INTERMEDIATE MACROECONOMICS

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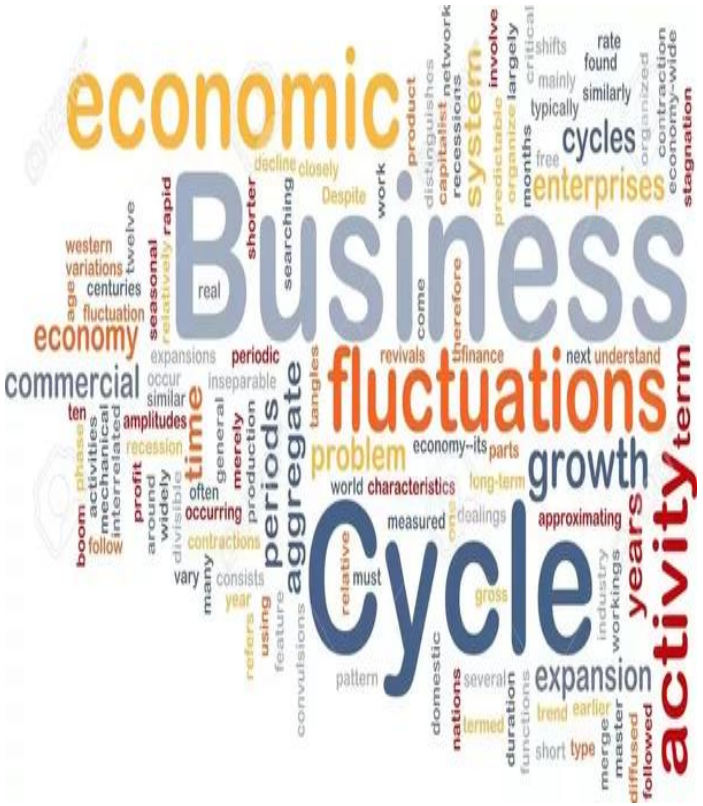
AGENDA



- Keynesian business cycle studies
- **Core Keynesian model: AD-AS model**
  - IS-LM-AD curve
  - **AS curve**
- Equilibrium analysis and propagation of shocks
- Fiscal and monetary policy analysis
- How does the Keynesian AD-AS model fit the facts?

AGGREGATE SUPPLY: FOUNDATION

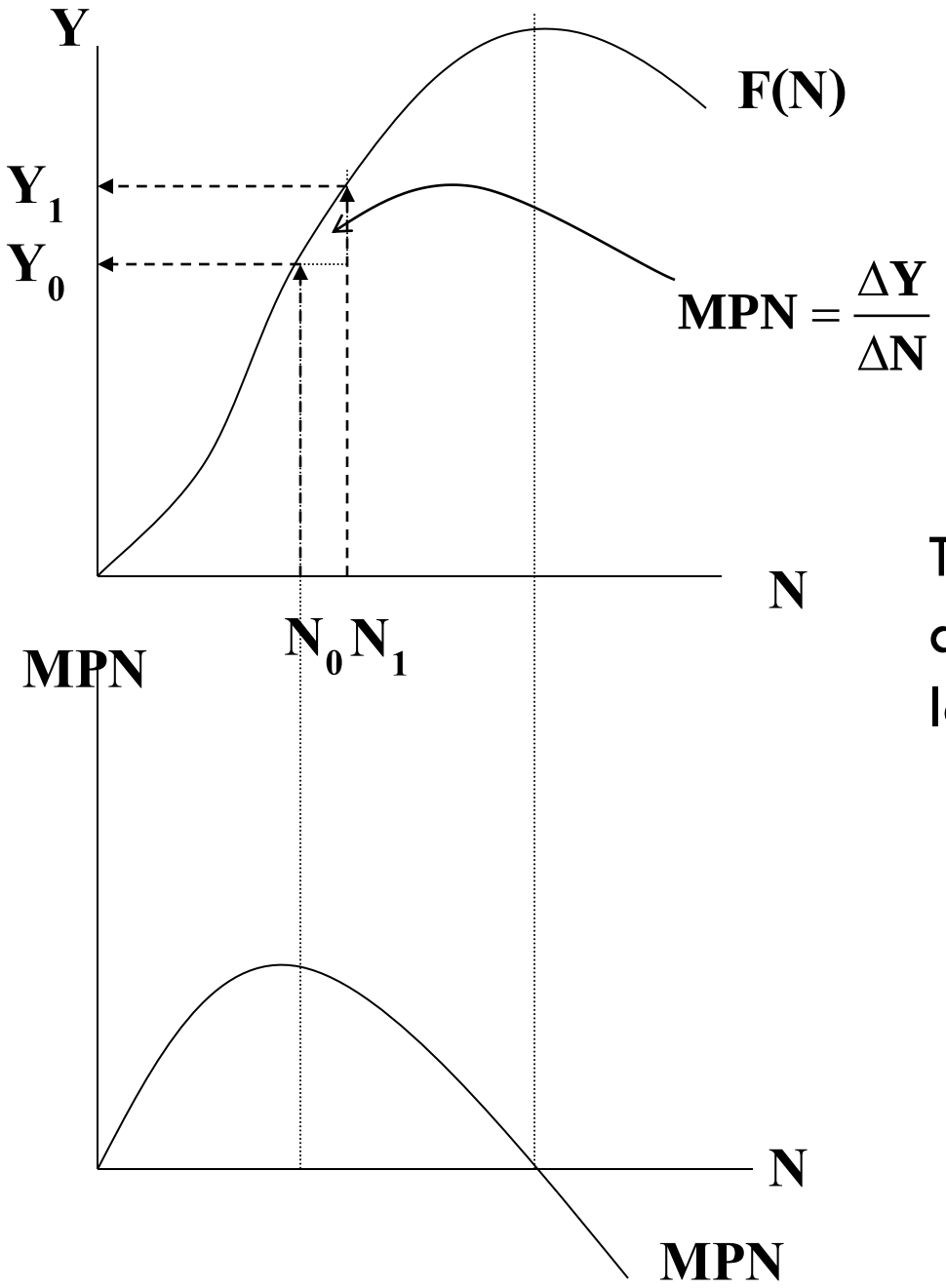
- This section provides a foundation for the theory of aggregate supply.
- Aggregate supply is the theory that describes the relationship between "price" and "*(aggregate)* amount of the output produced by firms".
- The foundation of AS theory can be derived from micro-founded individual supply theory.
- Understanding AS requires your priori understanding on production function and optimal labor input decision.

AGGREGATE SUPPLY: FOUNDATION

- What does the firm do?
  - Firm is a production unit; transform inputs into outputs using production technology that they have.
- Production technology is usually denoted by concept of the production function.

$$Y = F(K, N) \text{ where } K = \text{Capital and } N = \text{labor hired}$$

- In the short-run, K is fixed, i.e. $Y = F(\overline{K}, N)$.
  - Firm's production depends on the amount of labor hired/employed.



- Law of diminishing marginal productivity
- Marginal Product of Labor: MPN

Total output supply depends on the number of labor employment

Labor market

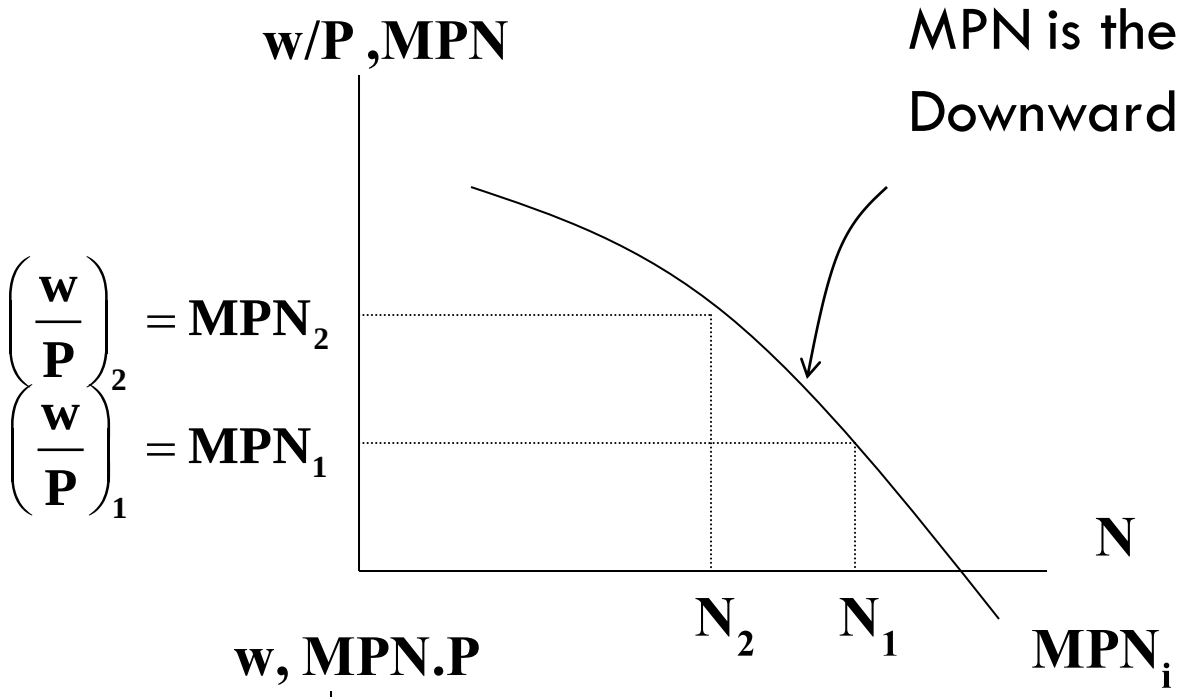
Demand **Supply**

LABOR MARKET DEMAND

- How to best transform inputs into outputs? (N? into Y?)
- Firm chooses for optimal level of inputs that maximizes profit.
- The optimizing condition suggests that firms choose the optimal level of employment where marginal cost of labor equalizes with marginal benefit of labor

