to a lowered liquidity, and thus an increase in market interest rate.

Rising in market interest rate then cuts private spending, and hence AE.

Eventually, quantity of aggregate demand reduced!

SLOPE OF THE AGGREGATE DEMAND

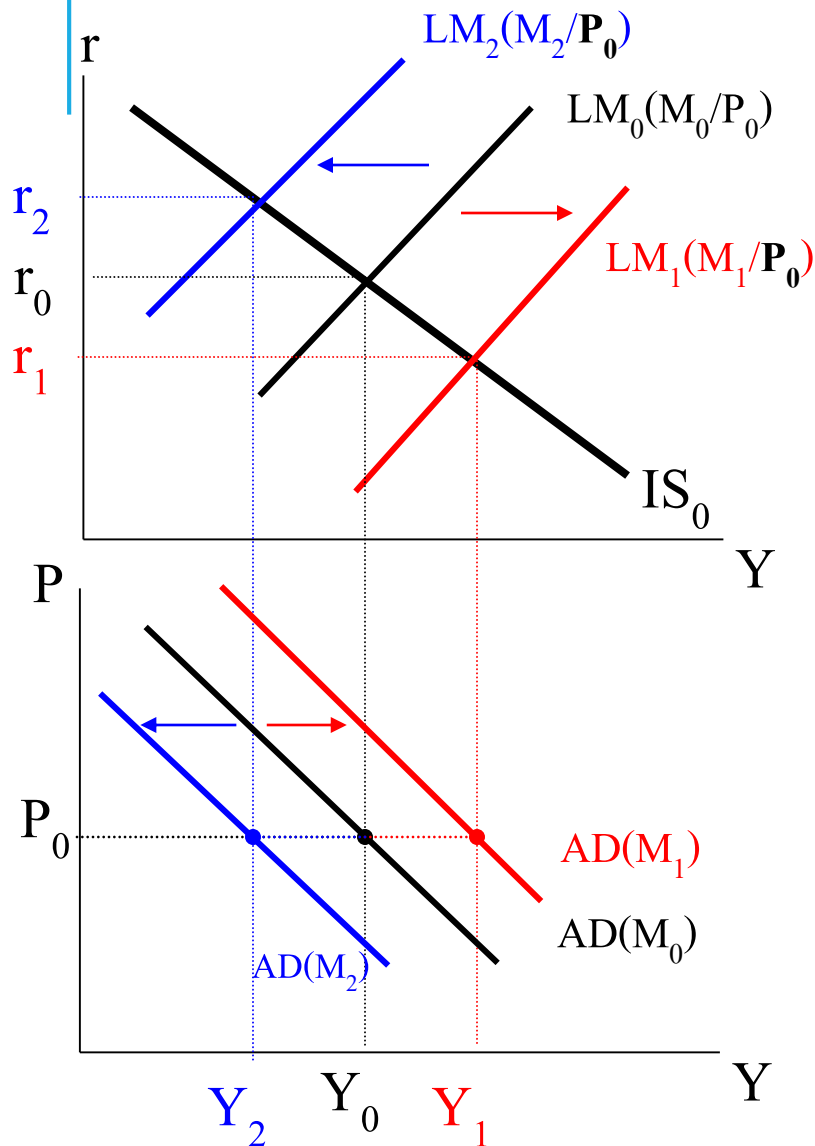
- When is the AD curve flat? When does the aggregate quantity demanded sensitively respond to change in price?



AGGREGATE DEMAND: CHANGES IN THE AD CURVE

- Aggregate demand can be shifted up/right (more demand for any given prices) and down/left (less demand for any given prices.)
- All the underlying factors that determine the IS curve and the LM curve can cause the change in Aggregate demand curve.
- Consider policy variables.

AGGREGATE DEMAND: CHANGES IN THE AD

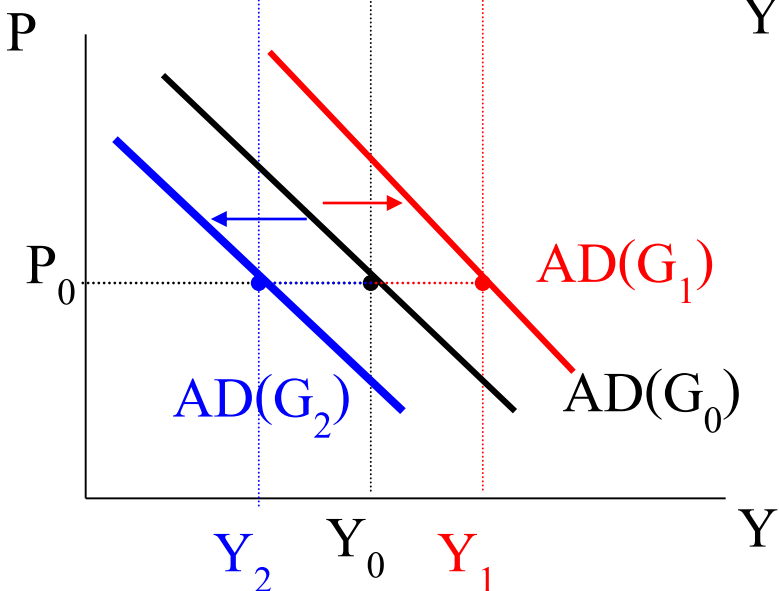
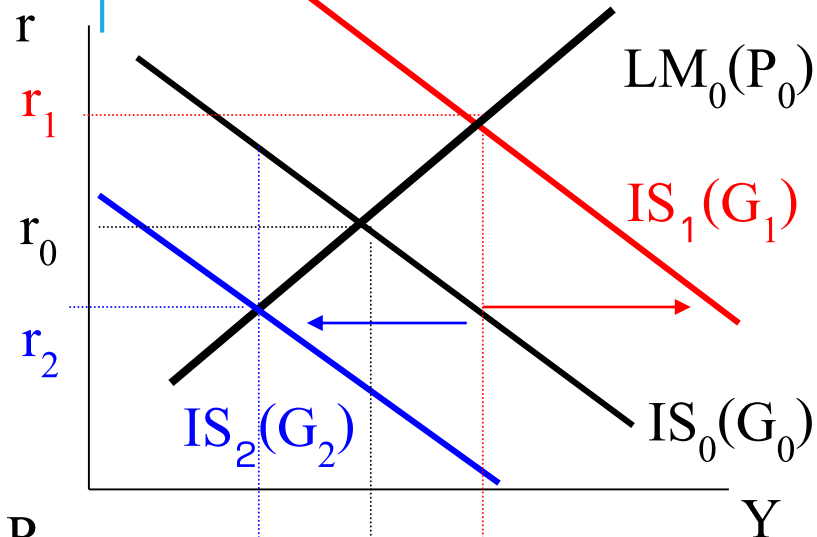


Change in the nominal money supply

- Consider a **fixed level of price P_0** .
- Suppose central bank increases money supply; $M_0 \rightarrow M_1$
- Positive money creation will cause the LM curve to shift right ($LM_0 \rightarrow LM_1$); income will rise from Y_0 **to Y_1** .
- Y_0 is no longer aggregate quantity demanded at P_0 when money supply is now $M_1 > M_0$; aggregate demand curve then shifts right.
- For any level of prices, lowering money supply would cause LM to shift left, and hence the AD curve.

AGGREGATE DEMAND: CHANGES IN THE AD CURVE

Change in the level of Government spending



- Consider a **fixed level of price, P_0**
- Suppose government increases spending from G_0 to **G_1** .
- Positive change in government spending will cause the IS curve to shift right ($IS_0 \rightarrow IS_1$); income will rise from Y_0 to **Y_1** .
- Y_0 is no longer aggregate quantity demanded at P_0 when government spending is now $G_1 > G_0$; aggregate demand curve then shifts right.
- For any level of prices, lowering G ($G_0 \rightarrow G_2$) would cause IS to shift left, and hence the AD curve.

AGGREGATE DEMAND: CHANGES IN THE AD CURVE

- **Question:** how does the deterioration in the level of consumer and business confidence affect aggregate demand curve?
- **Question:** how does the introduction and acceptance of digital currency affect aggregate demand curve?
- **Question:** When does the fiscal and monetary policy generate a big shift in AD curve?

FOUNDATION OF AS

VERSIONS OF AGGREGATE SUPPLY

- The concept of aggregate supply is highly controversial in macroeconomics
- This depends on the **time horizon of macroeconomic analysis**
- There are TWO main versions!

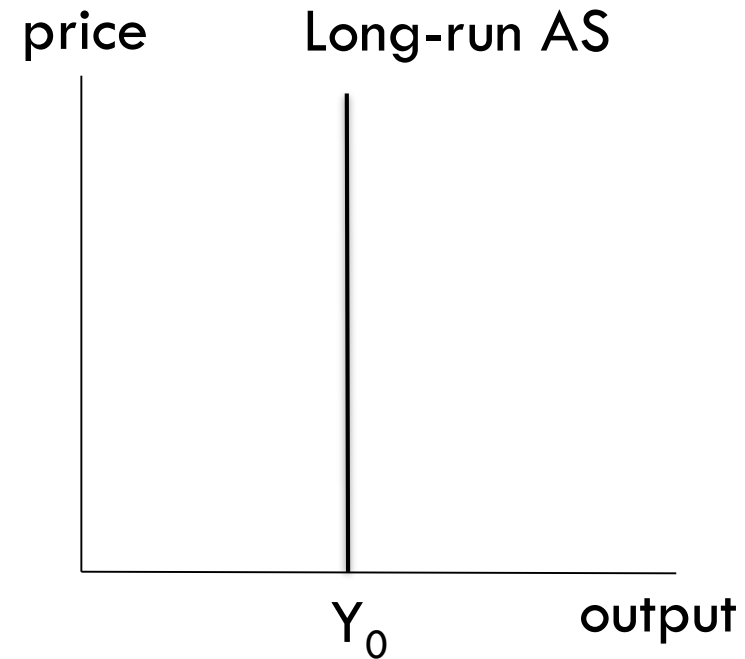
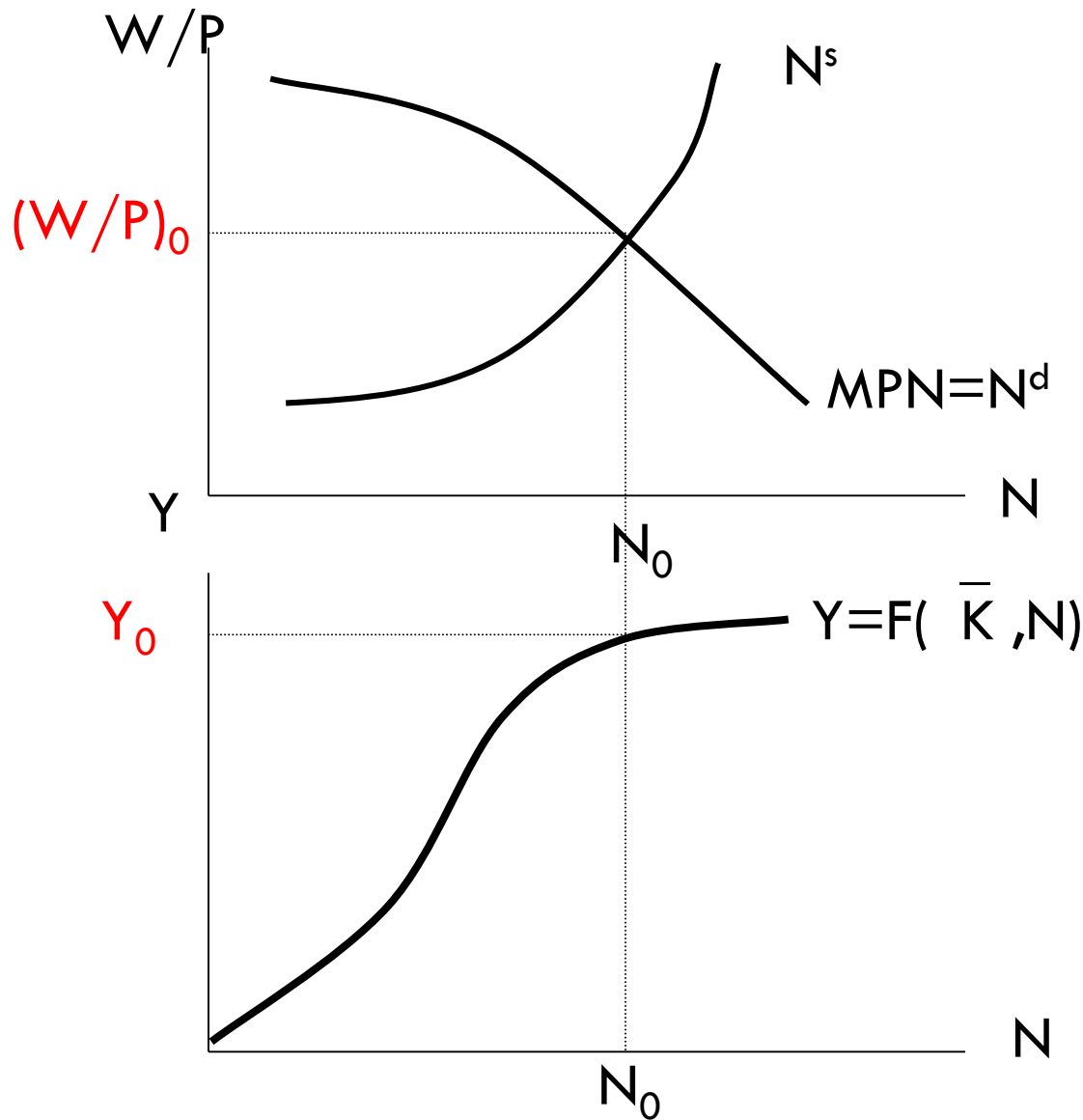
VERSIONS OF AGGREGATE SUPPLY

- Long-run AS
- Short-run AS
 - Very short-run AS is treated as an extreme case of short-run AS.

LONG-RUN AS

- Notion of AS when both **prices and wages are perfectly adjusted**
- That is, there is **no nominal frictions!**
- The aggregate supply is represented by **a vertical line**, where the economy produces at the full-employment output or potential output

Long-run aggregate supply and the full-employment output or potential output



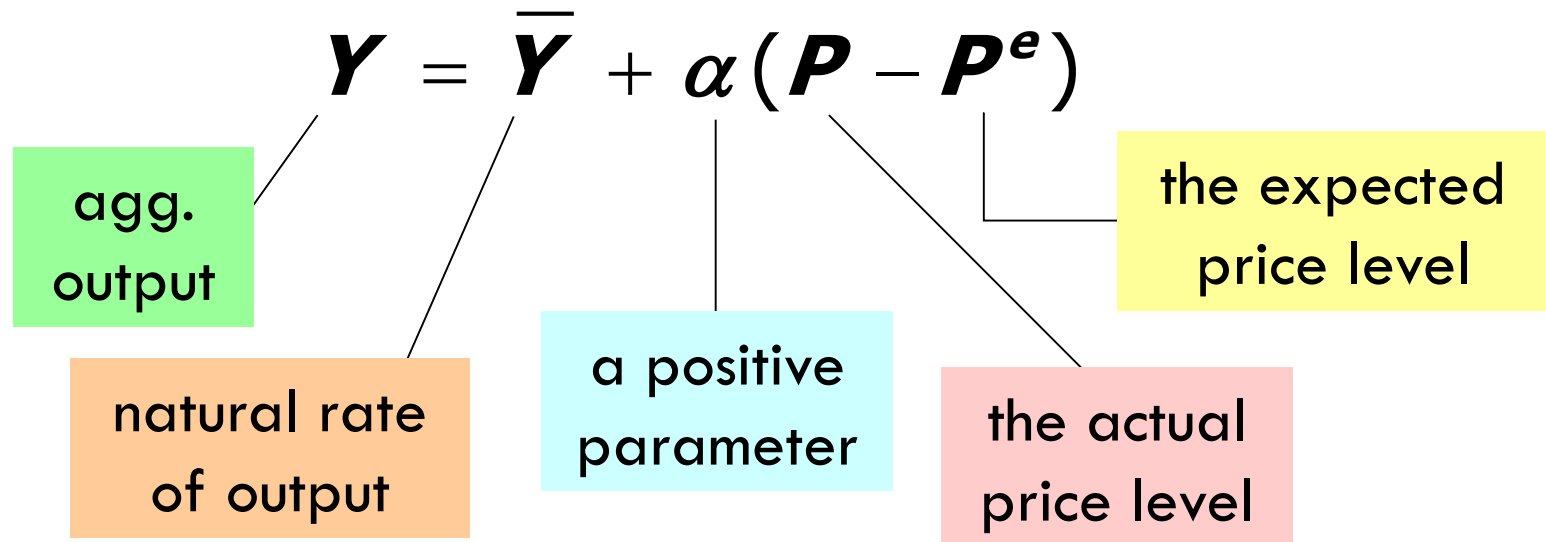
SHORT-RUN AS

- Notion of long-run AS is idealistic, and only holds in the long-run.
- Markets have full of **nominal frictions and incomplete adjustment**.
 - Labor market: wage stickiness (preset wages)
 - Goods market: Price stickiness (present prices)

TWO MODELS OF AGGREGATE SUPPLY

1. The sticky-wage model
2. The sticky-price model

Both models imply:



THE STICKY-WAGE MODEL

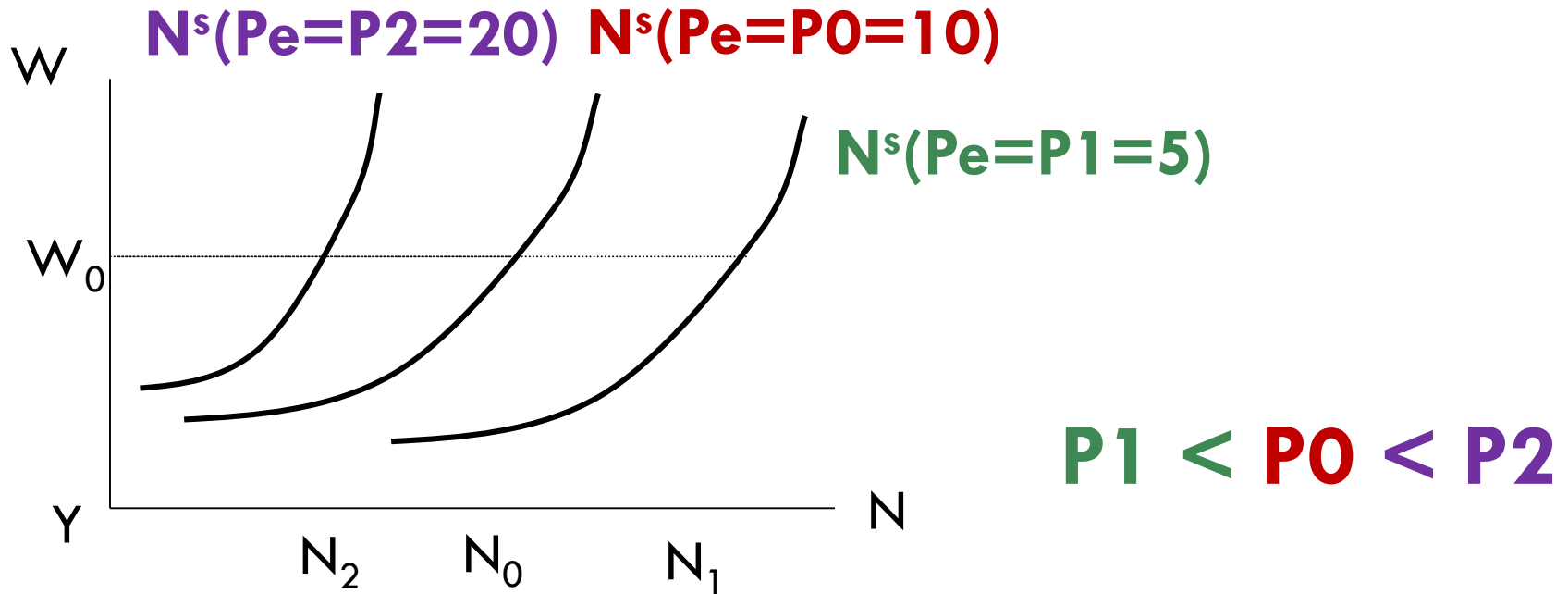
- In the reality, workers get paid in nominal terms
- Moreover, firms and workers usually negotiate contracts and fix the nominal wage before they know what the price level will turn out to be
- Households must choose for optimal labor choice, given the **expected price**

$$\text{Max } U(C,L)$$

$$\text{s.t. } PC = WN = W(24-L)$$

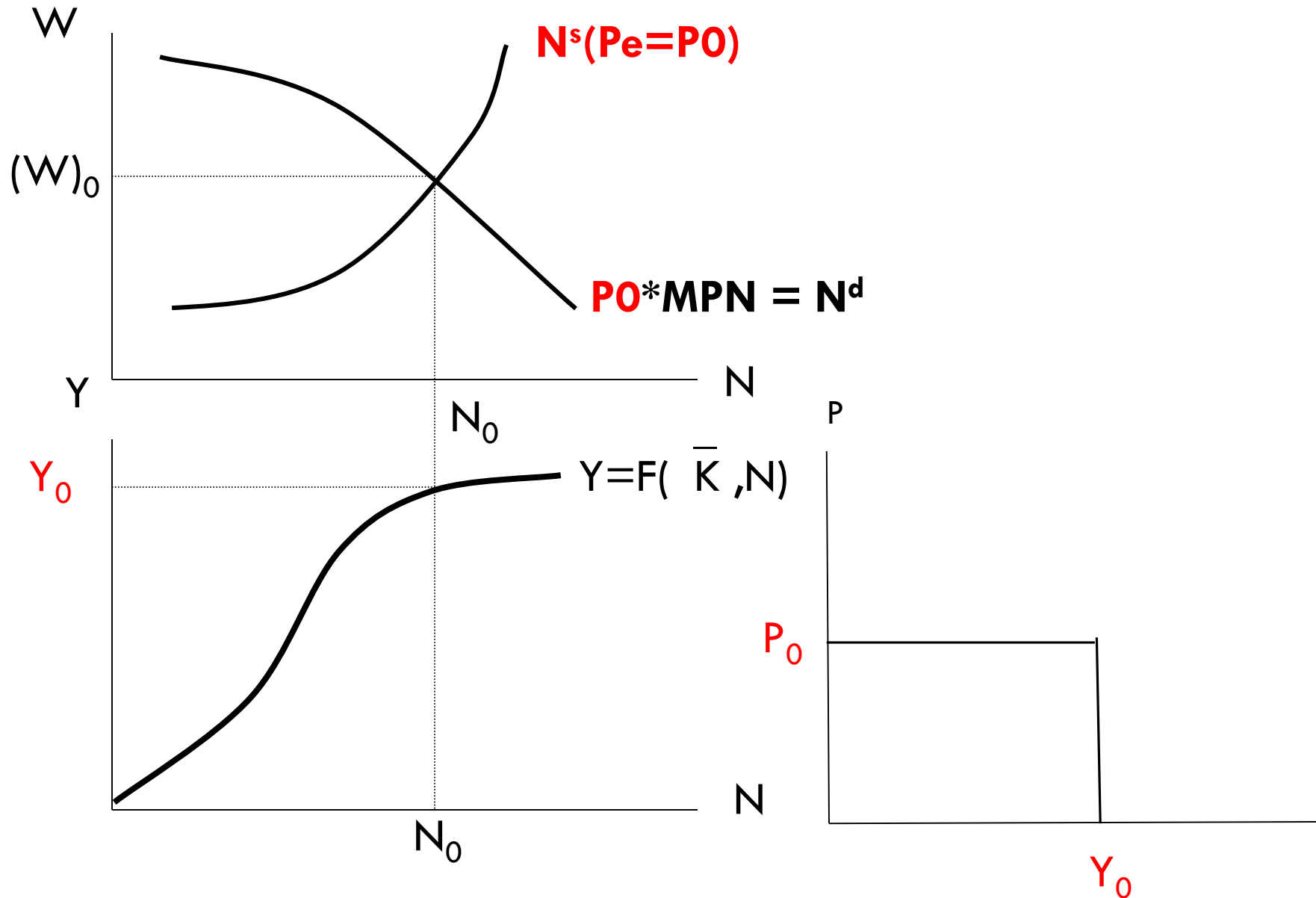
$$C = (W/P_e) (24 - L)$$

Behavior of Labor supply under pre-committed wage contract

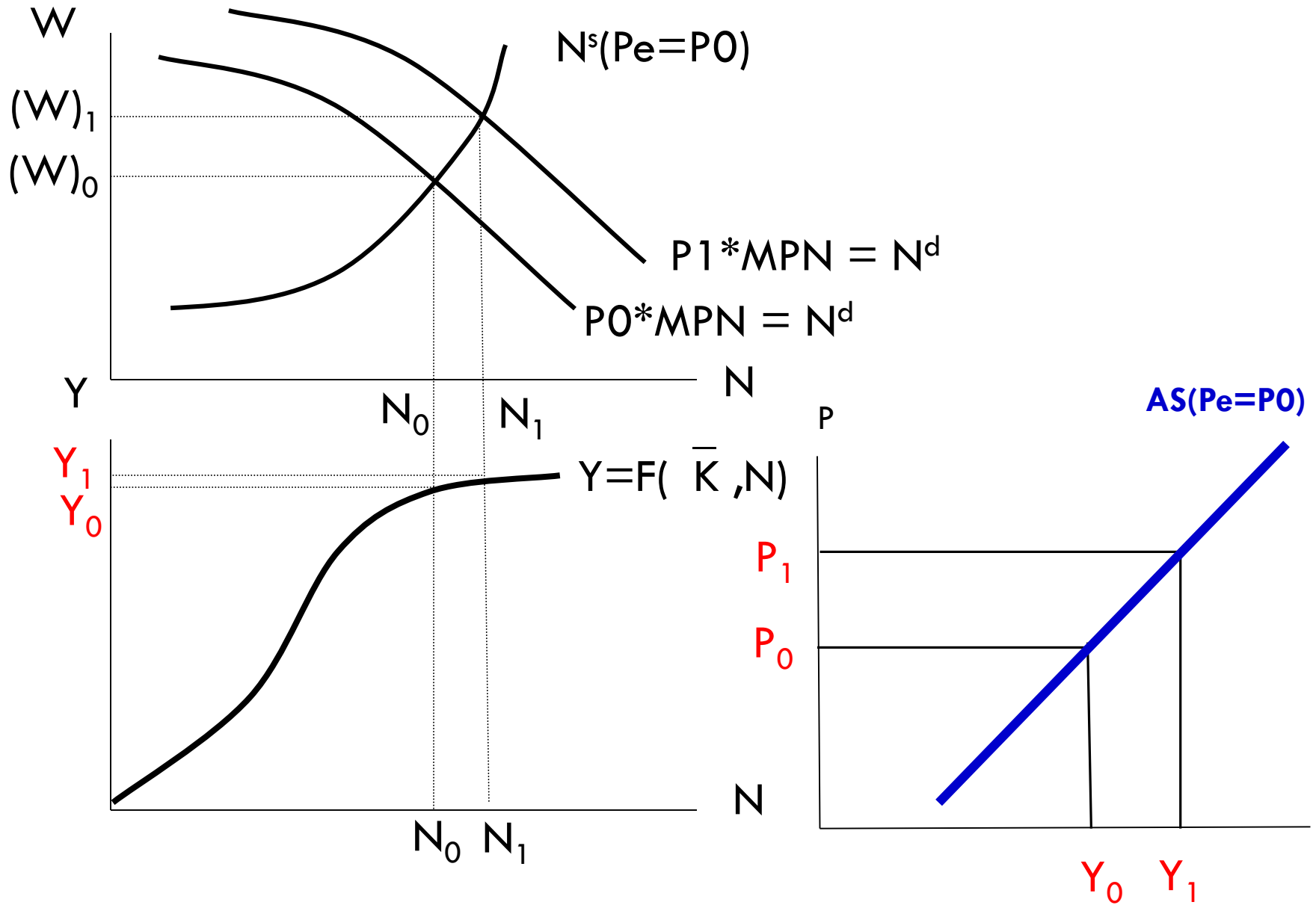


- Typical labor supply: upward sloping in nominal wage offered
- Expectation is important
- The higher expected price, the lower labor supply (the higher nominal wage required for each working hour).

Equilibrium of labor market and the determination of the production level under sticky-wage



Equilibrium of labor market and the determination of the production level under sticky-wage



THE STICKY-WAGE MODEL

If it turns out that

then

$$P = P^e$$

Unemployment and output are at their natural rates.

$$P > P^e$$

Real wage is less than its target, so firms hire more workers and output rises above its natural rate.

$$P < P^e$$

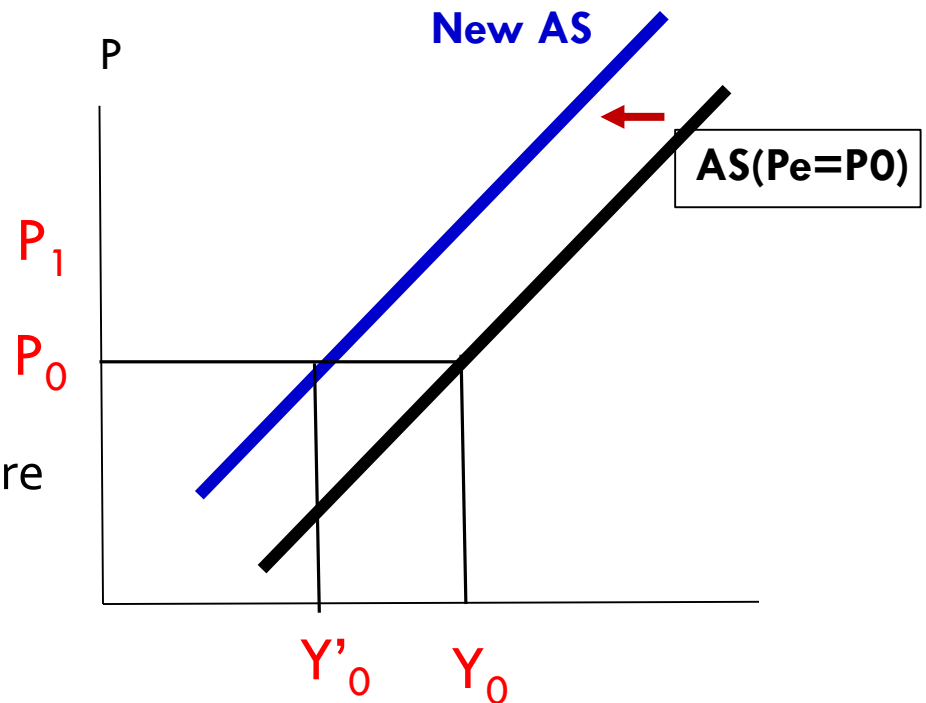
Real wage exceeds its target, so firms hire fewer workers and output falls below its natural rate.

DETERMINANTS OF SHORT-RUN AS

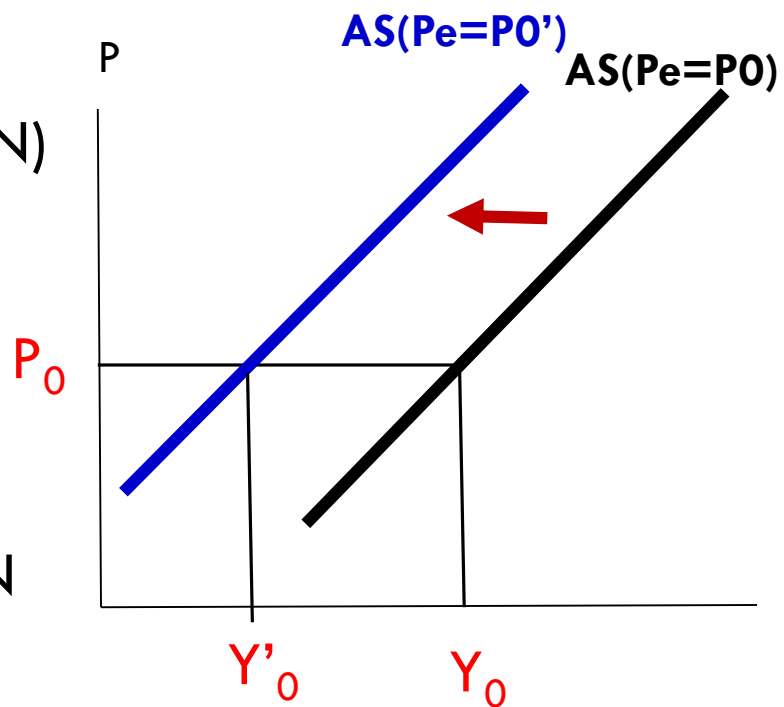
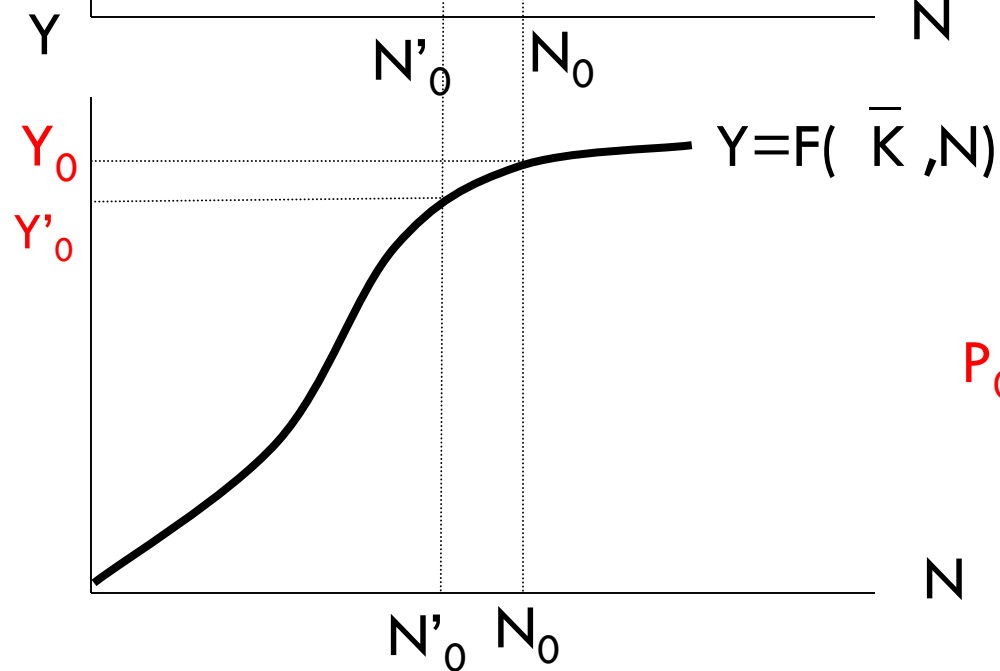
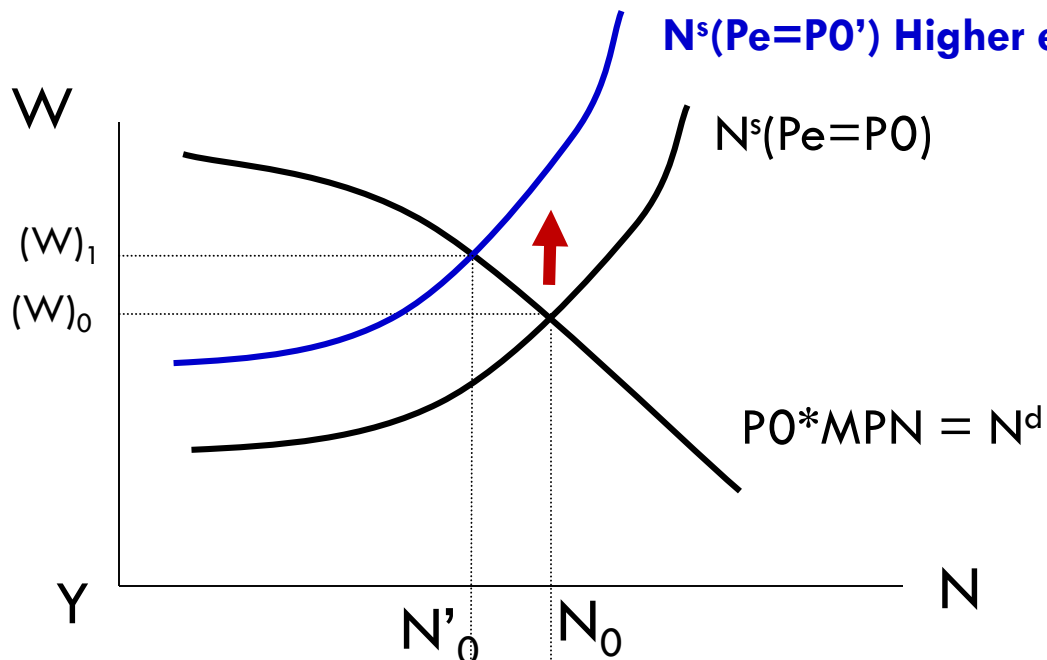
☐ Very much like standard AS that we learned in EE212 / 102 class