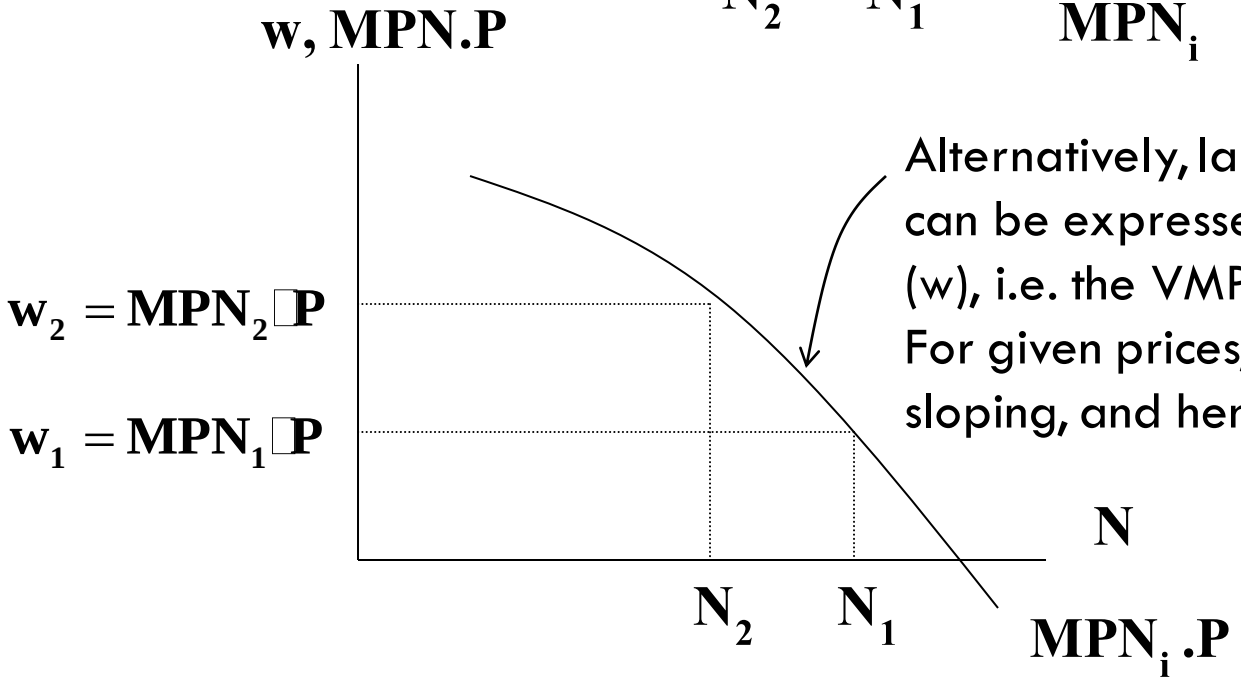
W = P * MPN (nominal wage = Value marginal product)

W/P = MPN (real wage = marginal product)



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.

LABOR MARKET SUPPLY

- Where does the supply of labor come from?
- Households supply labor force to the market. Why?
- They work and get paid; income earned can be used for purchasing goods in the goods market.
- Theorem for labor market supply emerges from foundation of individual labor supply, i.e. the consumption-leisure model.

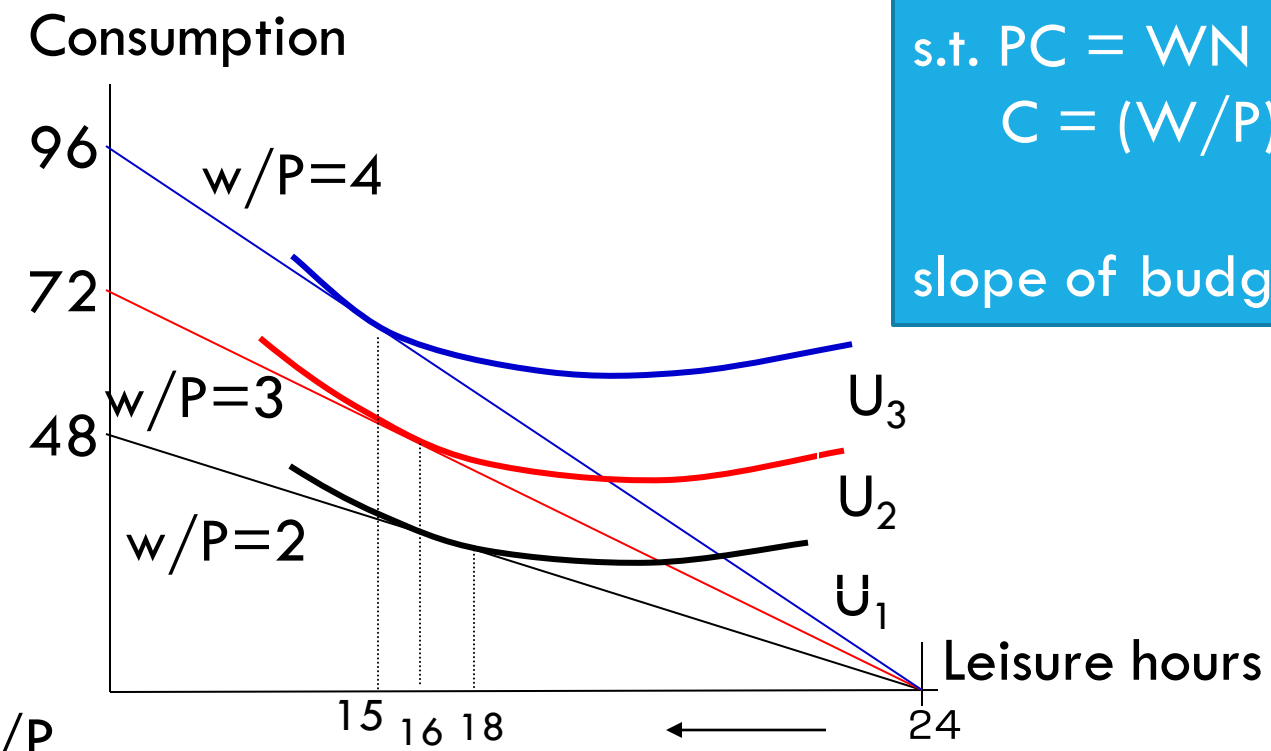
LABOR MARKET SUPPLY

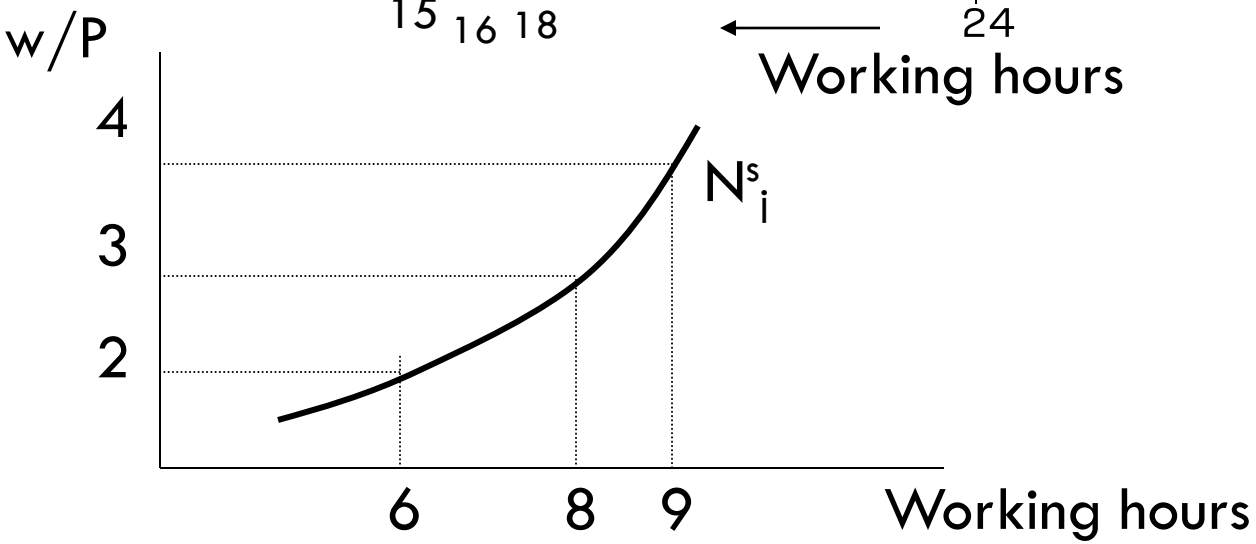
- Households choose for two things: consumption level (C) and leisure (L).
- Problem is not obvious as household needs to **trade-**off between the two.
  - More leisure is good, but associated with lower consumption.
  - More consumption is good, but household need to work a lot more; less leisure.
- Household is guided by preference or utility function, depends on "C" and "L". They choose for optimal C and optimal L under the constraint that they face.

Consumption – Leisure problem

Max U(C,L)
s.t. PC = WN = W(24-L)
C = (W/P) (24 – L)

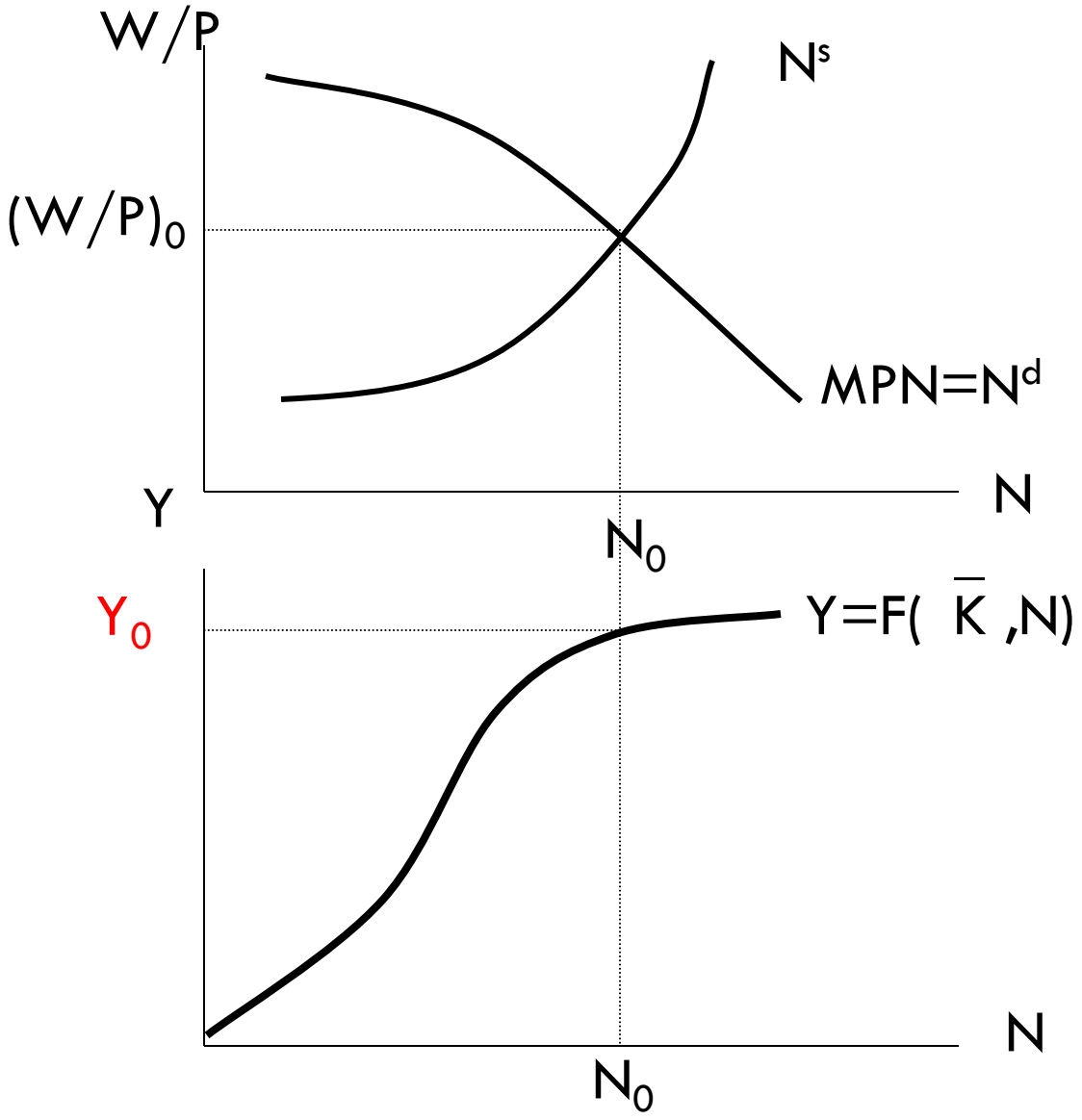
slope of budget line = W/P





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

Equilibrium of labor market and optimal production level



AGGREGATE SUPPLY AND LABOR MARKET OUTCOME

- Economy always produces at the full-employment output (Yo and No).
  - Aggregate supply is always a vertical line; neoclassical/classical aggregate supply (Long-run aggregate supply)
- The supply concept rests on a very strong, yet controversial, assumption; price and wage can be perfectly adjusted with a complete synchronization (no delay).
- Keynesian theorists then argue that classical foundation to Aggregate supply is misleading; empirically, nominal wage adjusts slower than nominal price – e.g. no full indexation.

WHAT'S RIGHT ABOUT LABOR SUPPLY: KEYNESIAN POINT OF VIEW

- Labor market decision involves with **contractual agreement**, and **length and duration of hiring**.

- Wage is usually **pre-specified** in advance in **nominal terms**, based on the bargaining problem between employers and employees.

- Lot more institution features that make it hard for wage to be adjusted instantaneously over time; **wage stickiness**.

TWO POSSIBLE TYPES OF WAGE STICKINESS

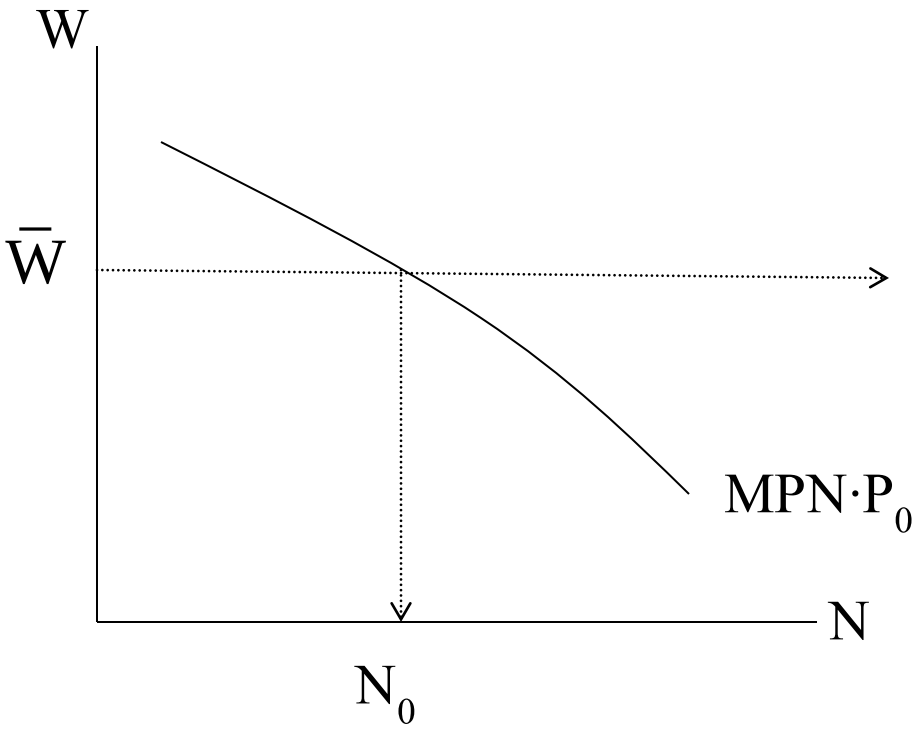
- **Possible wage schemes pre-determined in advance.**
  - **Constant fixed wage**: horizontal labor supply curve.
  - **Variable wage:** upward sloping labor supply curve.
- **Both types involve with a contractual arrangement that both employers and employees are committed to.**

POSSIBLE WAGE SETTING SCHEMES: FIXED WAGE (CONSTANT SCHEME)

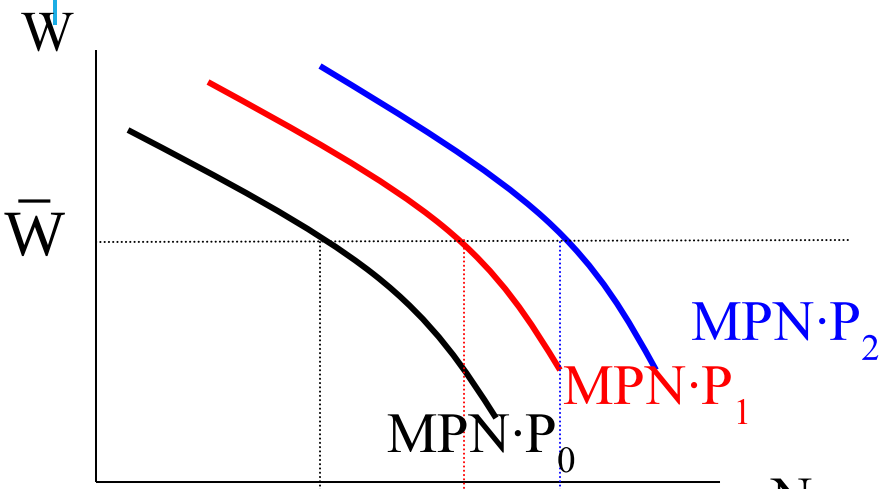
Perfectly rigidity in wage, ***Exogenous*** long-term **nominal wage** contract.

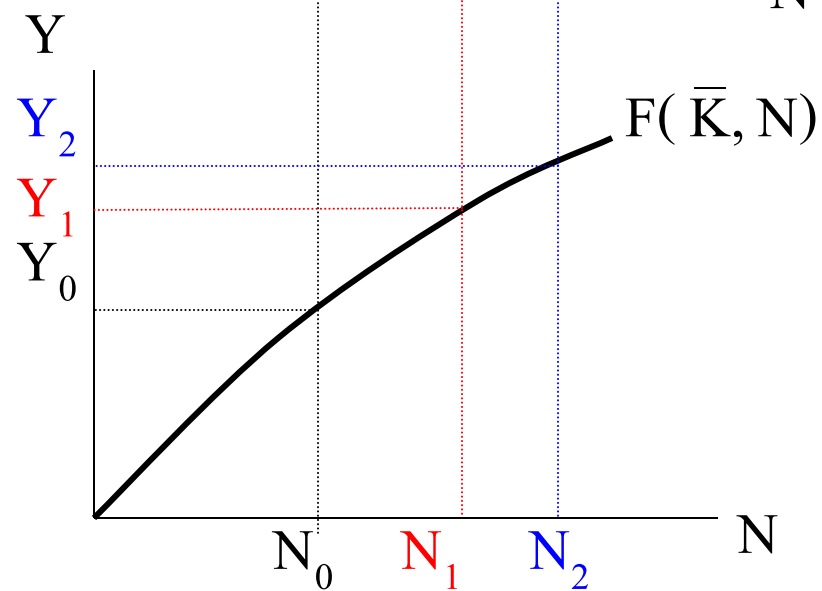
Labor supply curve is captured by **the horizontal line.**