☐ Examples

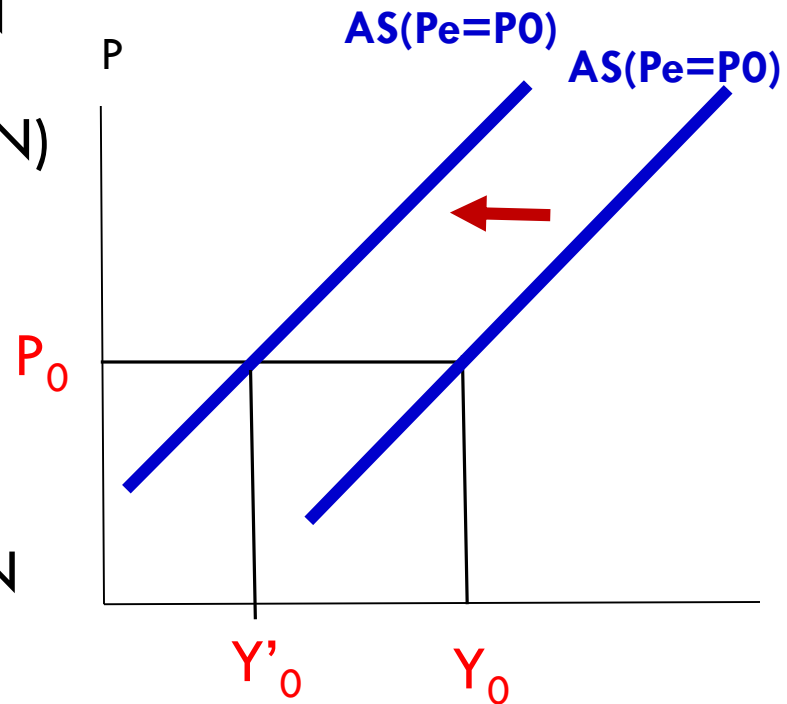
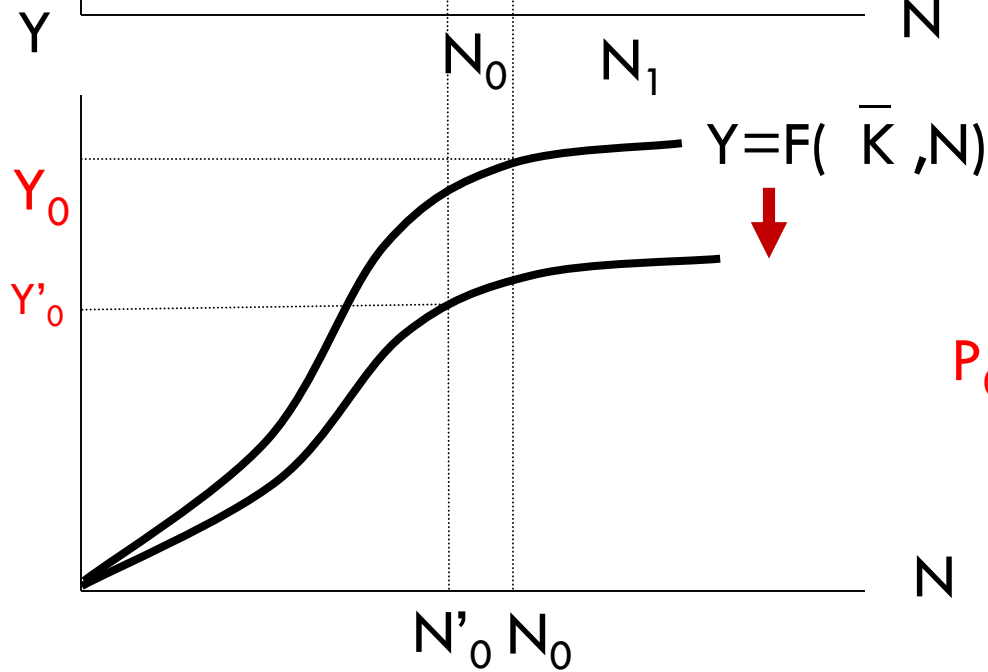
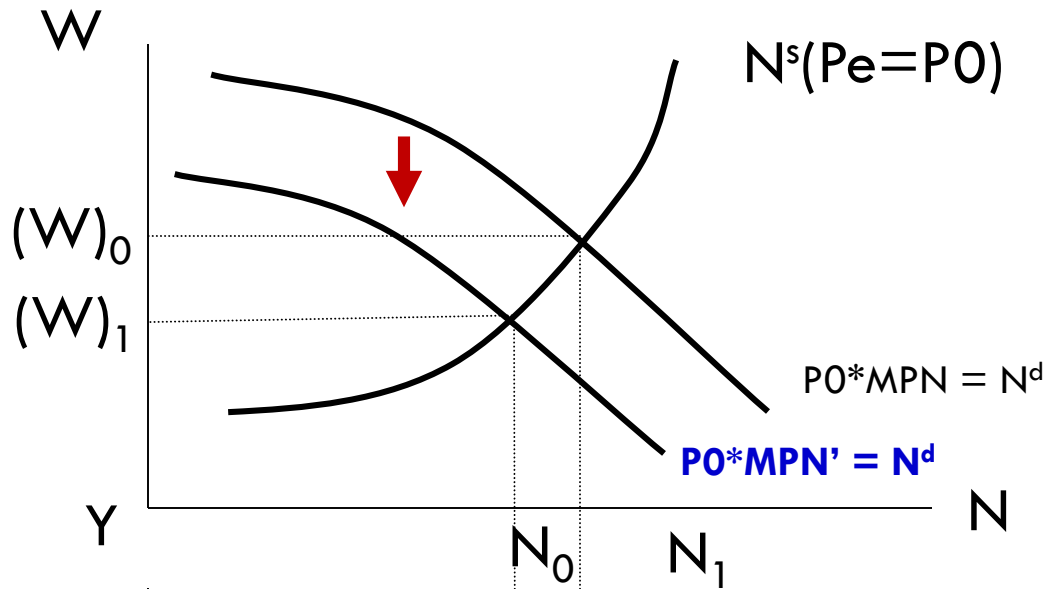
- Change in expected price P_1
- Production technology
- Change in market structure
- Government policies



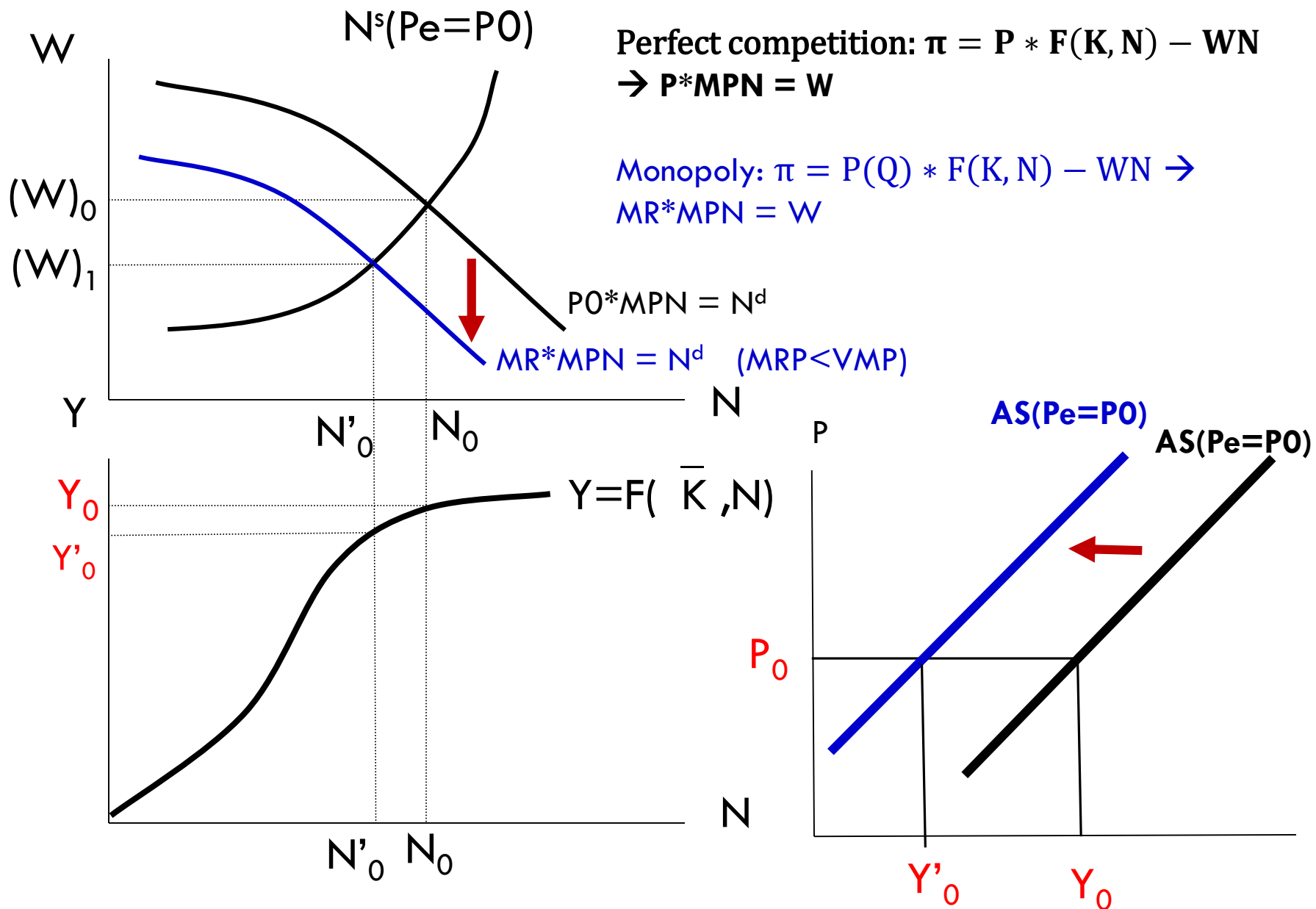
Example: Higher expected price



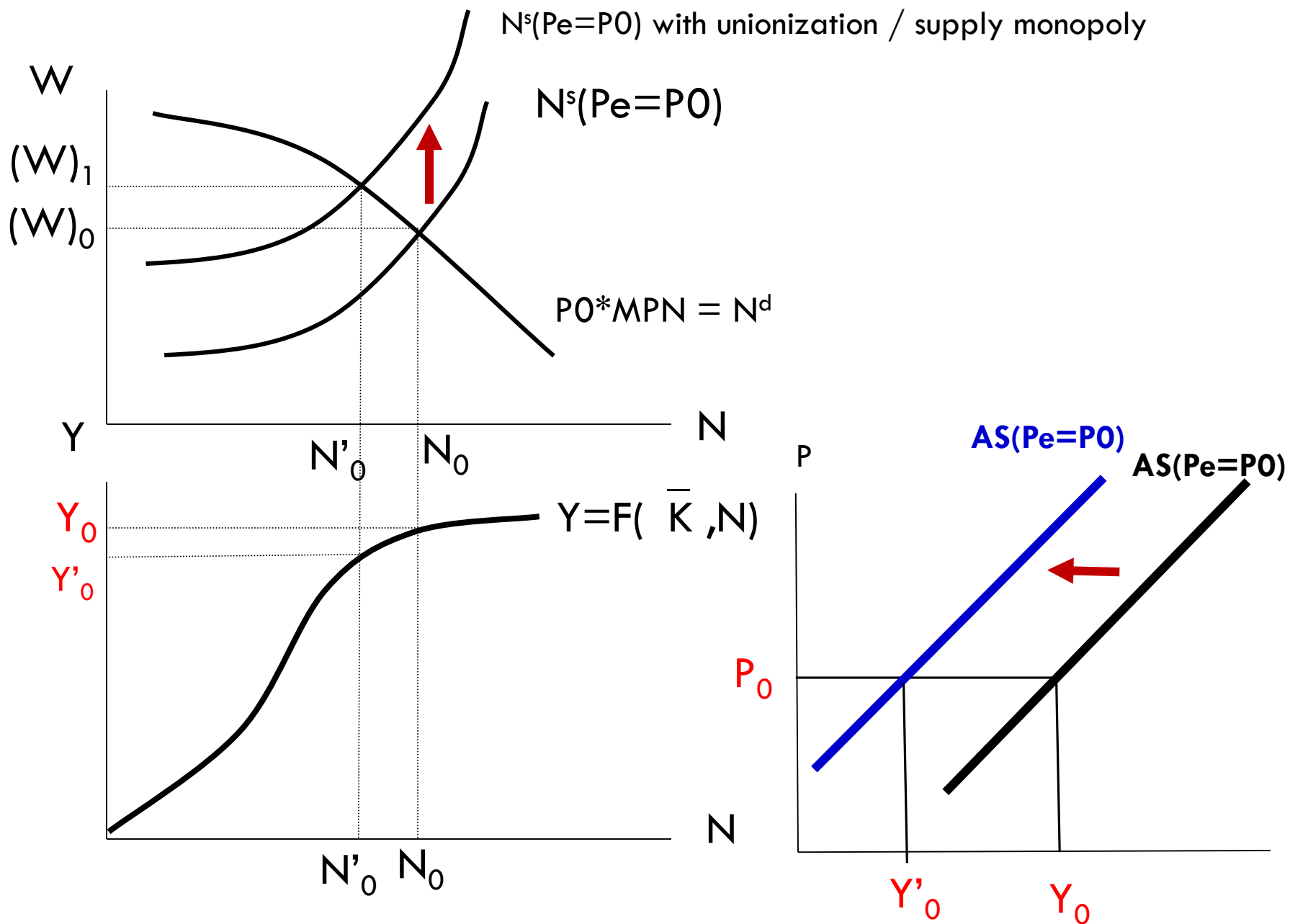
Example: Negative productivity shocks / Capital destruction



Example: Firm Monopoly power (mark-up power)

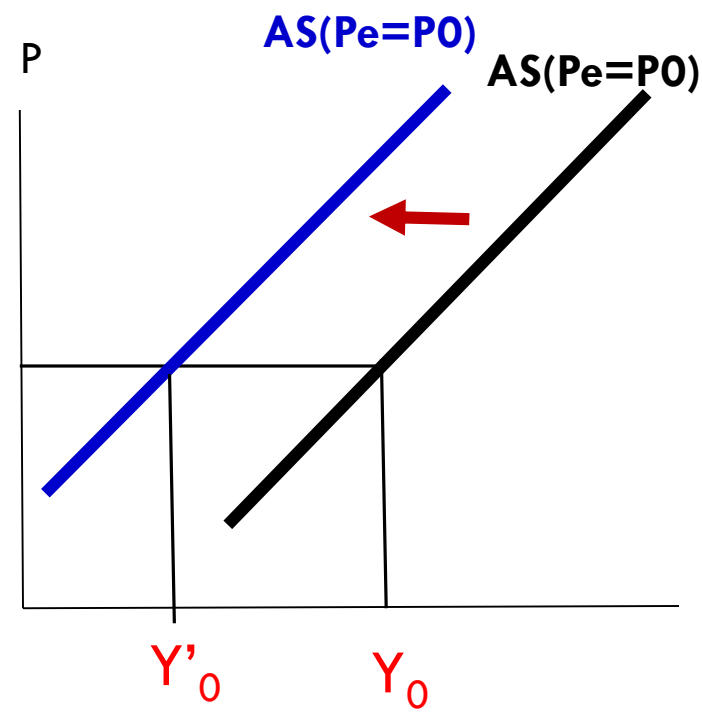
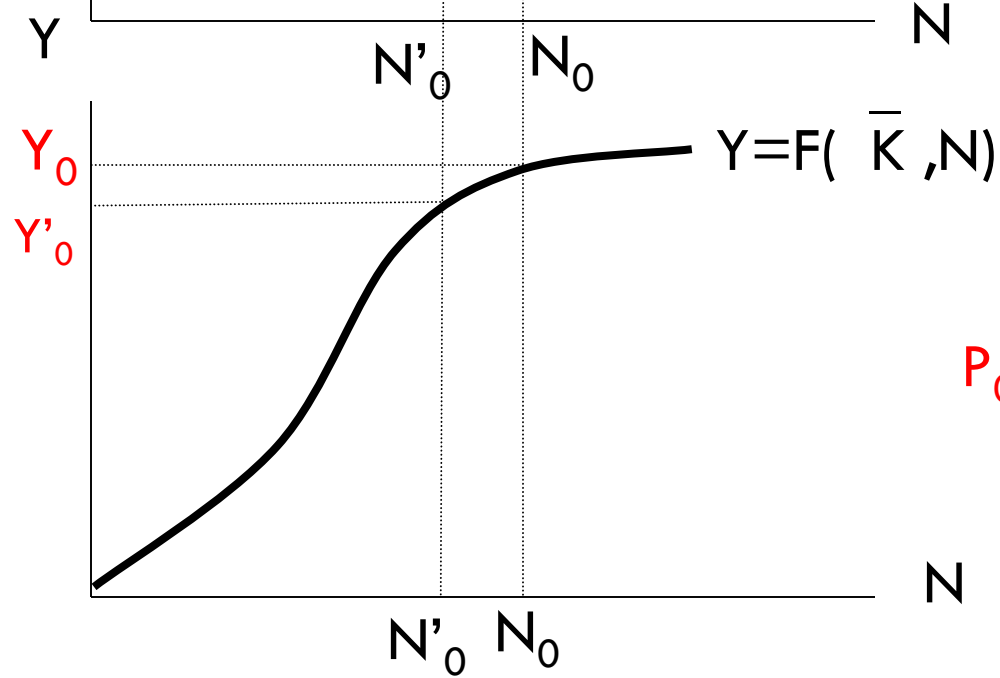
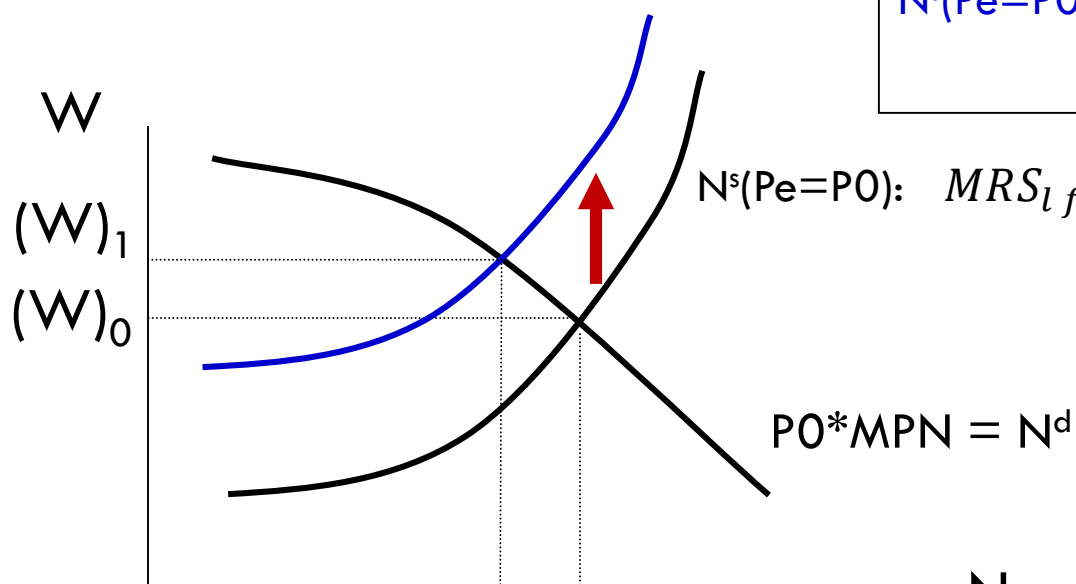


Example: Unionization



Example: Pay-roll tax

$$N^s(P_e=P_0): MRS_{l \text{ for } c} = \frac{W(1-t)}{P_e}$$



THE STICKY-PRICE MODEL

- Reasons for sticky prices:
 - long-term contracts between firms and customers
 - menu costs
 - firms not wishing to annoy customers with frequent price changes
- Assumption:
 - Firms set their own prices (*e.g.*, as with monopolies).

THE STICKY-PRICE MODEL

- An individual firm's desired price is

$$p = P + a(Y - \bar{Y})$$

where $a > 0$.

Suppose two types of firms:

- firms with flexible prices, set prices as above
- firms with sticky prices, must set their price before they know how P and Y will turn out:

$$p = P^e + a(Y^e - \bar{Y}^e)$$

THE STICKY-PRICE MODEL

$$p = P^e + a(Y^e - \bar{Y}^e)$$

- Assume sticky price firms expect that output will equal its natural rate. Then,

$$p = P^e$$

- To derive the aggregate supply curve, we first find an expression for the overall price level.
- Let s denote the fraction of firms with sticky prices. Then, we can write the overall price level as...

THE STICKY-PRICE MODEL

$$P = s P^e + (1 - s)[P + a(Y - \bar{Y})]$$

price set by sticky
price firms

price set by flexible
price firms

- Subtract $(1-s)P$ from both sides:

$$sP = s P^e + (1 - s)[a(Y - \bar{Y})]$$

- Divide both sides by s :

$$P = P^e + \left[\frac{(1 - s)a}{s} \right] (Y - \bar{Y})$$

THE STICKY-PRICE MODEL

$$P = P^e + \left[\frac{(1-s)a}{s} \right] (Y - \bar{Y})$$

- **High $P^e \Rightarrow$ High P**

If firms expect high prices, then firms that must set prices in advance will set them high.

Other firms respond by setting high prices.

- **High $Y \Rightarrow$ High P**

When income is high, the demand for goods is high. Firms with flexible prices set high prices.

The greater the fraction of flexible price firms, the smaller is s and the bigger is the effect of ΔY on P .

THE STICKY-PRICE MODEL

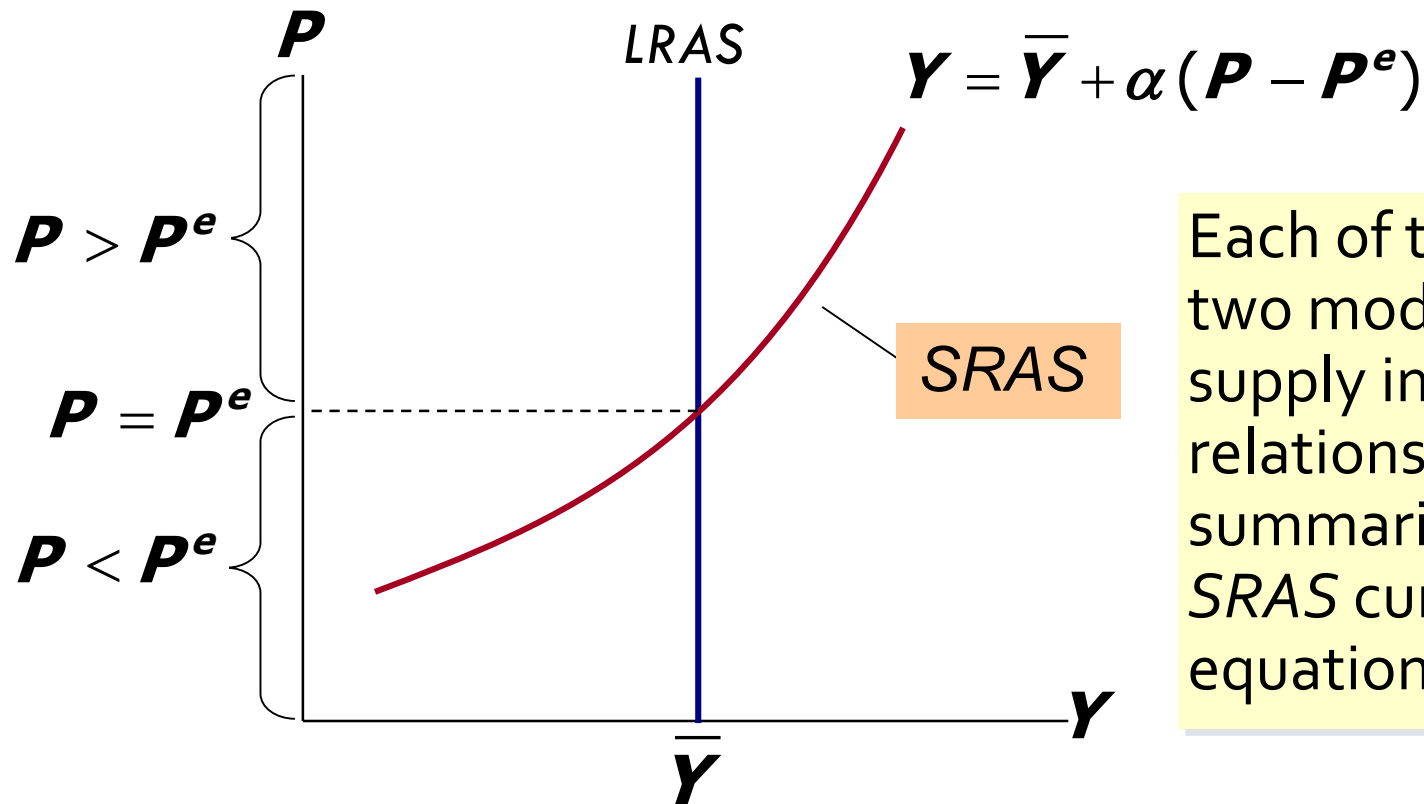
$$\mathbf{P} = \mathbf{P}^e + \left[\frac{(1 - \mathbf{s})\alpha}{\mathbf{s}} \right] (\mathbf{Y} - \bar{\mathbf{Y}})$$

- Finally, derive AS equation by solving for \mathbf{Y} :

$$\mathbf{Y} = \bar{\mathbf{Y}} + \alpha (\mathbf{P} - \mathbf{P}^e),$$

$$\text{where } \alpha = \frac{\mathbf{s}}{(1 - \mathbf{s})\alpha}$$

SHORT-RUN AS



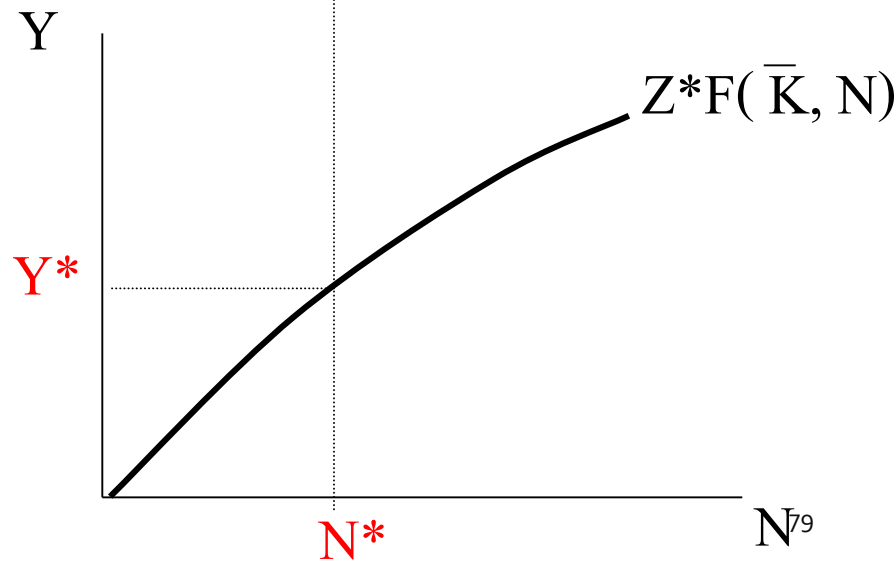
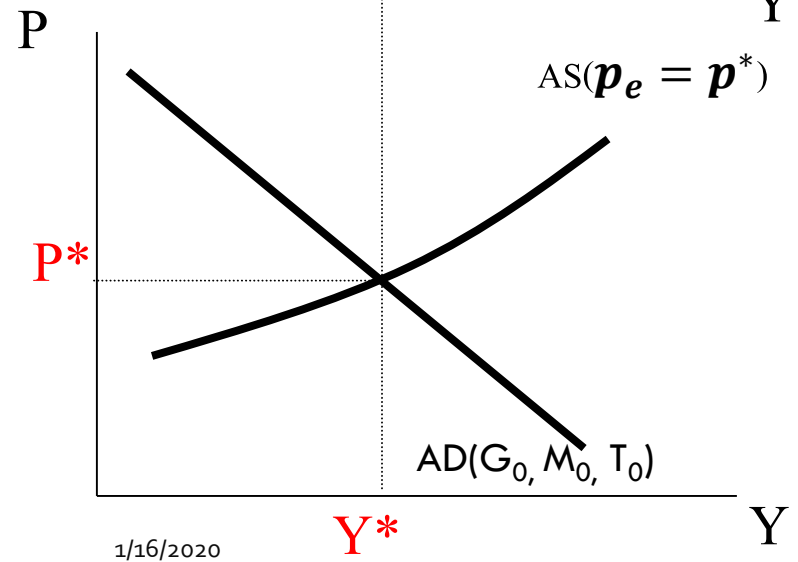
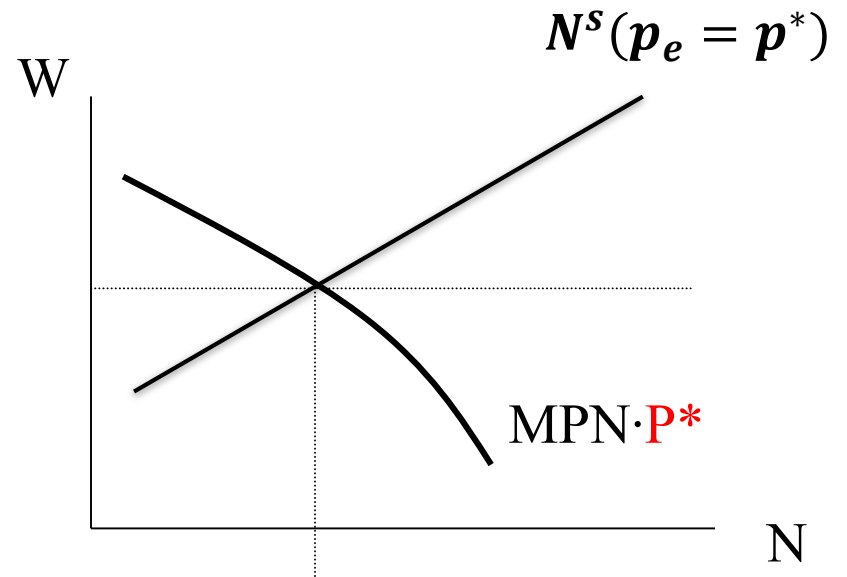
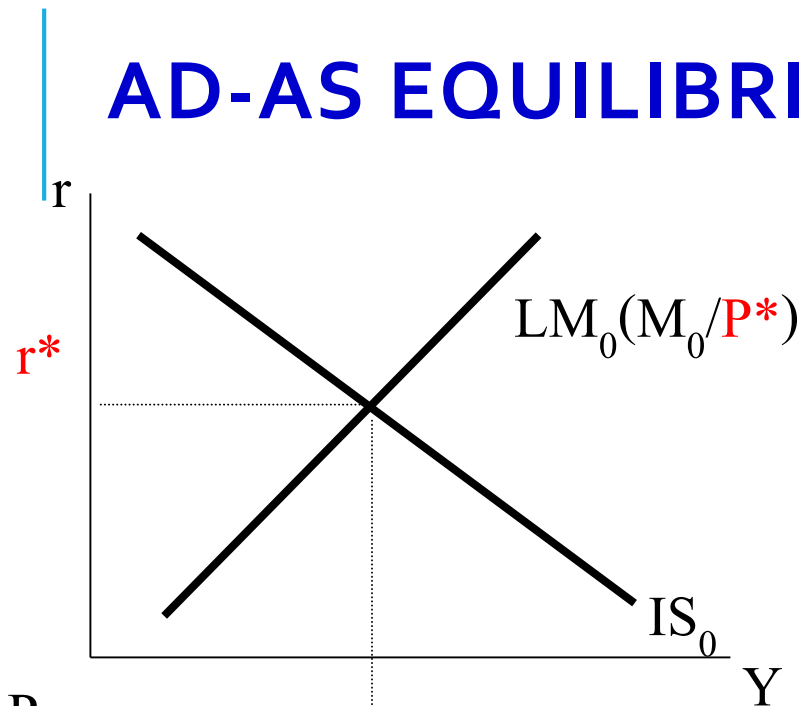
Each of the two models of agg. supply imply the relationship summarized by the $SRAS$ curve & equation.

AD-AS EQUILIBRIUM AND BUSINESS CYCLES

AD-AS EQUILIBRIUM

- Given the expected price, AD-AS equilibrium constitutes a set of variables, including output (y^*), price (P^*), interest rate (r^*), wage (w^*) and labor employment (N^*) that clear all the markets
- The equilibrium can be captured by **4 main figures**.
 - For simplicity, assuming that we use the sticky wage model

AD-AS EQUILIBRIUM



BUSINESS CYCLES FROM AD-AS PERSPECTIVE

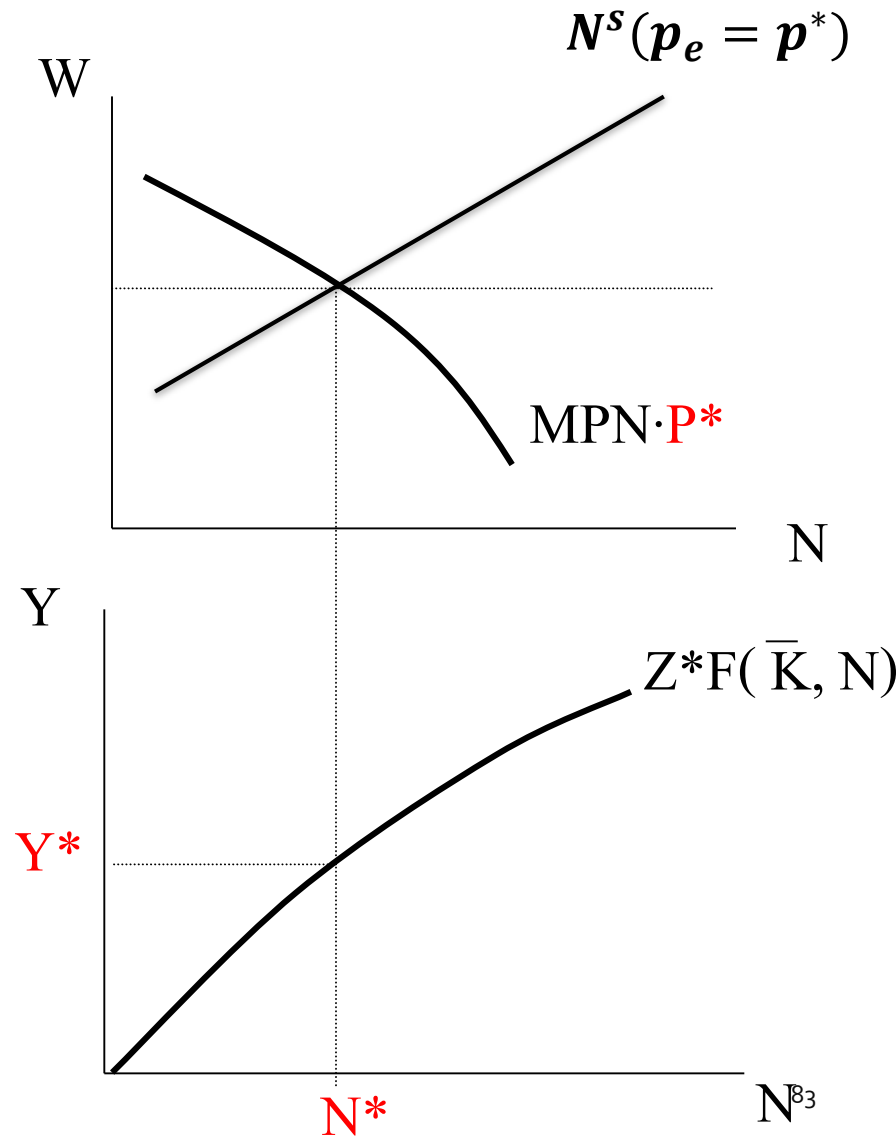
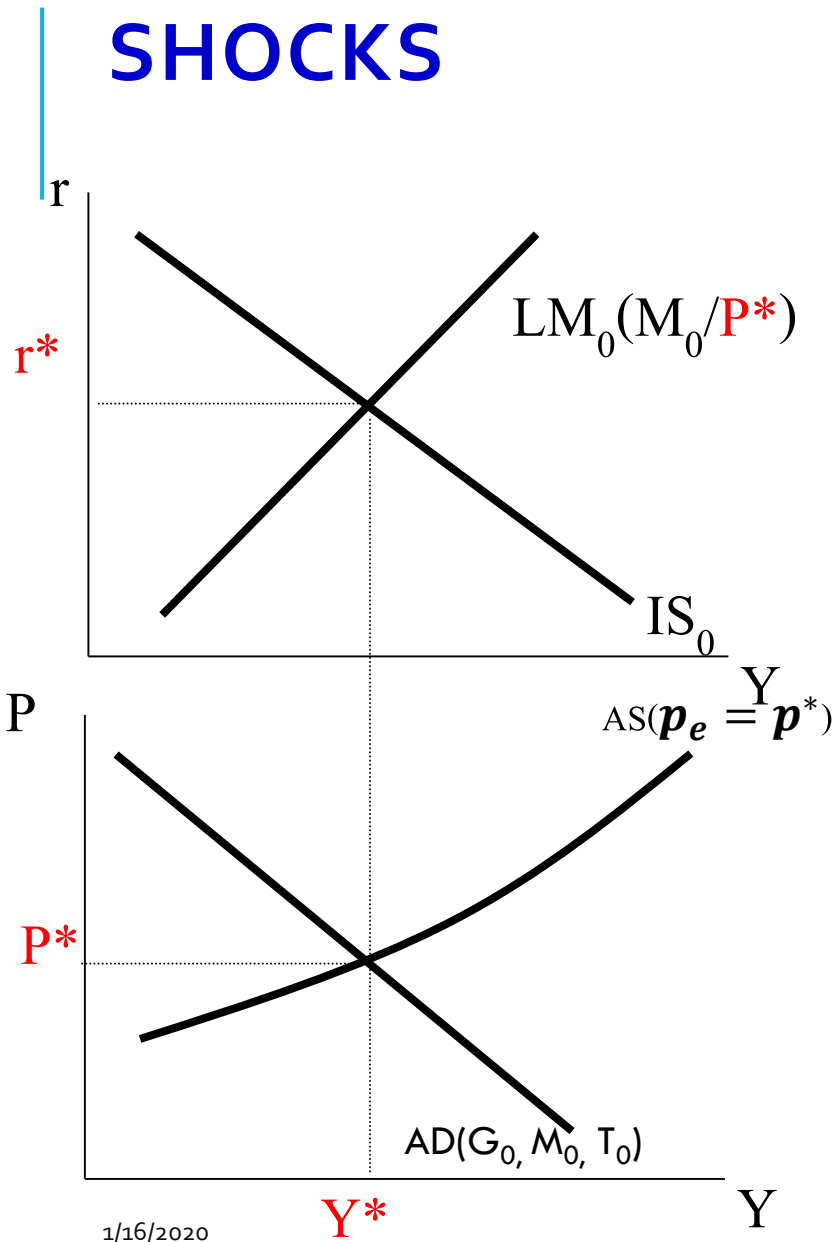
- Suppose we assume that Y^* is the potential level.
- The economy will deviate from Y^* if the economy is hit by **random shocks**.
- The AD-AS framework can shed lights on our understanding over (i) **the channel of transmission of shocks (shocks propagation)** and (ii) **the pattern/nature of business cycles (large/small)**