The amount of employment is given by **labor demand** $W=MPN\cdot P$



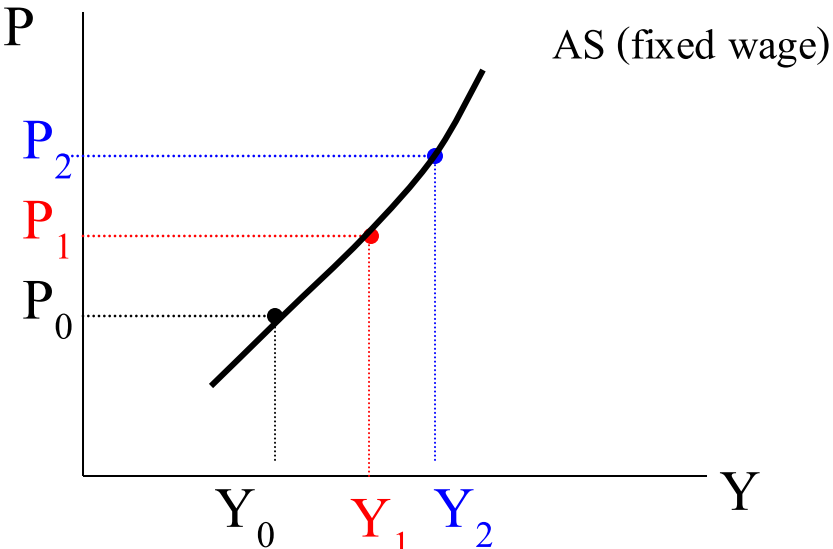
THE KEYNESIAN AGGREGATE SUPPLY I





As price increases, firm hires more labor. Output will increases.

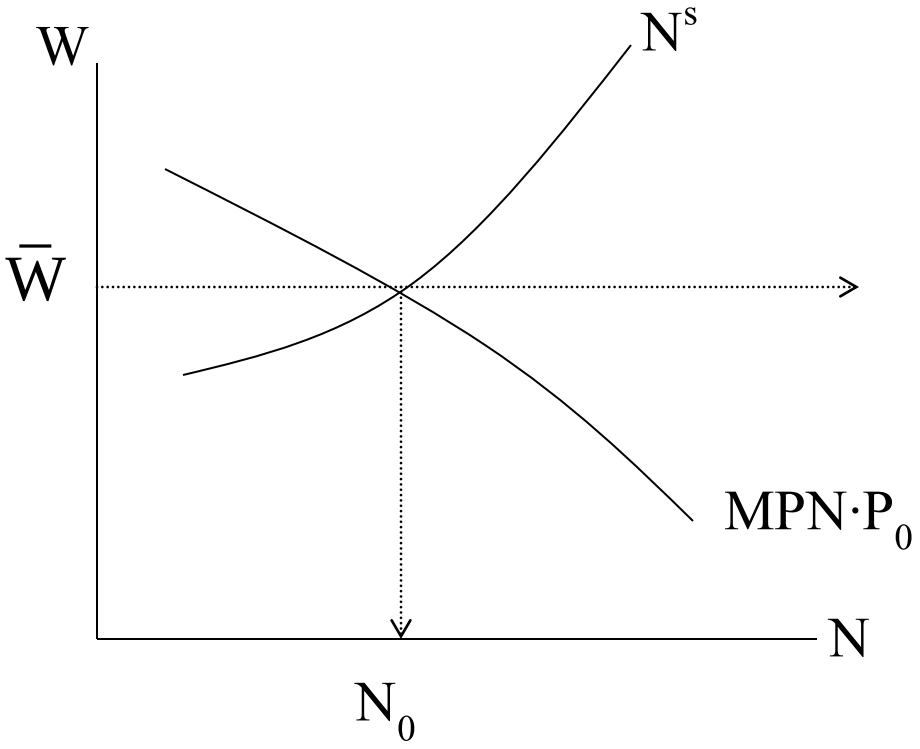
AS is upward sloping



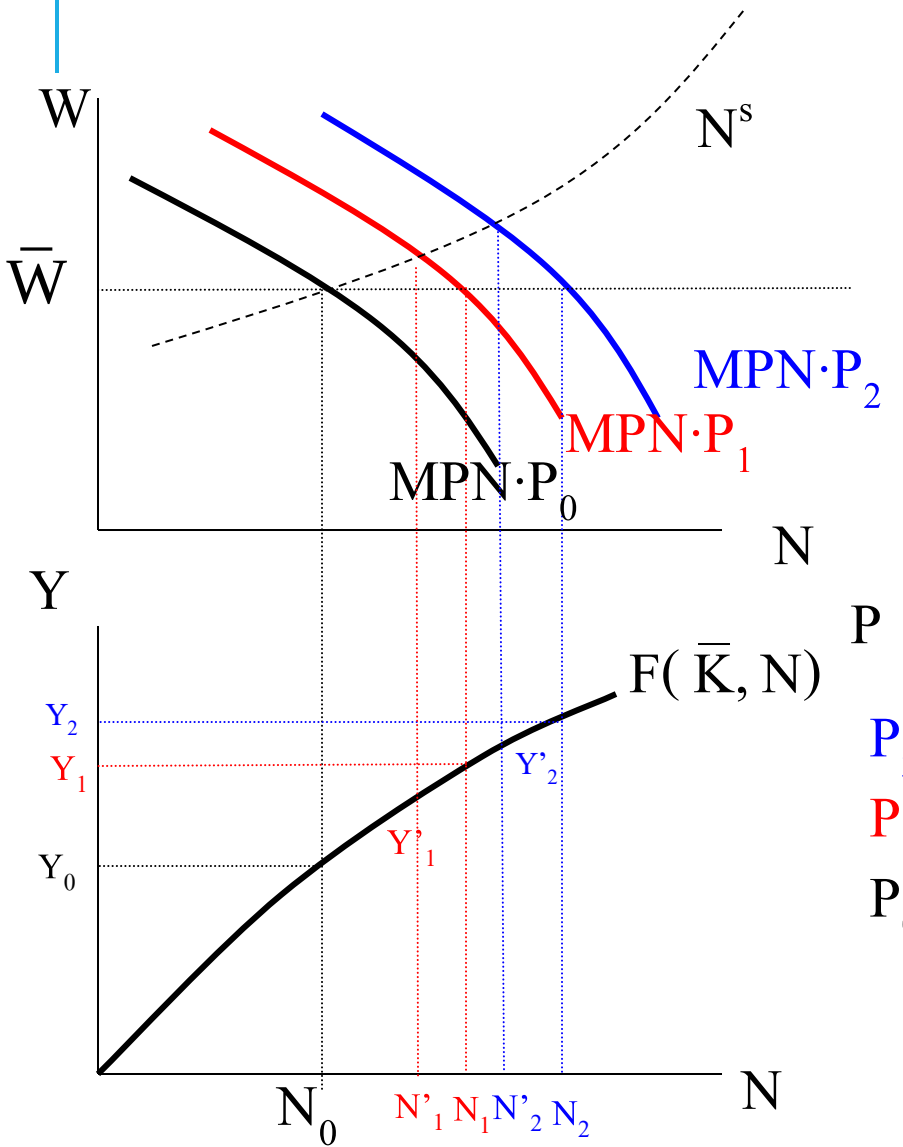
POSSIBLE WAGE SETTING SCHEMES: PRE-SPECIFIED *VARIABLE WAGE*

Wage schemes are **pre-specified**, but can be varied over the amount of hours – e.g. variable wage per hour.

The supply is now captured by the **upward sloping one**.

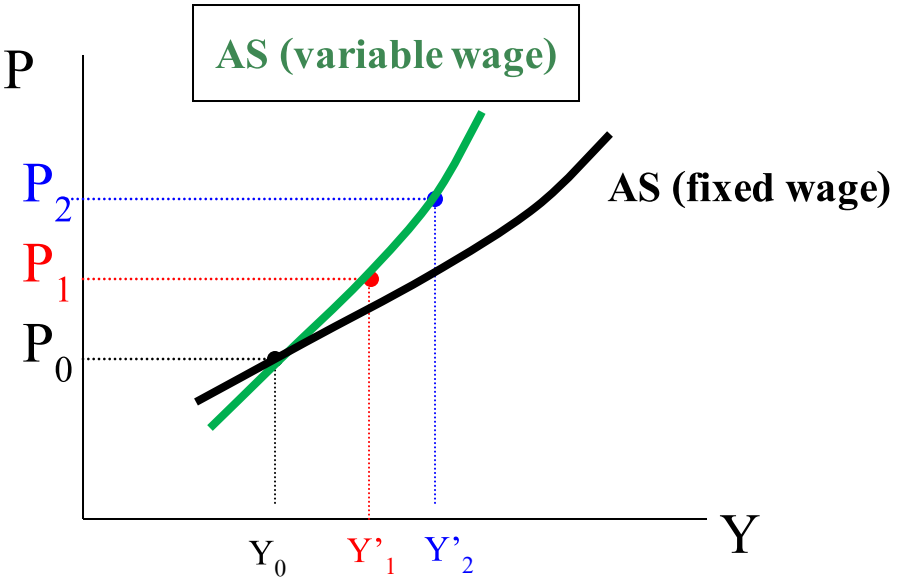


THE KEYNESIAN AGGREGATE SUPPLY II



With variable wage, AS is steeper.

Intuition: Rising wage partially *attenuates* the effect of rising price; output increases less.