BUSINESS CYCLES FROM AD-AS PERSPECTIVE

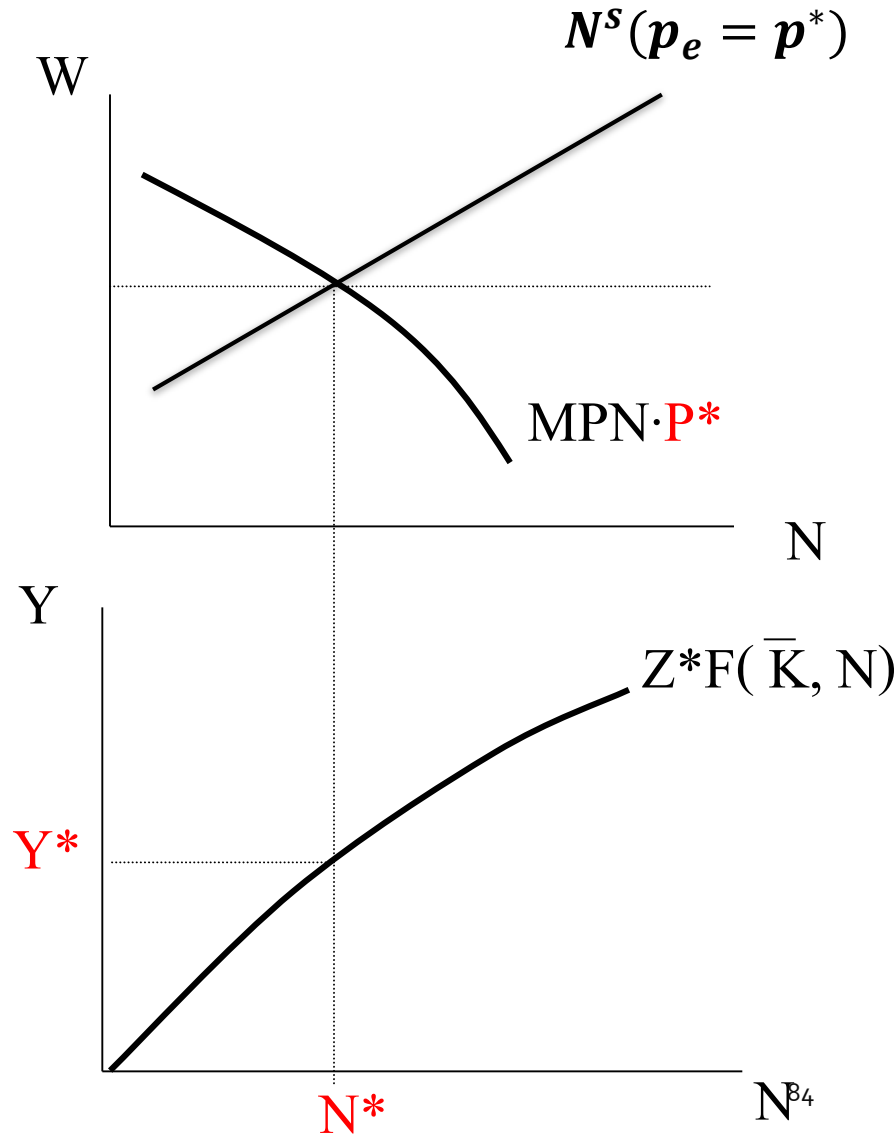
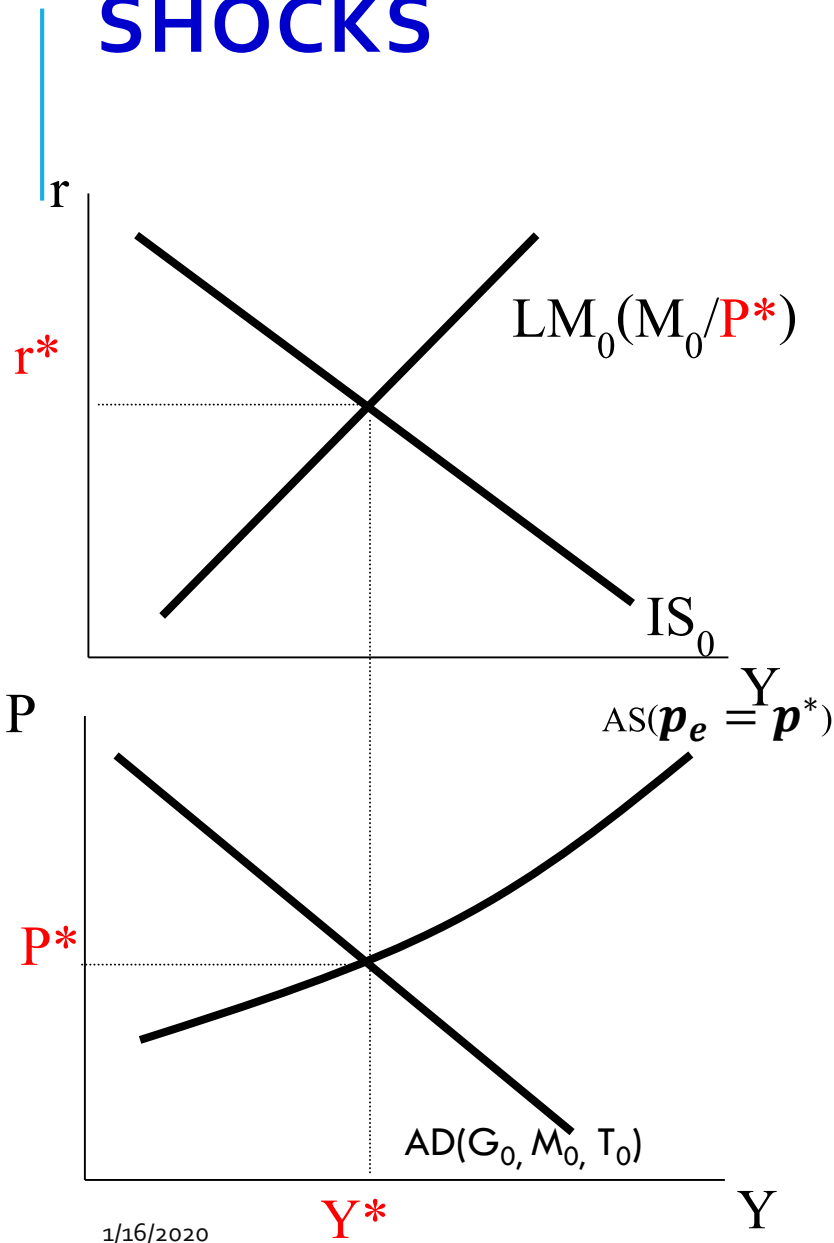
- In our framework, shocks can be classified into two types.
 - **AD shocks (IS – shocks or LM – Shocks)**
 - **AS shocks**
- The timeframe of the analysis can be divided into two horizon
 - **Short-run:** when shock hits and causes a deviation
 - **Medium-run:** when the economy adjusts and reverts to the long-run potential level

SHORT-RUN FLUCTUATIONS

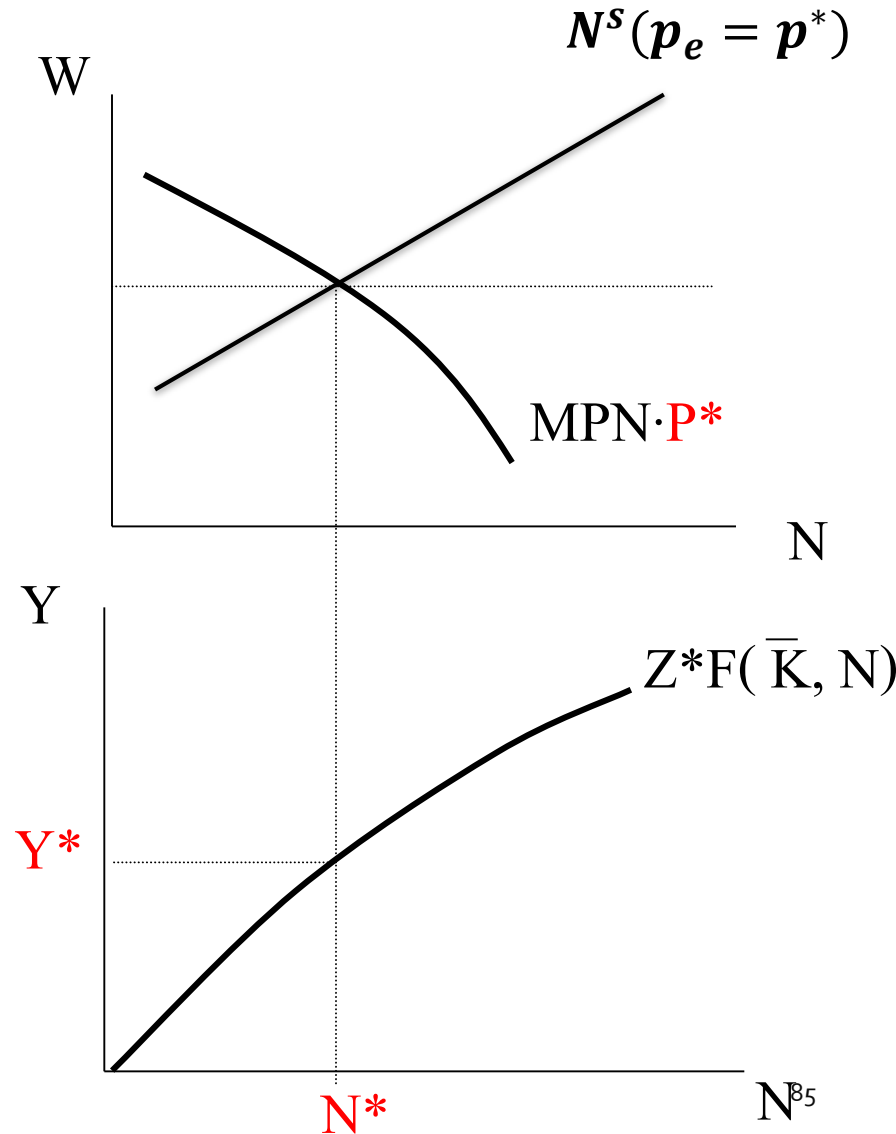
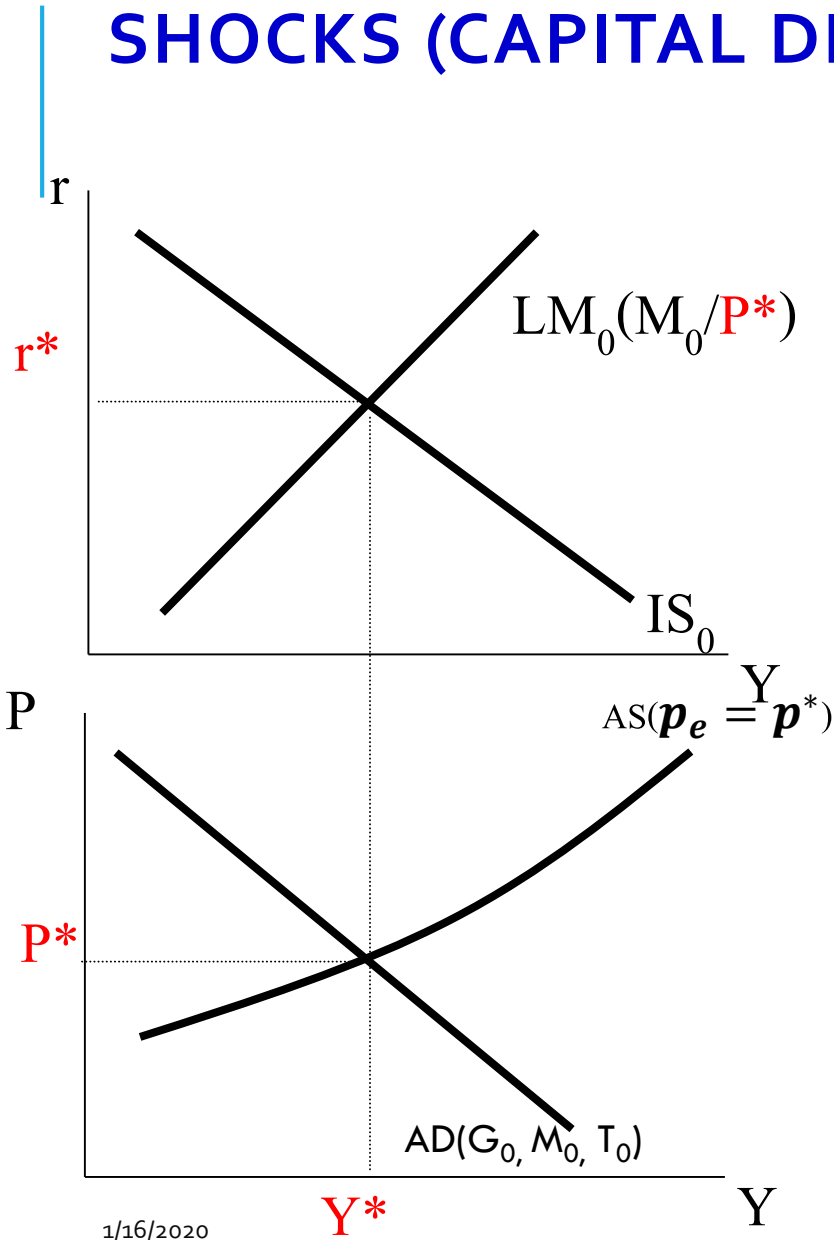
AD-AS EQUILIBRIUM: NEGATIVE IS SHOCKS



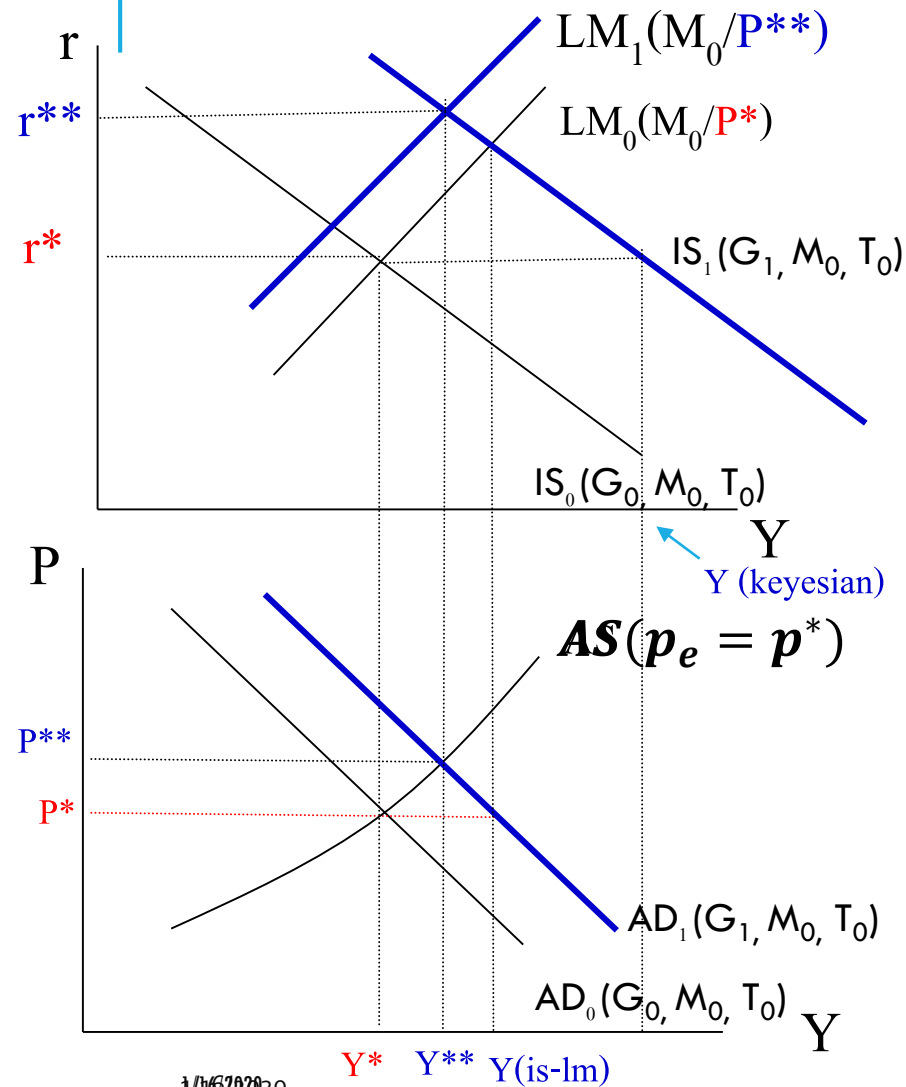
AD-AS EQUILIBRIUM: POSITIVE LM SHOCKS



AD-AS EQUILIBRIUM: NEGATIVE SUPPLY SHOCKS (CAPITAL DESTRUCTION)



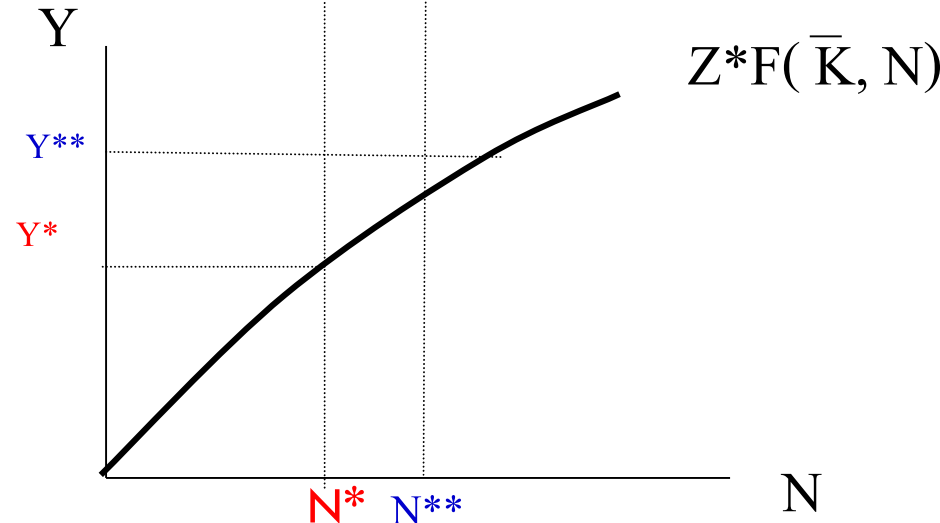
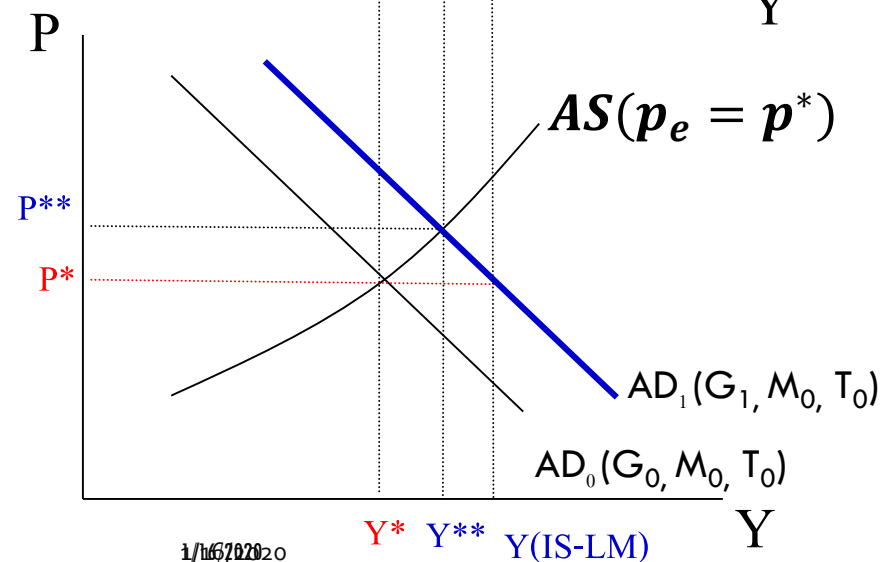
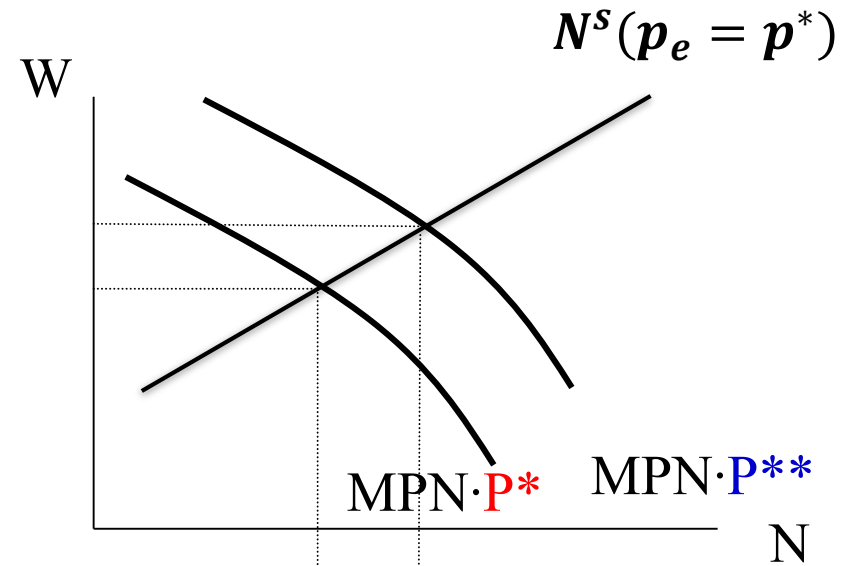
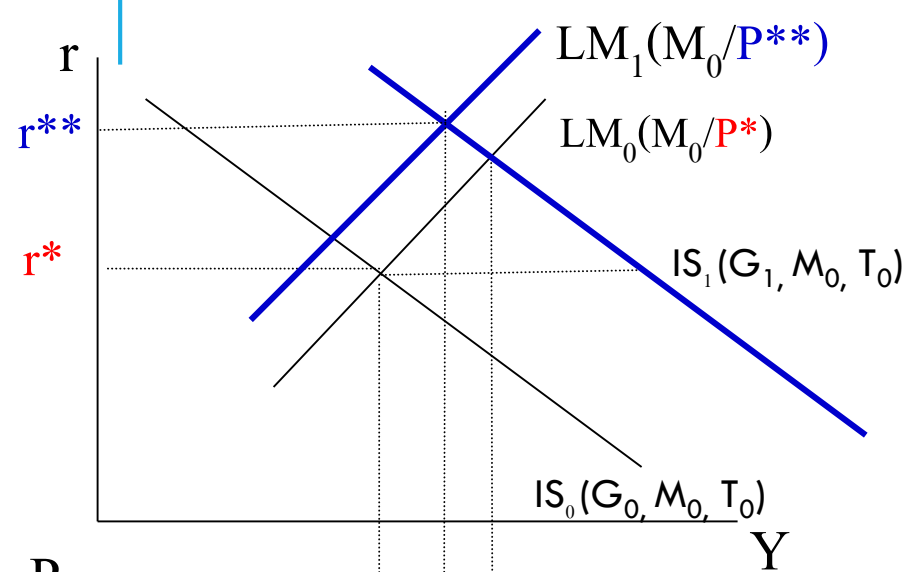
EQUILIBRIUM ANALYSIS: FISCAL POLICY



Mechanisms of Fiscal policy

1. Suppose price fixed equal to P^* .
2. $G_0 \rightarrow G_1$; IS_0 curve shifted to IS_1 .
3. AD_0 shift to AD_1 . (Horizontal shift?)
4. At P^* , we have excess demand; price starts to rise from P^* to P^{**} .
5. Rising price offsets the initial impact of "G" as it tends to push up the market interest rate; this is called the **price effect**.

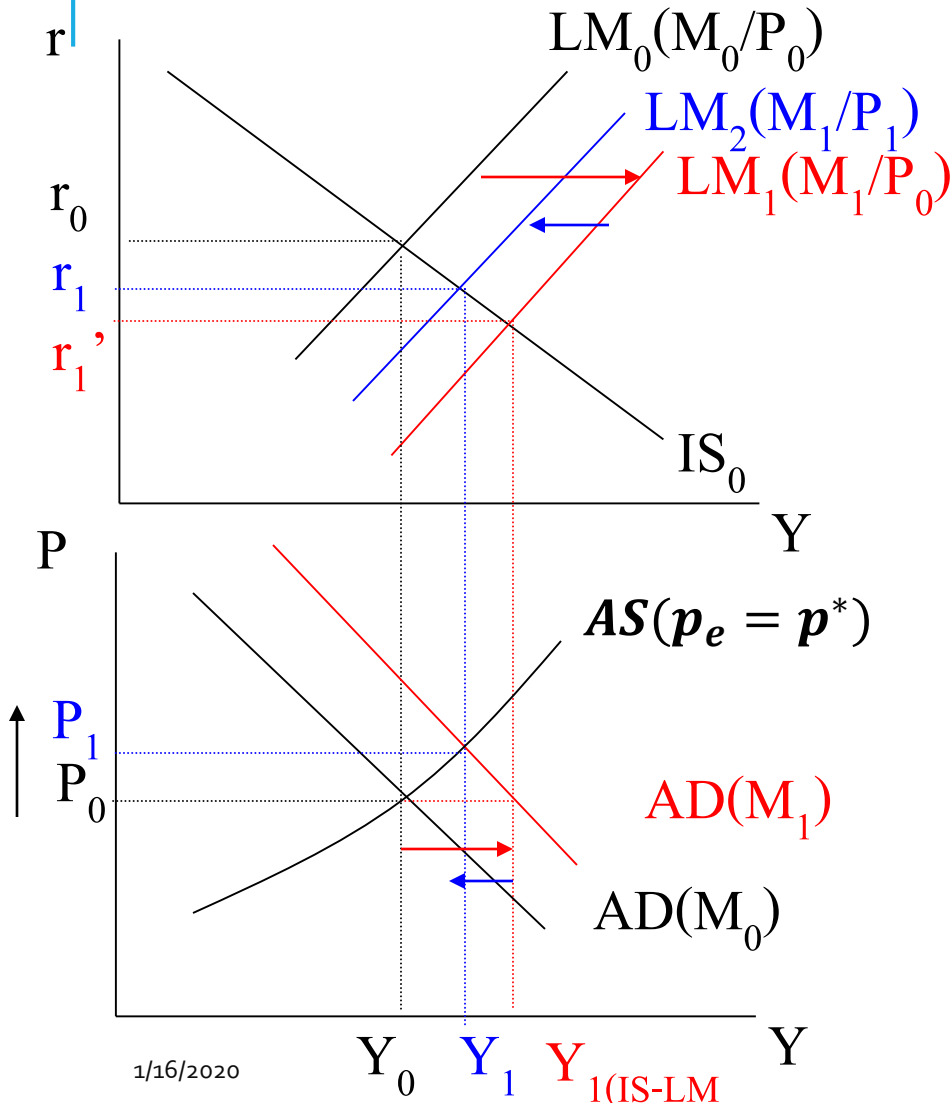
EQUILIBRIUM ANALYSIS: FISCAL POLICY



FISCAL MULTIPLIERS

Multipliers	Scenario
Traditional multiplier	Typical Keynesian cross Fixing “r” and “p”
IS-LM multiplier	r endogenously adjusted. Crowding-out effect; However, price remains fixed
AD-AS multiplier	Price changes along with the state of excess demand and excess supply.

EQUILIBRIUM ANALYSIS: MONETARY POLICY



Mechanisms of Monetary policy

- Increase nominal money supply ($M_0 \rightarrow M_1$): LM shifts right.
- At P_0 , AD shift right.
- At P_0 , we have excess demand; price must be rising. It rises to P_1 .
- This causes the LM curve to shift left because real money supply decreases.
- The effect on Y is smaller than the effect under IS-LM model.

MEDIUM-RUN ADJUSTMENT AND SELF-CORRECTING MECHANISM

MEDIUM-RUN ADJUSTMENT

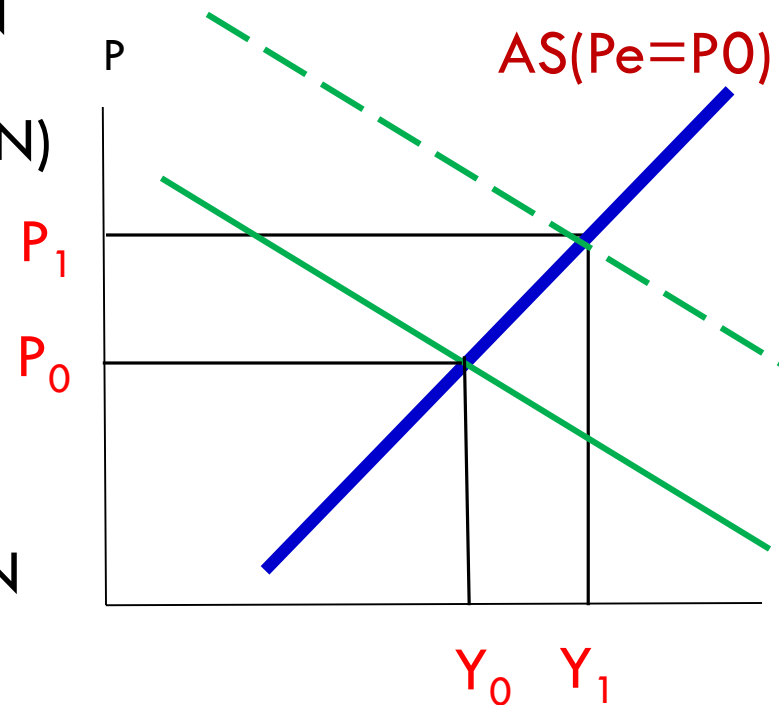
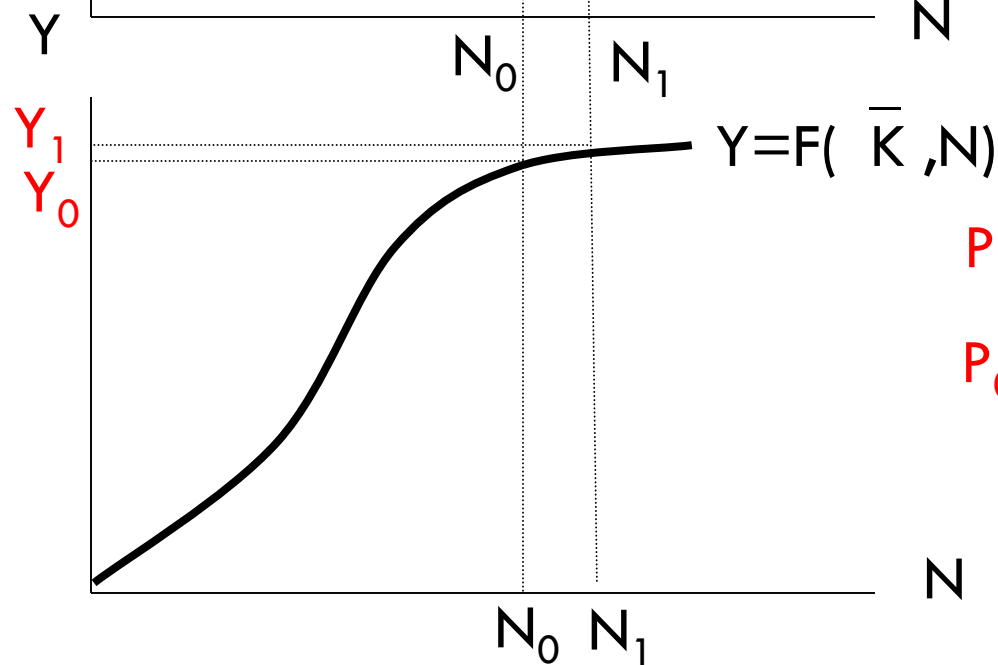
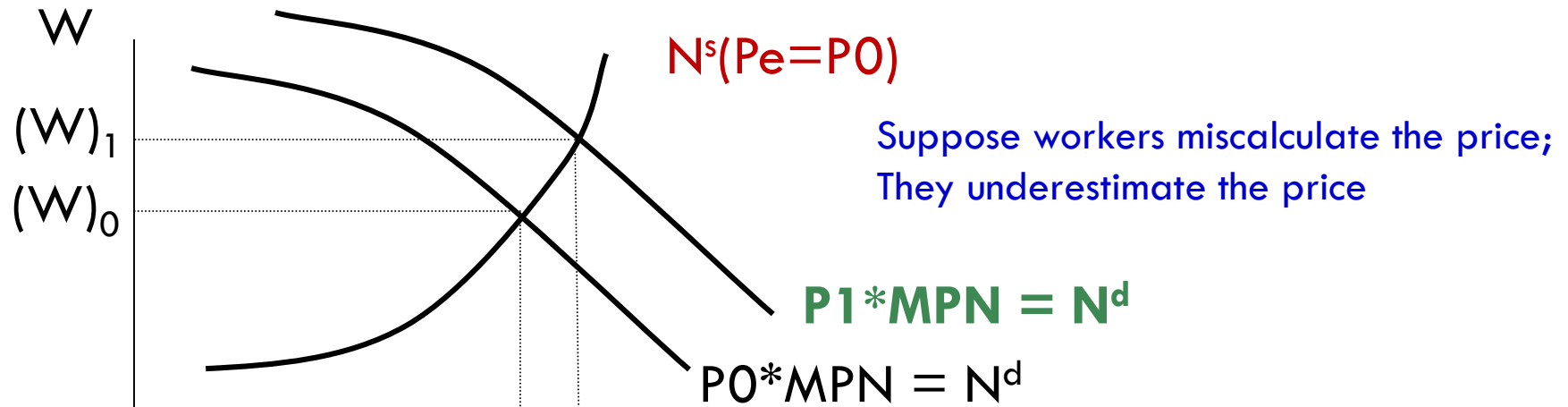
- The effect of shocks die down; **as times pass by the economy reverts to the long-term trend, i.e. potential level**
- Output gap becomes zero again!
- Economists refer this process as the **medium-run adjustment** or **self-correcting mechanism**

THE SELF-CORRECT MECHANISM IN STICKY WAGE MODEL

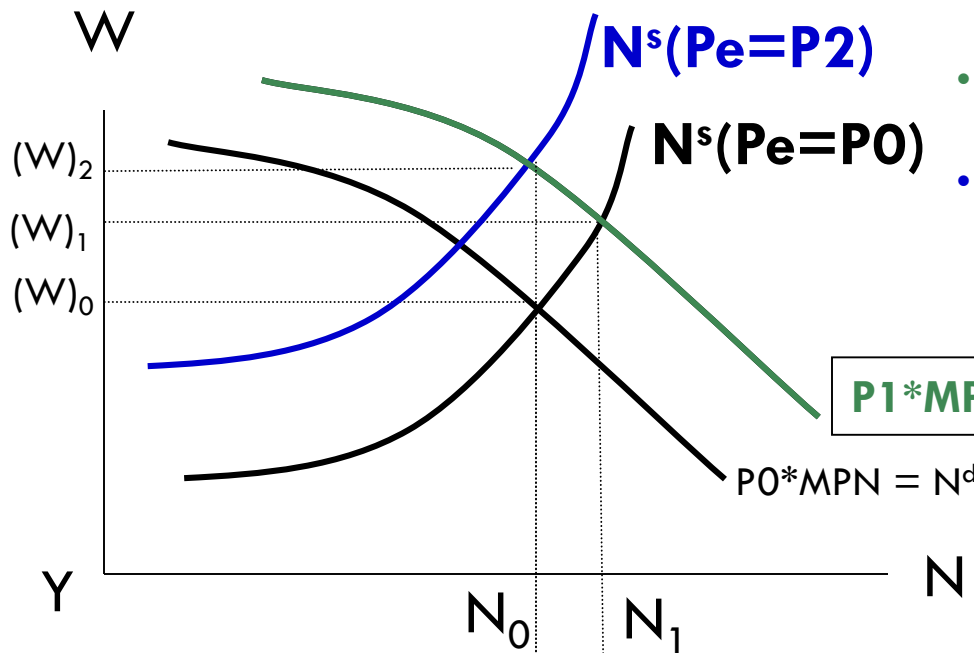
□ Self-correcting mechanism

- Labor market will adjust to the imbalance that is generated by error in the price expectation
- **Workers renegotiate for higher wage because they previously underestimated the actual price**
- Contraction in labor supply, and hence a rise wage, would cut the production as the cost of production increases
- **Natural rate or potential level can be restored with the medium-term adjustment process**

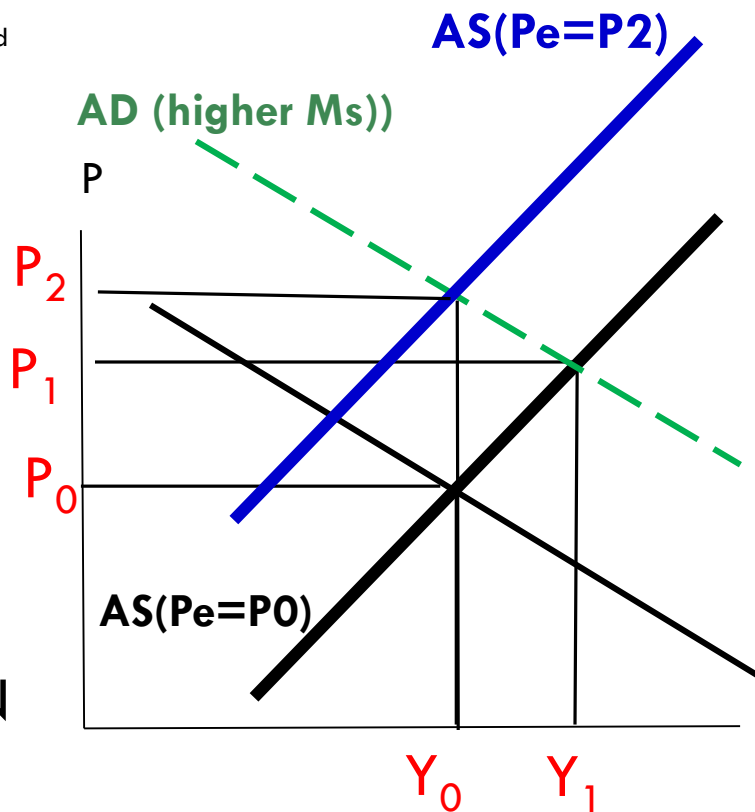
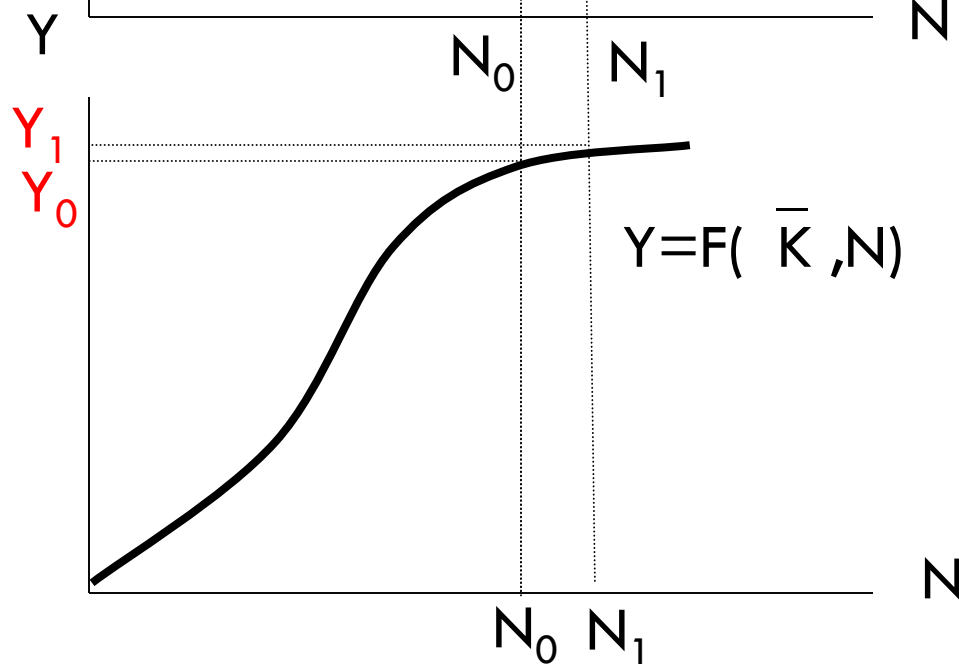
Expectation-driven Aggregate Supply and Effect of demand shock



Expectation-driven Aggregate Supply and Effect of demand shock



- As workers miscalculated the price; they underestimated the price.
- Once the time has come, they re-negotiate for a new wage that is consistent with correctly expected price



MEDIUM-RUN ADJUSTMENT: ISSUES

- How long does it take time for the self-correction?
- Economists propose two different versions of adjustments
 - **Swift adjustment:** Fast trend-reversion
 - Commonly known New Classical or Classical business cycles economist
 - No policy needed!
 - **Gradual adjustment:** Slowly trend-reverting with gradual changes
 - Commonly known as Keynesian or New Keynesian business cycles economist
 - Policy might be welfare-improving!