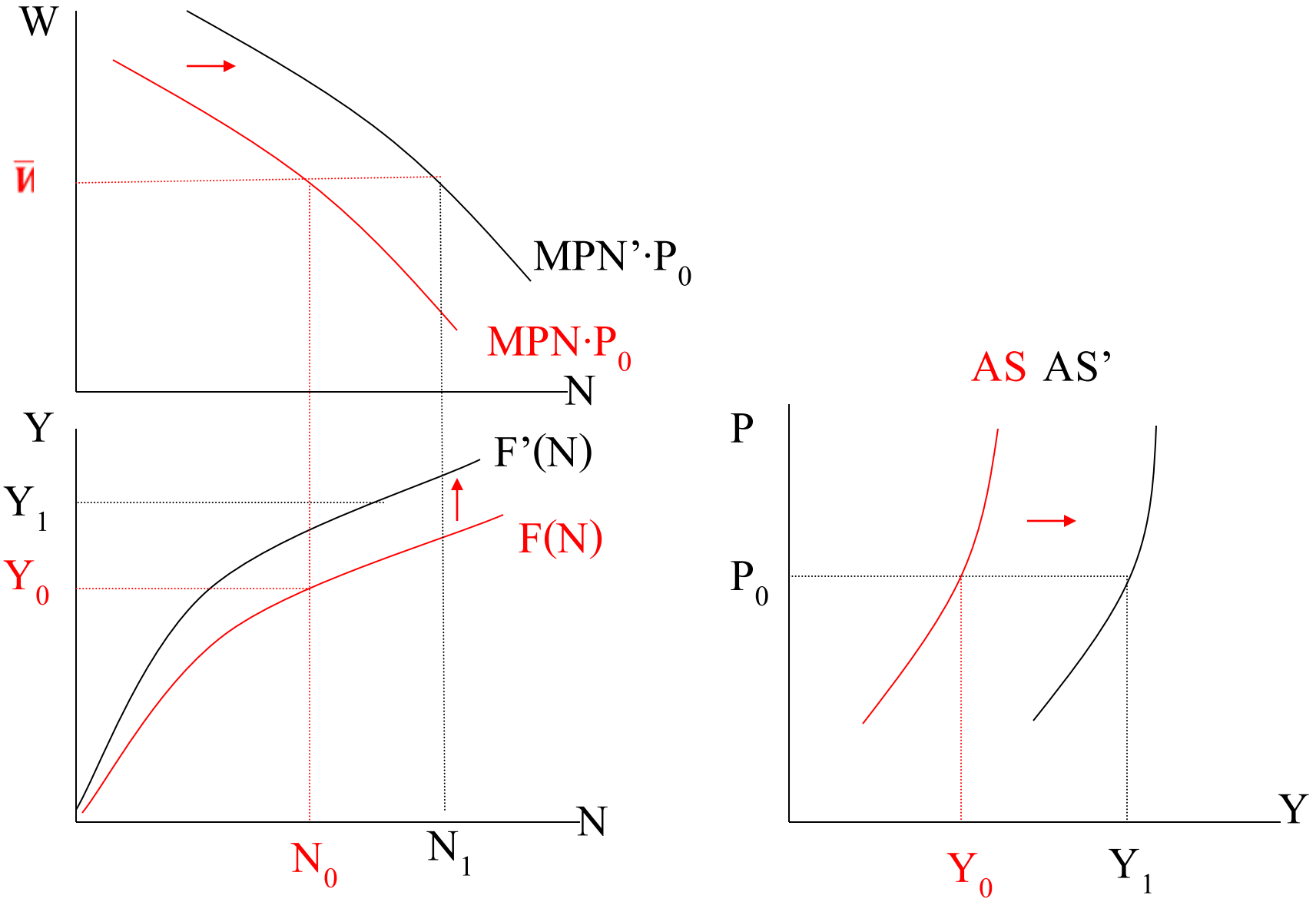
FACTORS AFFECTING AGGREGATE SUPPLY CURVE

- We knew about the foundation of an upward sloping AS curve.
- Several factors are kept steady while we are deriving the upward sloping curve. What if they change?
- Their changes cause a **shift in the Aggregate supply**.

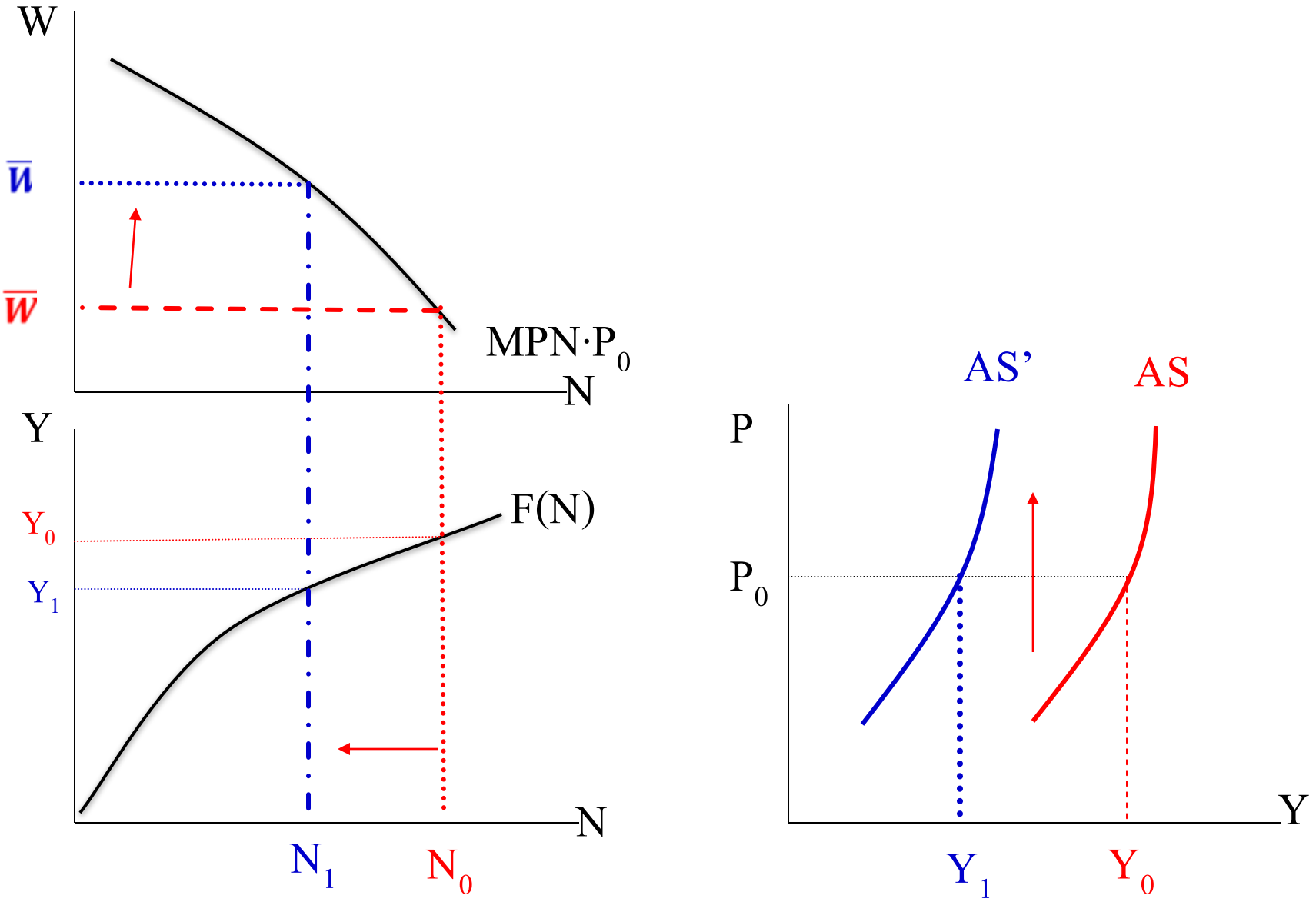
FACTORS AFFECTING AGGREGATE SUPPLY CURVE

- Technological factors
- Cost-push factor; oil price and material inputs price.
- Underlying factor behind the wage-setting.

The impact of technological improvement / positive cost advantage



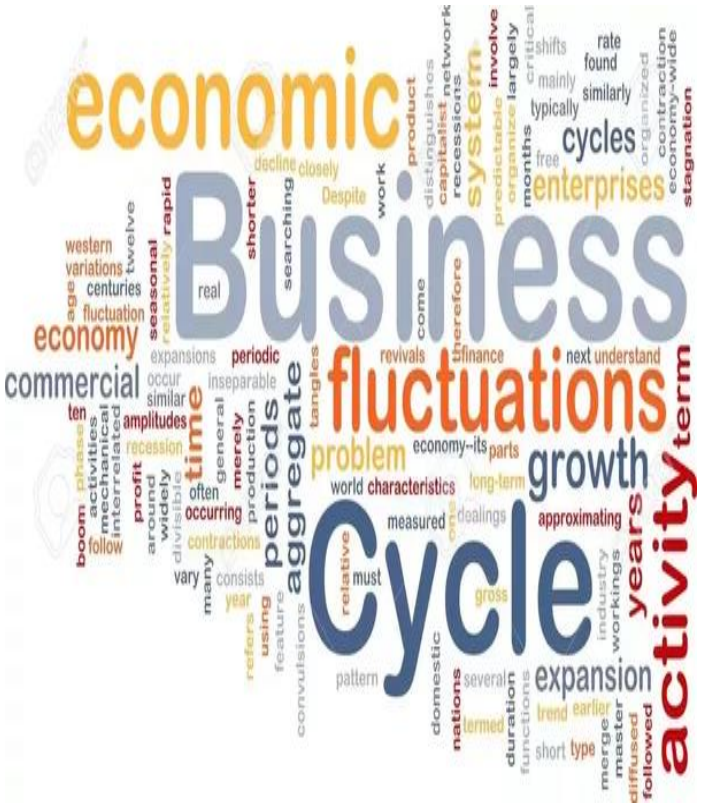
Change in bargained wage (nominal contract)



WHAT DETERMINE THE LEVEL OF BARGAINED (PRE-SPECIFIED) WAGE?

- What are the ultimate drivers that cause the movement in bargained wage?
  - **Structural factor**: Institution features related to the bargaining power between employers and employees – e.g. labor union.
  - **Cyclical factor:** Labor market conditions (tight/slack)
  - **Expectation factor:** Wage's negotiation to keep up with the rising cost of living – e.g. price and inflation expectation.

AGENDA



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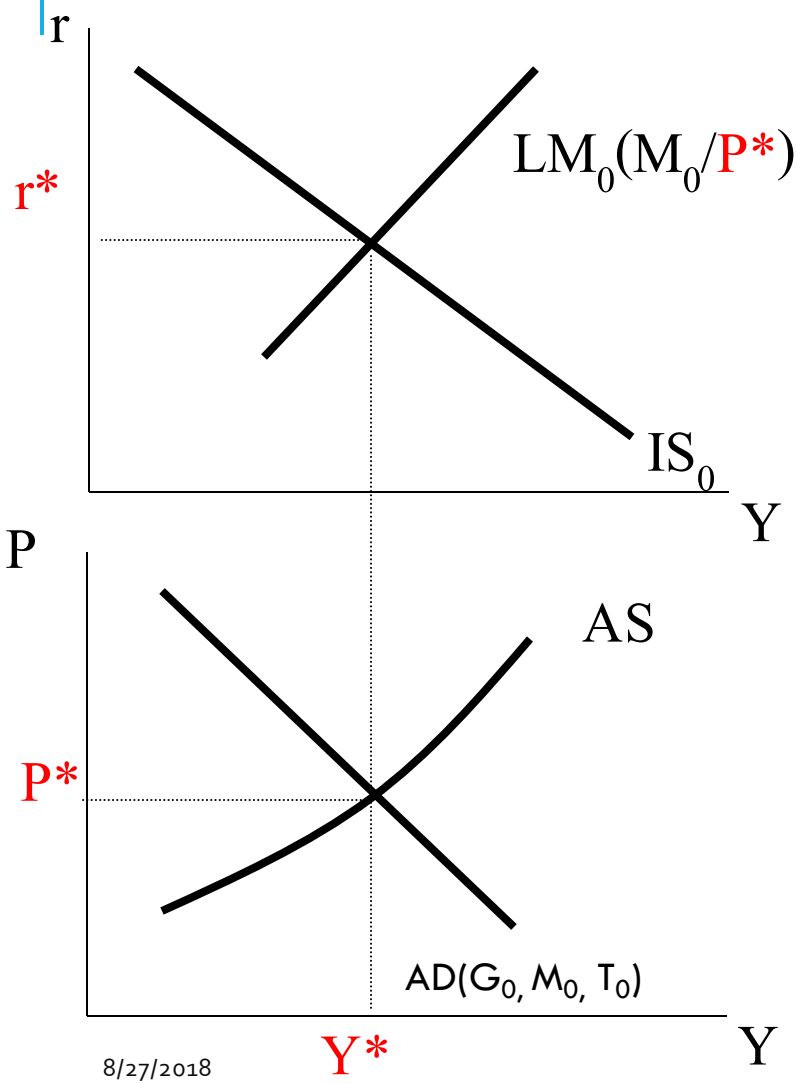
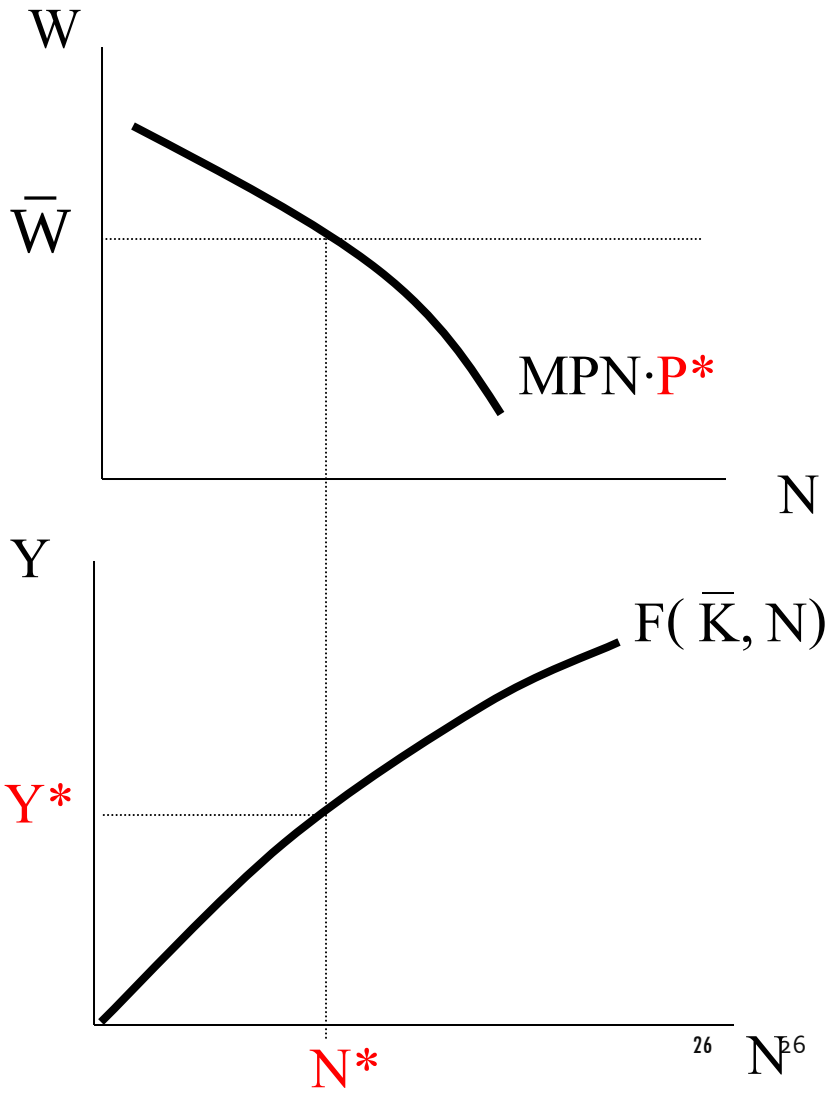
KEYNESIAN EQUILIBRIUM

- Keynesian 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.

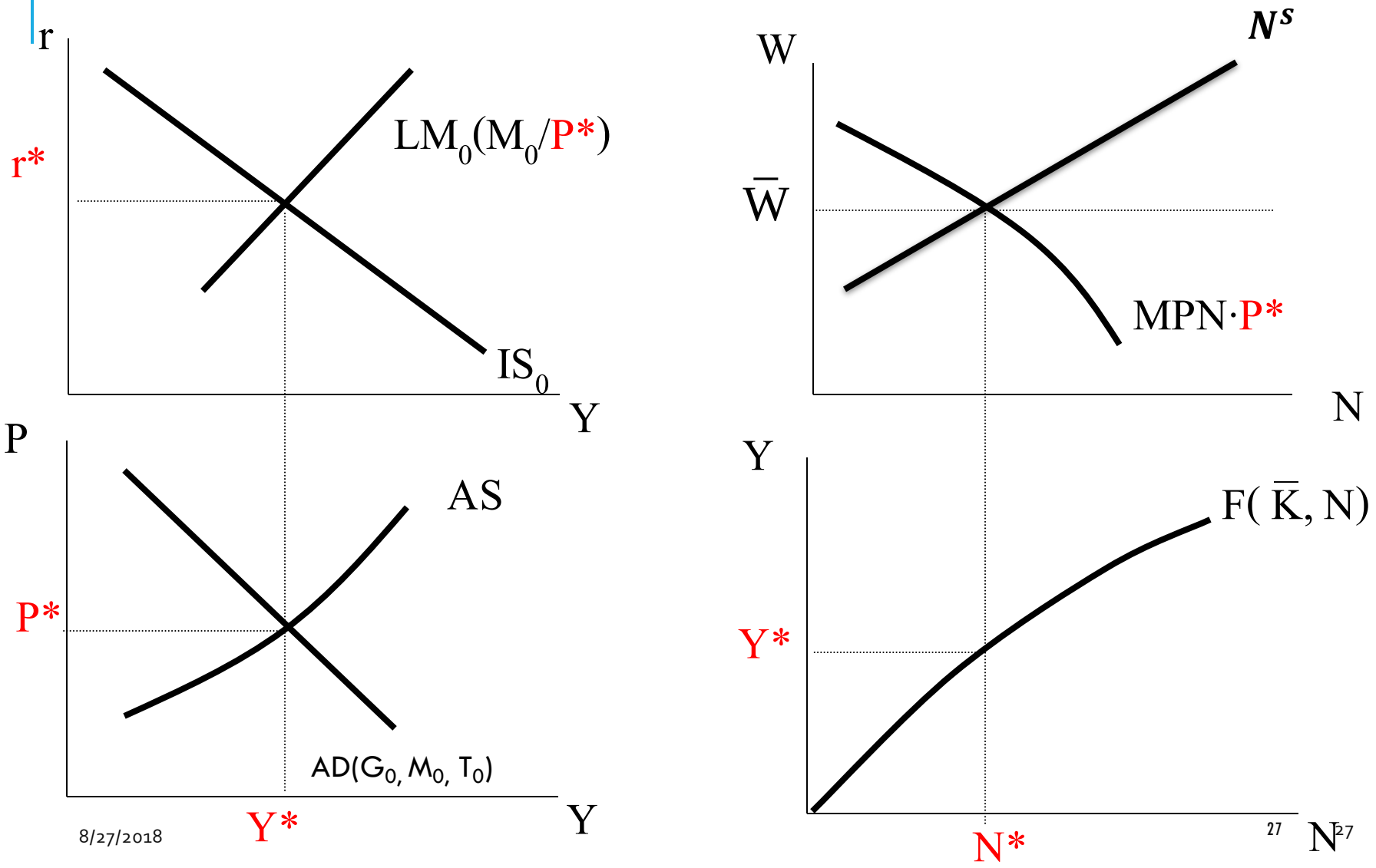
- The equilibrium can be captured by **4 main figures**.