MICRO EVIDENCES ON PRICE SETTINGS KLENOW AND MALIN (2010)

Price Durations by Category in the U.S. CPI

Durations in Months	Posted		Regular		% of CPI
	Median	Mean	Median	Mean	
<i>All Items</i>	3.4	6.2	6.9	8.0	100.0%
Durable Goods	1.8	3.0	1.8	5.0	21.7
Nondurable Goods	3.4	5.8	7.3	8.3	48.6
Services	7.6	9.4	7.6	9.6	29.7
Raw Goods	1.0	1.1	1.0	1.2	12.0
Processed Goods	4.4	6.9	7.7	8.9	88.0
Apparel	2.8	2.9	9.2	10.1	7.0
Education and Communication	5.4	6.2	6.7	6.3	7.3
Food	3.4	6.9	8.5	9.3	22.4
Home Furnishings	1.9	3.5	2.0	5.4	17.0
Medical Care	10.0	14.2	12.6	14.7	7.8
Recreation	6.3	7.5	9.4	9.8	8.5
Transportation	1.8	3.7	1.8	3.8	24.5
Other Goods and Services	8.6	14.7	12.1	16.7	5.5

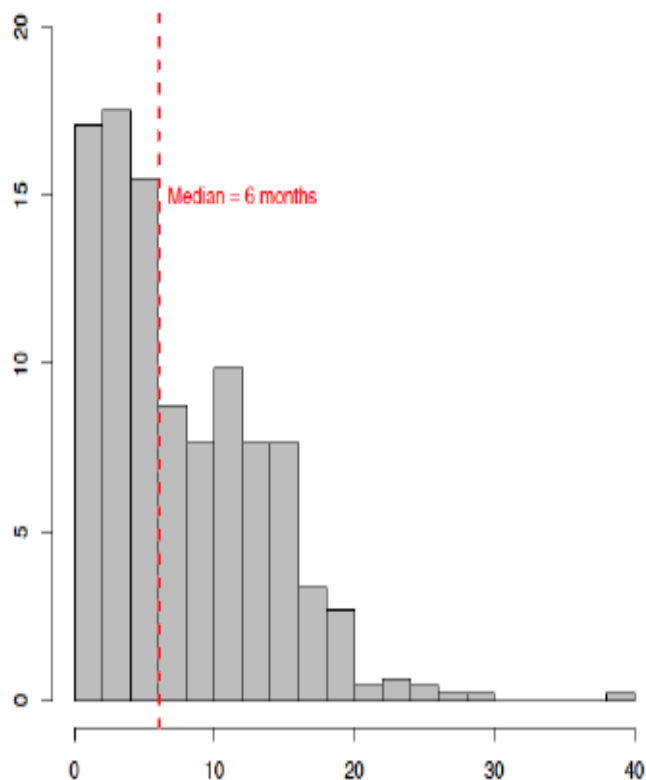
1. In each sector, each firm cannot adjust their price at the same time!
2. *Duration of price stickiness varies across sectors. (finer disaggregate details)*
3. Sectoral price rigidities is academically referred to *“unsynchronized adjustment of products within and across sector”*

Source: CPI-RDB. Data are for the top three cities (New York, Los Angeles, and Chicago) from February 1988 through October 2009. Durations are weighted medians or means of implied durations from weighted average frequencies within ELIs. Durables, Nondurables, and Services coincide with U.S. National Income and Product Account classifications. Raw goods include gasoline, motor oil and coolants, fuel oil and other fuels, electricity, natural gas, meats, fish, eggs, fresh fruits, fresh vegetables, and fresh milk and cream. Apparel, etc. are Major Groups in the CPI (1998-onward definition).

MICRO EVIDENCES ON PRICE SETTINGS

APHAITHAN AND PYM (2018)

Distribution of the duration of price changes



Category	Mean Frequency	Implied Mean Duration (months)	Mean Duration (months)
Food & Non-Alcoholic Beverages	0.23	3.91	5.47
Apparel & Footware	0.03	29.37	13.85
Housing & Furnishing	0.13	7.37	6.57
Medical & Personal Care	0.07	13.03	10.10
Transportation & Communication	0.29	2.86	7.25
Recreation & Education	0.04	22.88	8.79
Tobacco & Alcoholic Beverages	0.11	8.70	7.17
Total CPI	0.20	4.40	7.04

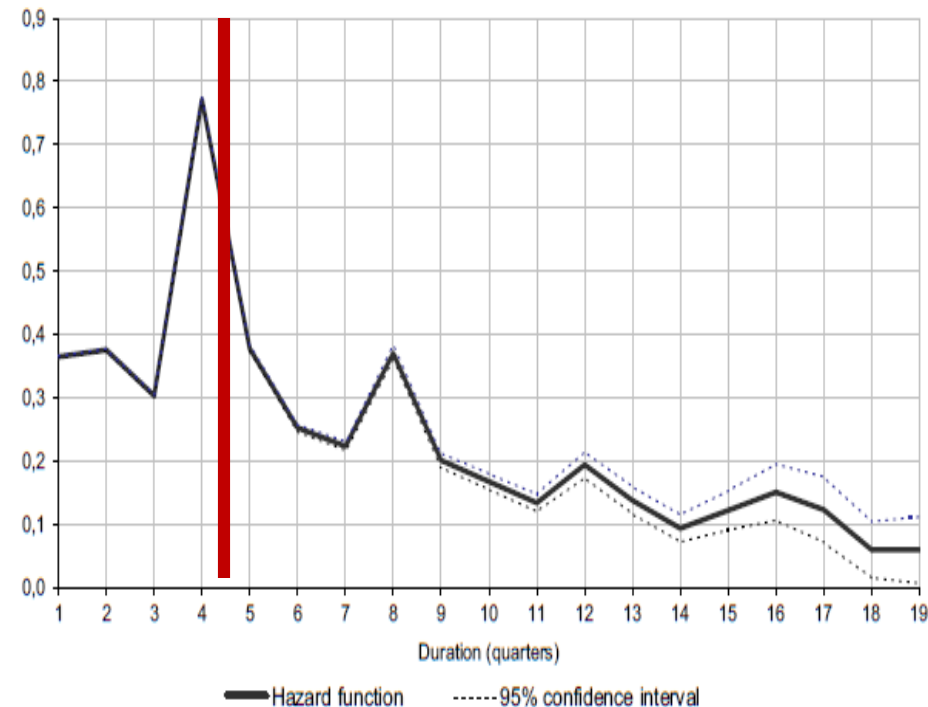
Sector	Mean Frequency	Implied Mean Duration (months)	Mean Duration (months)
Core	0.06	15.13	9.16
Non-core	0.50	1.44	2.50
Control	0.34	2.45	5.28
Non-Control	0.12	7.60	8.10
Service	0.06	16.88	9.72
Non-Service	0.26	3.38	6.07
Durables	0.07	14.38	8.43
Non-Durables	0.22	4.03	6.87
Total CPI	0.20	4.40	7.04

Nominal rigidities: Wage setting

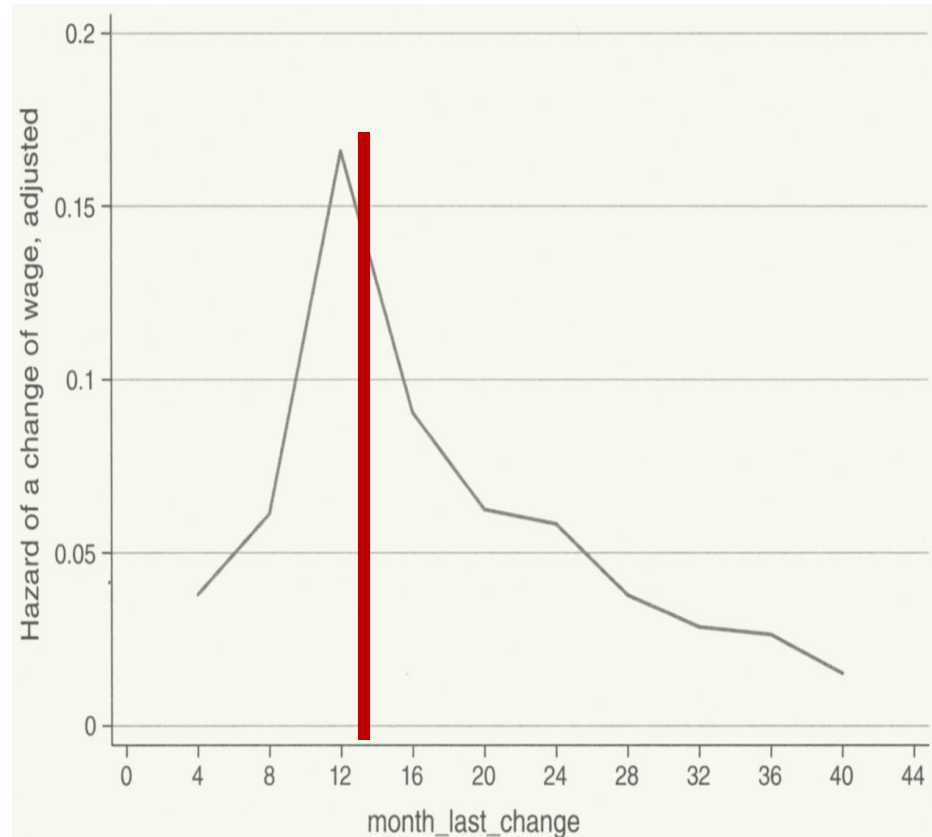
There appears to be many clear evidences that wage lasts longer than price; *wage appears to be changed on the yearly basis*

USA

Figure 2 : Hazard function of wage changes



EUROPEAN



IMPLICATION FOR STAGGERED PRICES ADJUSTMENT

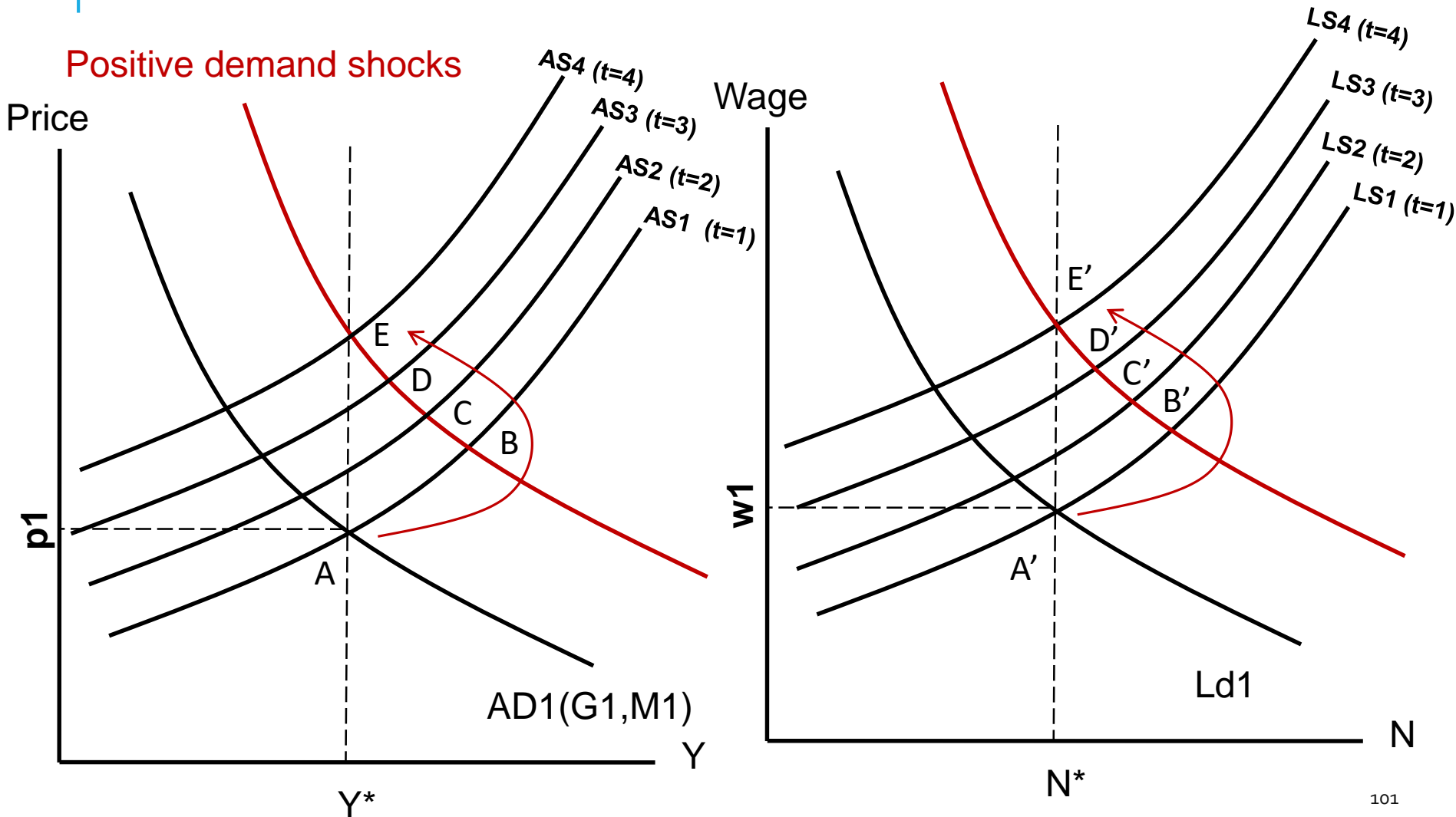
- For an illustrative purpose, consider 4 types of firms with different speed of price adjustment
 - Firms 1: gasoline station (fastest)
 - Firms 2: Logistic company
 - Firms 3: Electronic product
 - Firms 4: Service goods (hair cut / noodle restaurant) (Slowest)
- Suppose that worker for each type of firm can adjust wage at the same time as their firms adjust price.
 - Things would be profound if we assume different degree!

FOUNDATION OF NKES AS CURVE

1. Upward sloping Aggregate **SUPPLY** in goods
 - Many individual firms might have flat supply curve at each point of time.
 - A fraction of firms can adjust the price; individual supply for price-adjusting firm will be upward sloping!.
 - By aggregation, output should increase with the general price level.

2. The similar intuition applies to upward sloping of Aggregate supply in labor.

IMPLICATIONS OF NOMINAL PRICE / WAGE RIGIDITY: INTUITIONS FOR STAGGERING ADJUSTMENT (OR INERTIA IMPACTS)



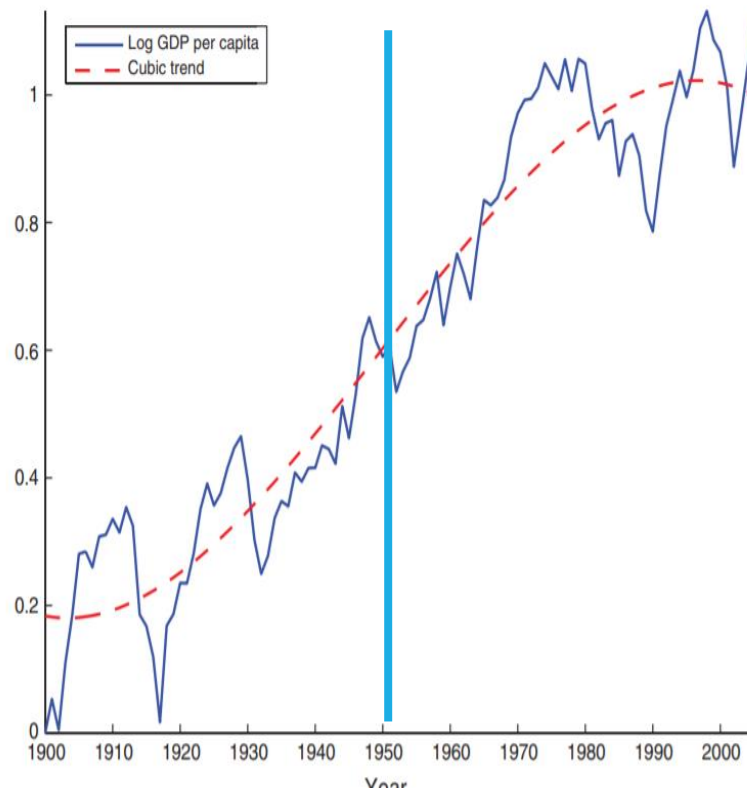
CASE DISCUSSION 2: WHICH VERSION IS RIGHT?

- How can we justify the model?
- **Swift adjustment** → Assumption does not fall in line with realities...
- **Gradual adjustment** → Assumption does fall in line with realities... **But Using correct assumptions imply empirical validity?**

CASE DISCUSSION 3 : DIFFERENCE BETWEEN BUSINESS CYCLES IN ADVANCED AND EMERGING MARKET

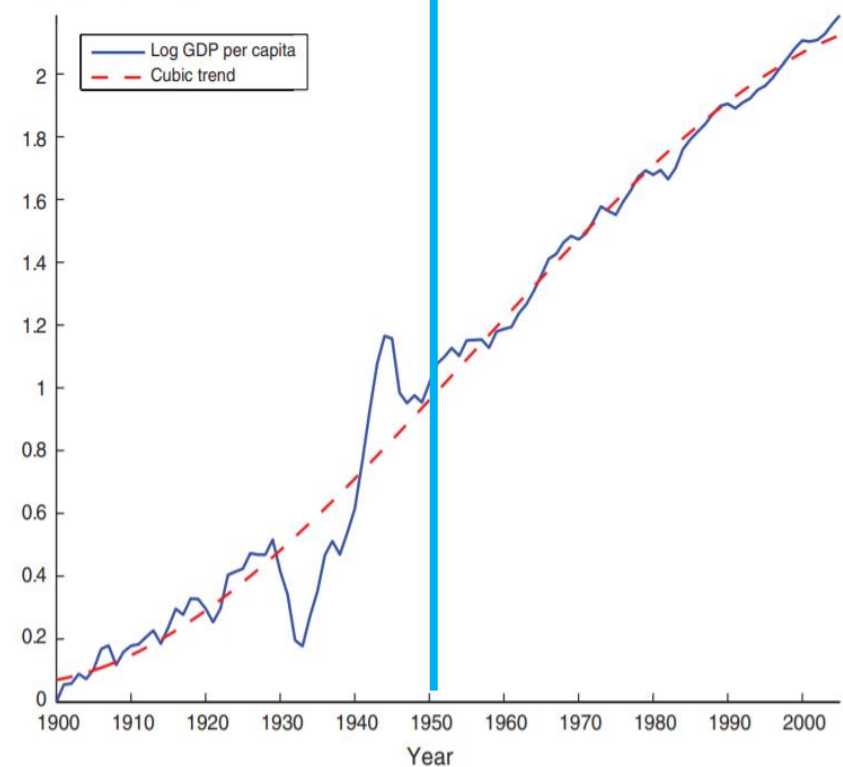
Panel A. Argentina

1950s

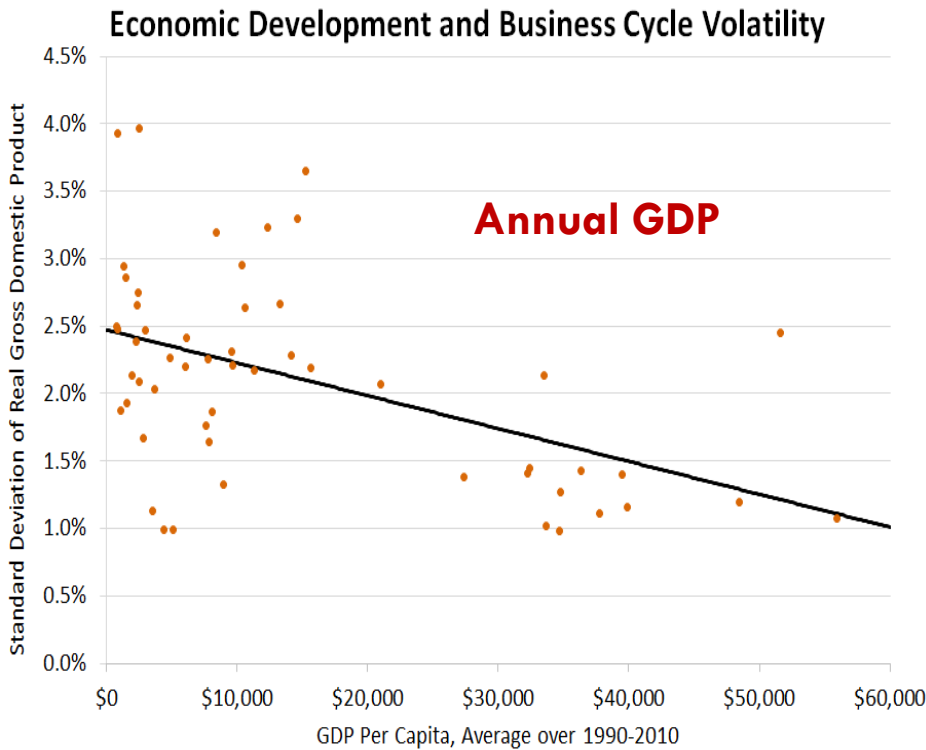


Panel B. United States

1950s



CASE DISCUSSION 2 : DIFFERENCE BETWEEN BUSINESS CYCLES IN ADVANCED AND EMERGING MARKET



SOURCE: World Bank's World Development Indicators.

FEDERAL RESERVE BANK of ST. LOUIS

Excess Volatility of Poor and Emerging Countries

Business-Cycle Statistic	Emerging	Rich
σ_y	8.7%	3.3%

Quarterly GDP

What could possibly explain these differences?

HOW WELL DOES THE AD-AS MODEL EXPLAIN DATA?

ACCOUNTING SOME STYLIZED FEATURES IN DATA IN MACROECONOMY WITH MODEL

- **Long-term view**
 - 1. Long-term growth (positive; output growing over time.)
 - 2. Inflation rate is positive (around 2% p.a. after 2001)
- **Short-term view**
 - 1. Output growing more in some periods; choppy fluctuations.
 - 2. Inflation is sometimes higher or lower than the long-term trend (the 2% after 2001)

STYLIZED FEATURES IN DATA IN MACROECONOMY

Question: How can we explain/reconcile all these with in the AD-AS model. How to put all these stories together in the language of AD-AS model?

ACCOUNTING FOR THE LONG-TERM GROWTH

Think about AD and AS growing over time.

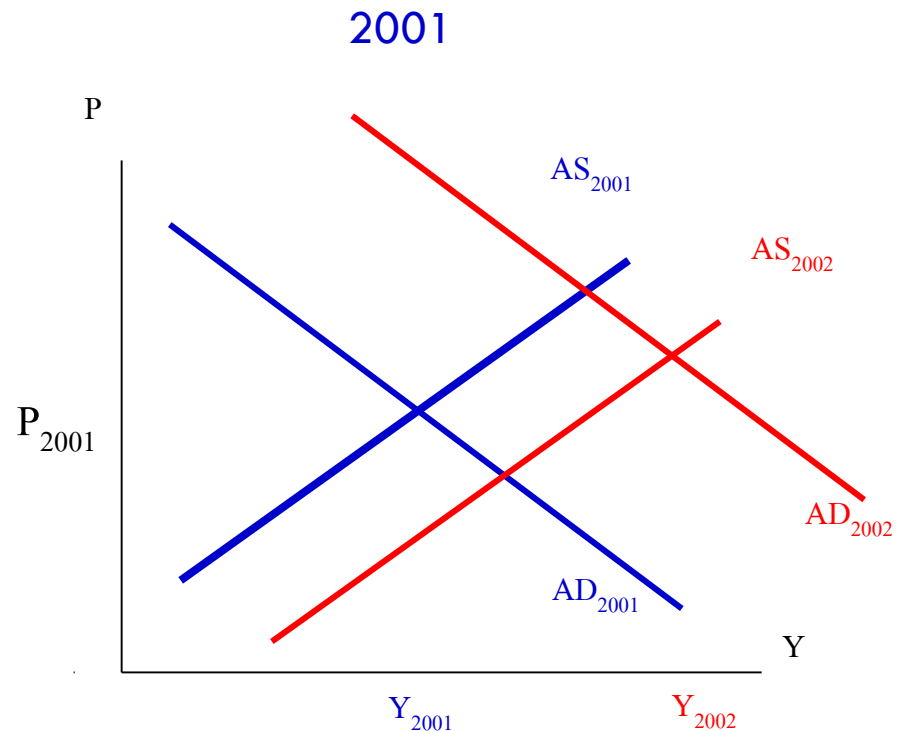
Example:

- Money supply grows over time;
Government spending grows over time.

-The level of technology improvement grows over time.

Account for positive inflation;

Demand-side factor might need to be growing faster than supply-side factor?



ACCOUNTING FOR THE CYCLES

- Then, how does the cycles occur?
 - The cycle occurs because AD and AS might be growing **more or less** than the rate required to ensure $x\%$ output growth – e.g., potential growth.
 - These deviations usually come at surprise; people call and treat them as **shocks/disturbances**.
- AD curve → **Demand shocks**
 - IS shocks: private spending shocks, animal spirits, etc.
 - LM shocks: financial panic, financial innovations, etc.
- AS curve → **Supply shocks**

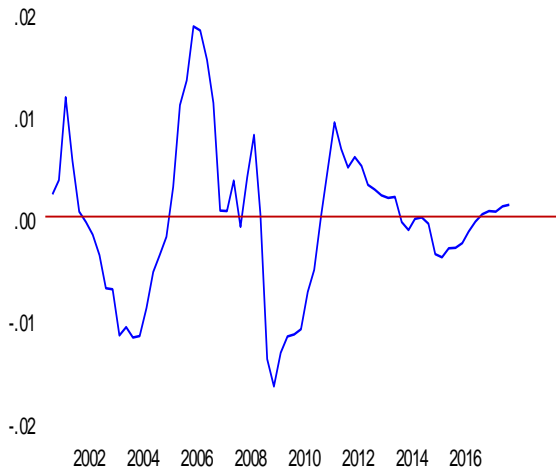
HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

- Compare model's prediction and Real-world data.
- **Qualitatively** assesses the fitness of the model!
- Then, what do we see in the data?

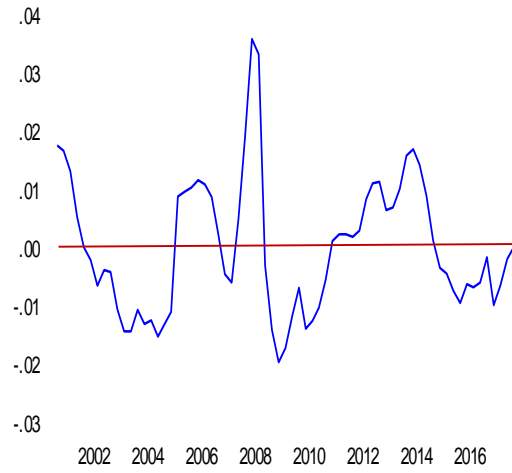
HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

- **Data:**
 - Real-GDP / Consumption / Private investment
 - Interest rates: 1-year government bond.
 - Real wage: average wage adjusted by headline CPI.
 - Price: headline CPI
- **Treatment:**
 - Detrend / Calculate: "Cyclical variations"
 - Compute pair-wise correlation.

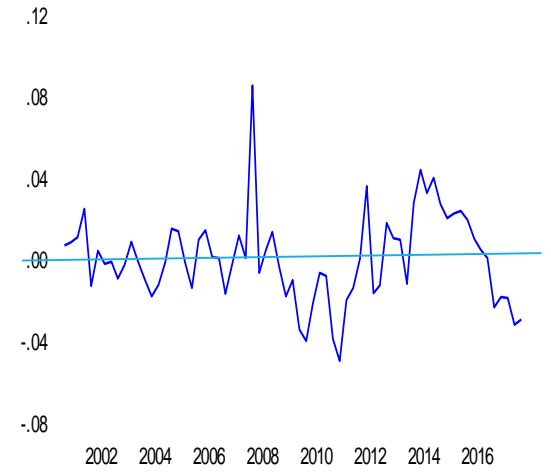
GOVT_BOND_1YR_CYC/100



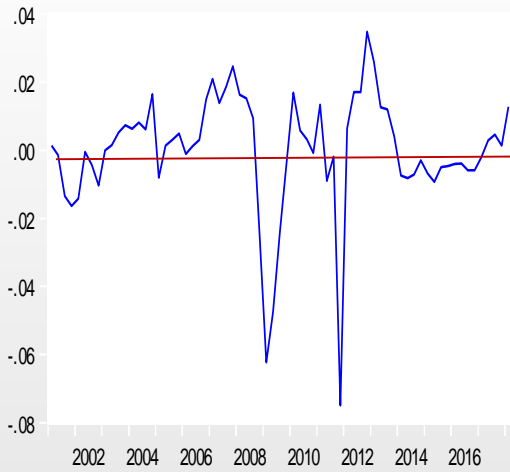
HL_CPI_CYC



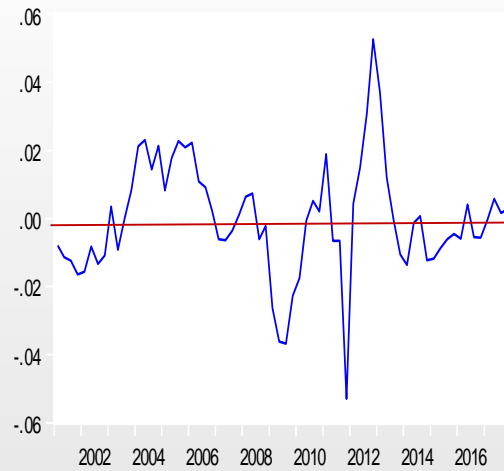
REAL_WAGE_CYC



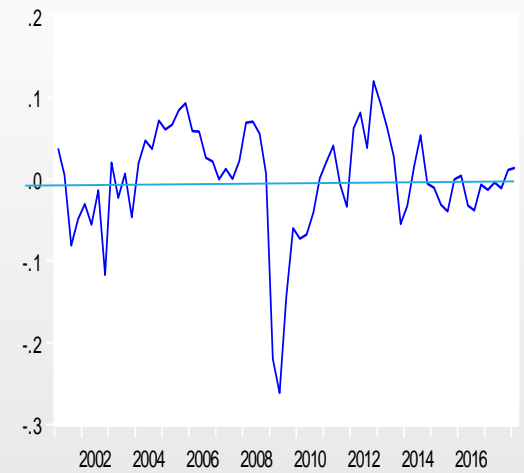
RGDP_CYC



RPC_CYC



RPI_CYC



HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

Covariance Analysis: Ordinary
 Date: 08/27/18 Time: 16:16
 Sample: 2001Q1 2018Q1
 Included observations: 69

Correlation Probability	GOVT BON...	HL CPI CYC	REAL WAG...	RGDP CYC	RPC CYC	RPI CYC
GOVT_BOND_1Y...	1.000000 ----					
HL_CPI_CYC	0.687204 0.0000	1.000000				
REAL_WAGE_CYC	0.134363 0.2710	0.340238 0.0042	1.000000 ----			
RGDP_CYC	0.217482 0.0726	0.240540 0.0465	0.003125 0.9797	1.000000 ----		
RPC_CYC	0.218555 0.0712	0.160057 0.1889	0.025904 0.8327	0.720238 0.0000	1.000000 ----	
RPI_CYC	0.490877 0.0000	0.454588 0.0001	0.191887 0.1142	0.644726 0.0000	0.740333 0.0000	1.000000 ----

Correlation statistic

Probability; Significant

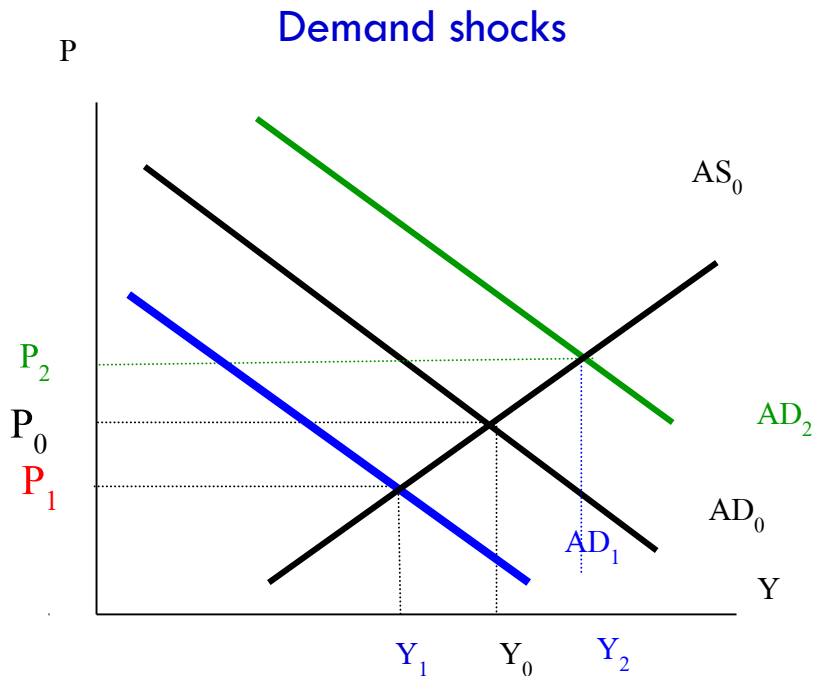
HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

- Since 2001, data suggests that aggregate variables are *procyclical*.
 - Price, interest rate and measures of real economic activities positively move together
- Real-wage might be an only exception – e.g. *weakly procyclical* (*statistically acyclical*).

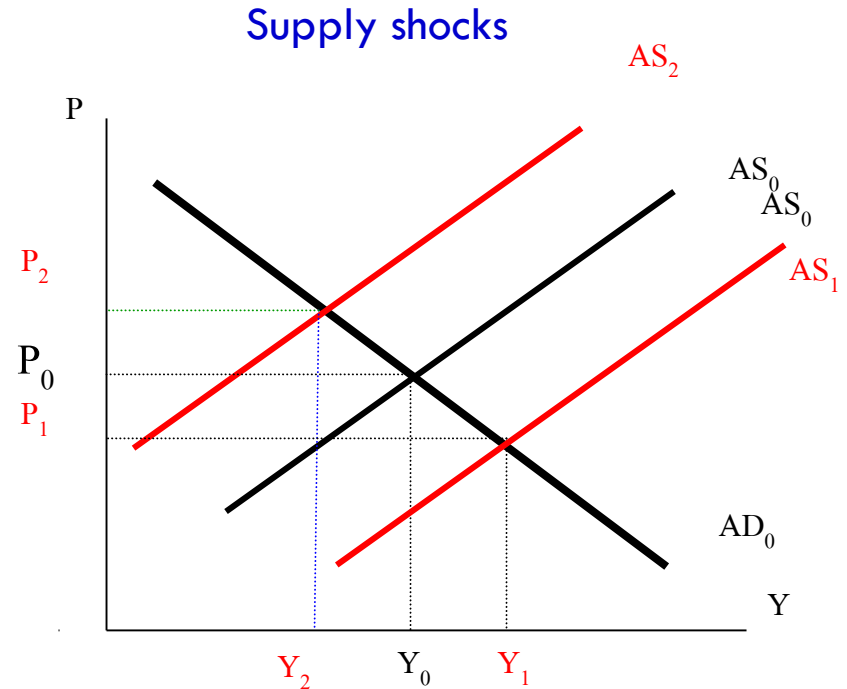
DATA V.S. MODEL: TESTABLE IMPLICATIONS

- Can the AD-AS model account for these stylized facts?
 - If you believe that your AD-AS story is right, the answer is *yes*.
 - But a better question to ask is, if one is to explain the business cycles using AD-AS, what types of factor/shock drive our business cycles?

SUPPLY V.S. DEMAND SHOCKS: IMPLICATION



Positive correlation: output and inflation



Negative correlation: output and inflation

DATA V.S. MODEL: TESTABLE IMPLICATIONS

- The two shocks offer different **conditional comovement pattern** in the AD-AS model.
- However, in lights of the evidence that we found, it's more reasonable to argue that the economy is ***pre-dominantly driven by demand shocks!***
 - Note this doesn't mean the supply factor is not important; it merely states that demand factors dominate the supply factors.