AD-AS EQUILIBRIUM ANALYSIS: FIXED WAGE





AD-AS EQUILIBRIUM ANALYSIS: PRE-SPECIFIED VARIABLE WAGE



PROPAGATION OF SHOCKS

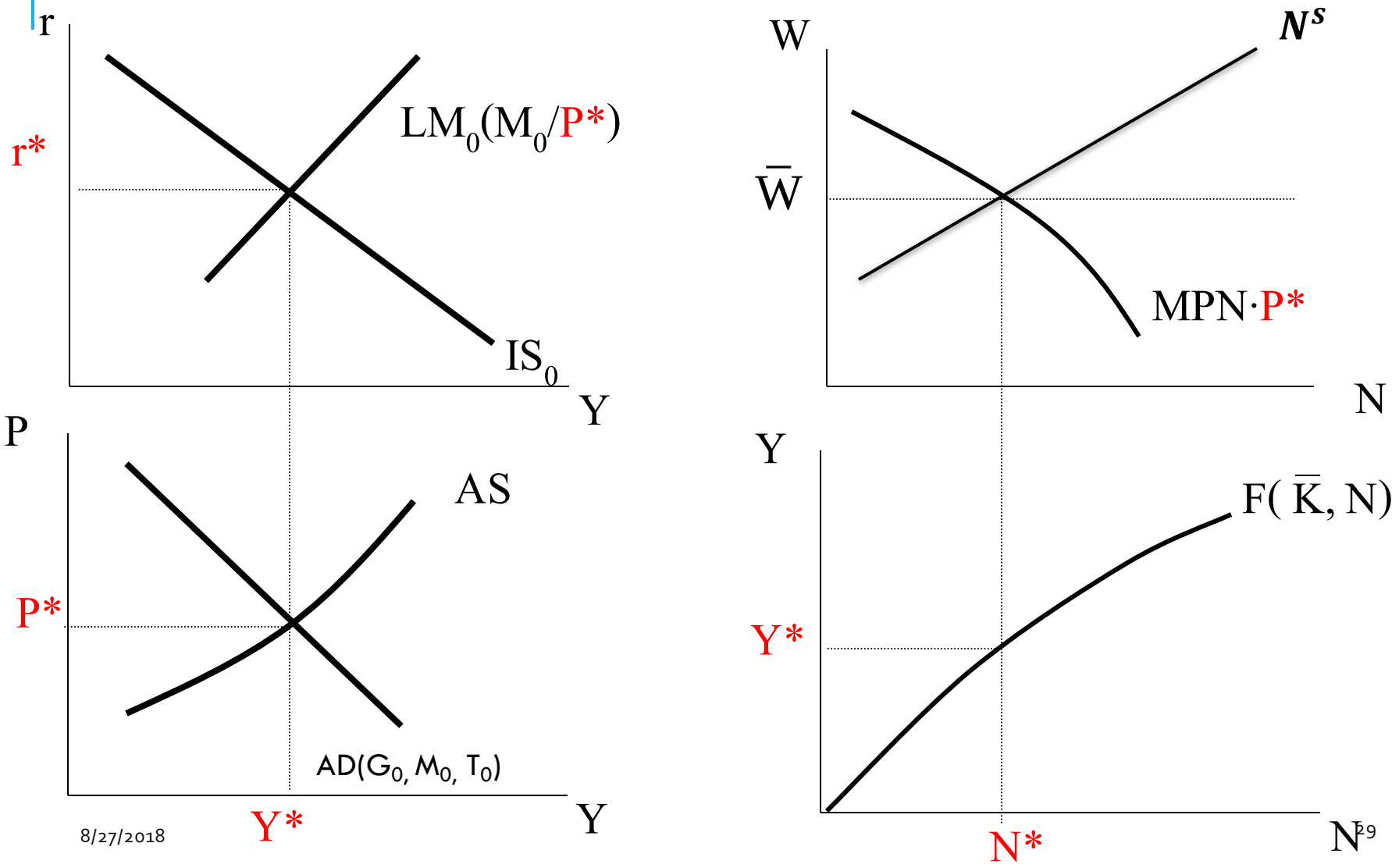
- Macroeconomy is randomly hit by shocks; business cycle followed.

- **Questions:**

  - How does shock **propagate**? (Transmission?)

  - Does shock generate **large or small** impact? When?

DEMAND SHOCK: NEGATIVE ANIMAL SPIRIT (FIXED WAGE)



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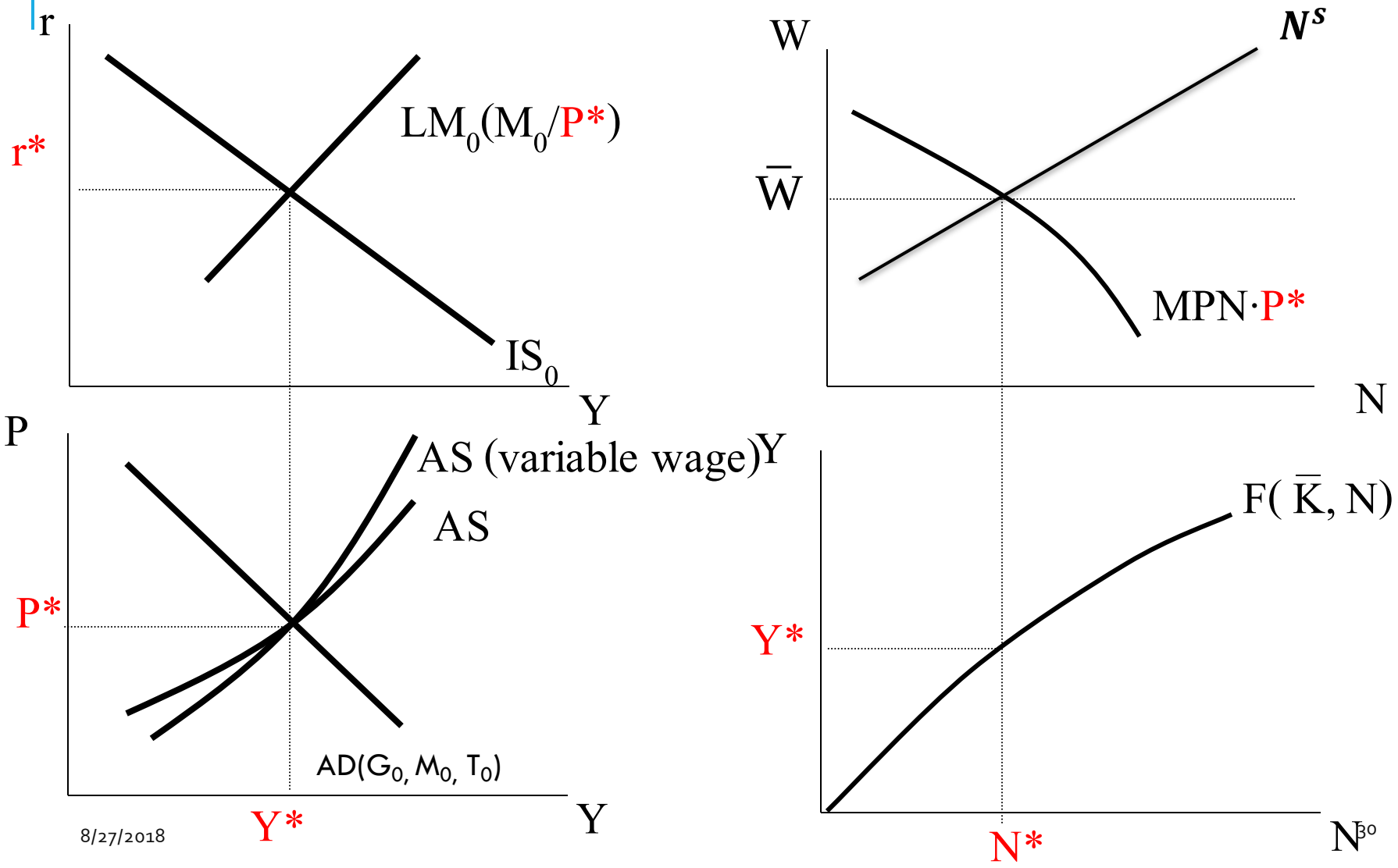


PROPAGATION MECHANISM OF DEMAND SHOCKS

- Under **demand shocks**, it follows that
  1. Shift in the AD curve (forward/backward)
     - Stemming from the shift in IS/LM curve; those basic mechanisms underlie the IS/LM framework apply here – e.g. multiplier/crowding-out/slope.
  2. Effect of AD shocks would be stronger under fixed price system.
     - Price adjustment will partially attenuates the effect of demand shocks – e.g. deviation of output would be relatively.

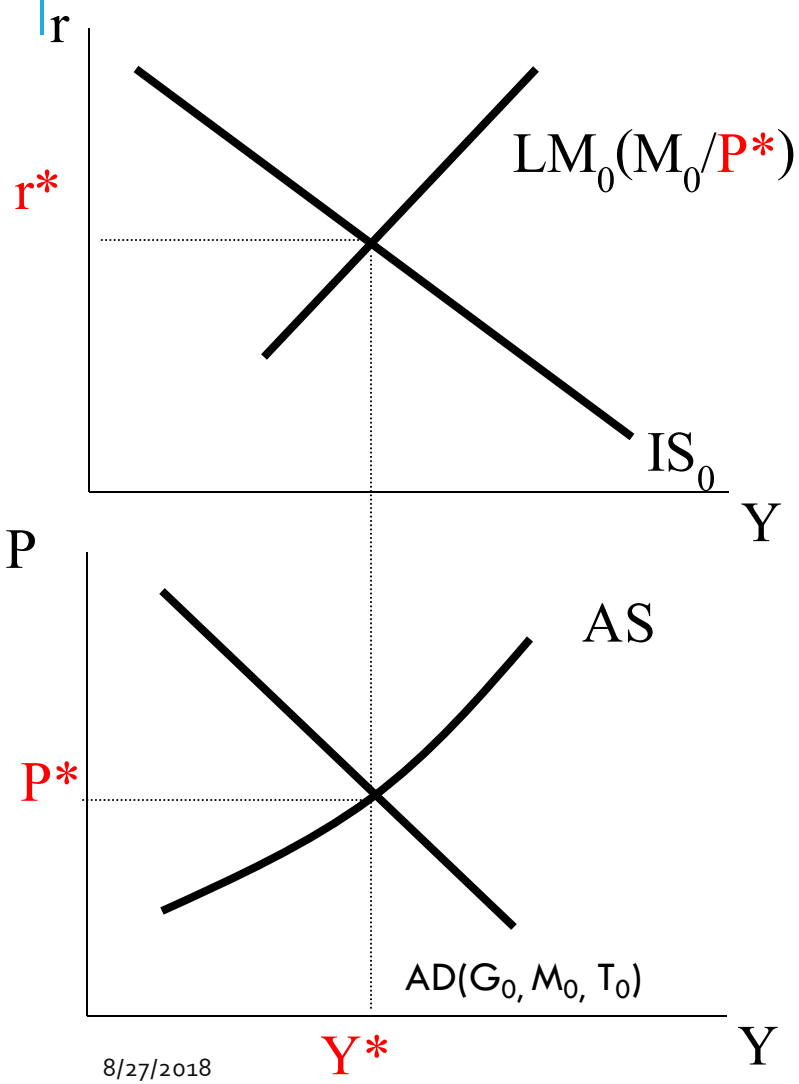
PROPAGATION MECHANISM OF DEMAND SHOCKS

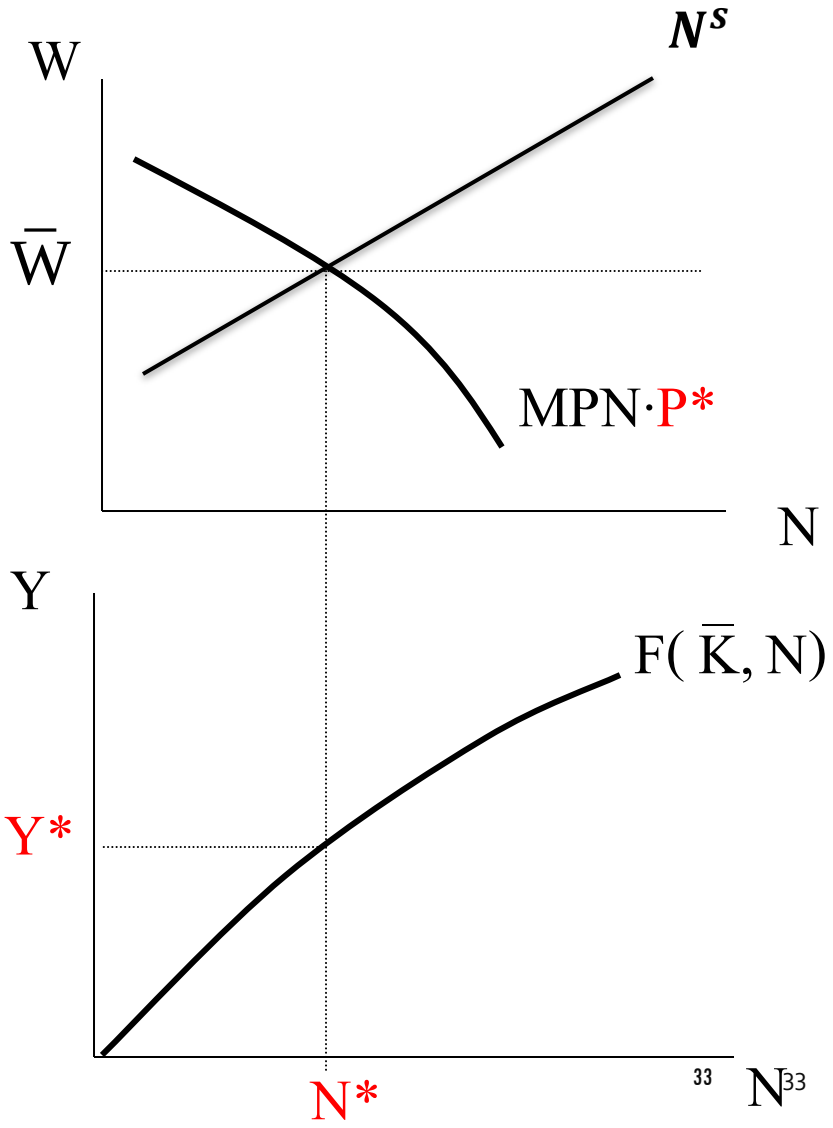
- Under **demand shocks**, it follows that

  3. Effect of AD shocks would be further mitigated under variable wage system.

     - Variation in wage limits the adverse effect of demand shocks.
     - If the nominal wage were fixed, change in price will result in a change in real wage.
     - Under fixed constant nominal wage, this causes a large swing in the employment, and hence output.

SUPPLY SHOCK: NATURAL DISASTER





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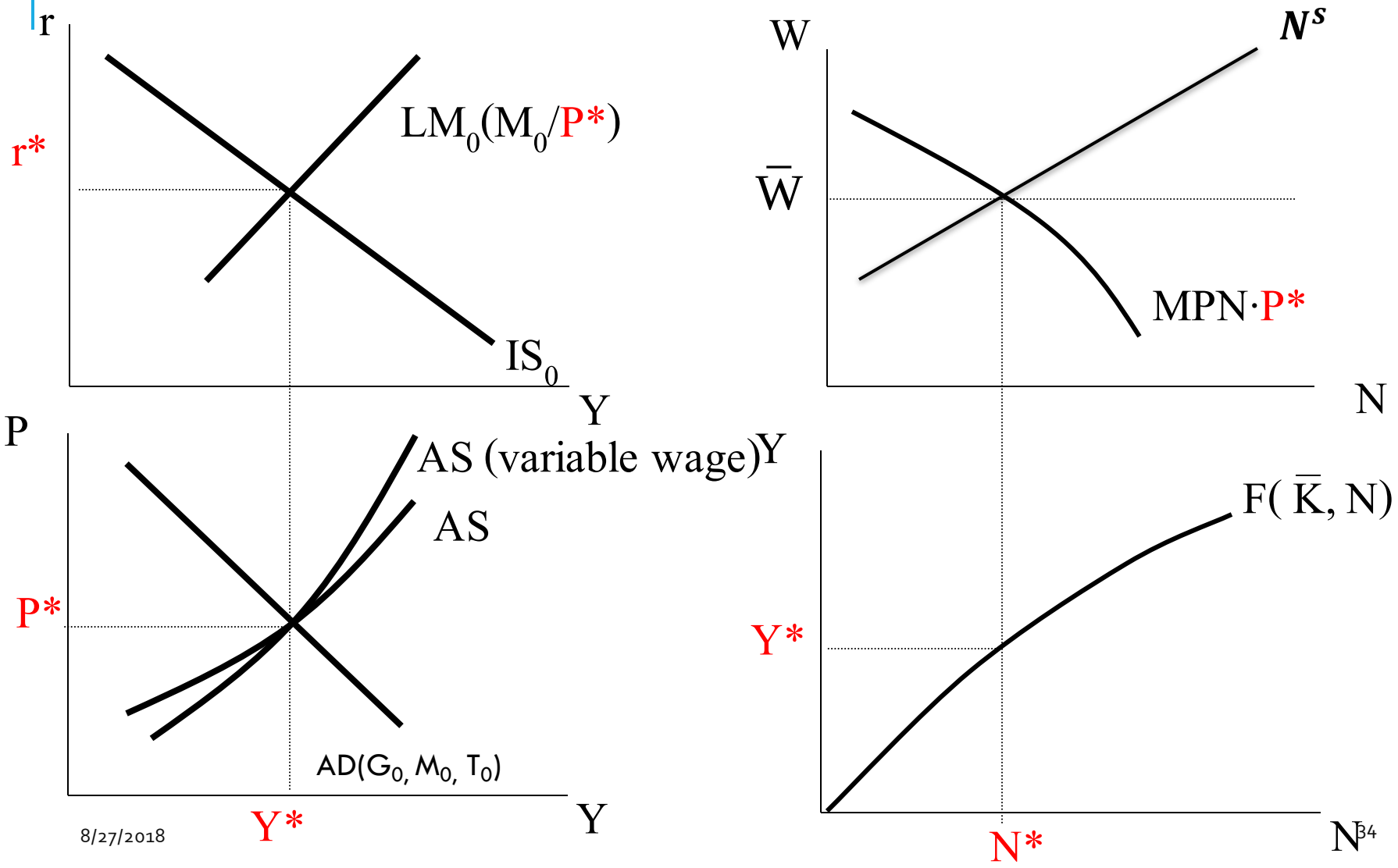

PROPAGATION MECHANISM OF SUPPLY SHOCKS

- Under **supply shocks**, it follows that
  1. Shift in the AS curve (forward/backward)
     - Change in price will affect the quantity of aggregate demand.
  2. Effect of AS shocks would be stronger under the flat AD curve.
     - Aggregate demand is more responsive to price .
     - When do we have a flat aggregate demand curve?

PROPAGATION MECHANISM OF SUPPLY SHOCKS

- Under **supply shocks**, it follows that
  3. Effect of AS shocks would be stronger if AS is steep.
     - Bigger impact on the horizontal shift of AS under steep AS curve.

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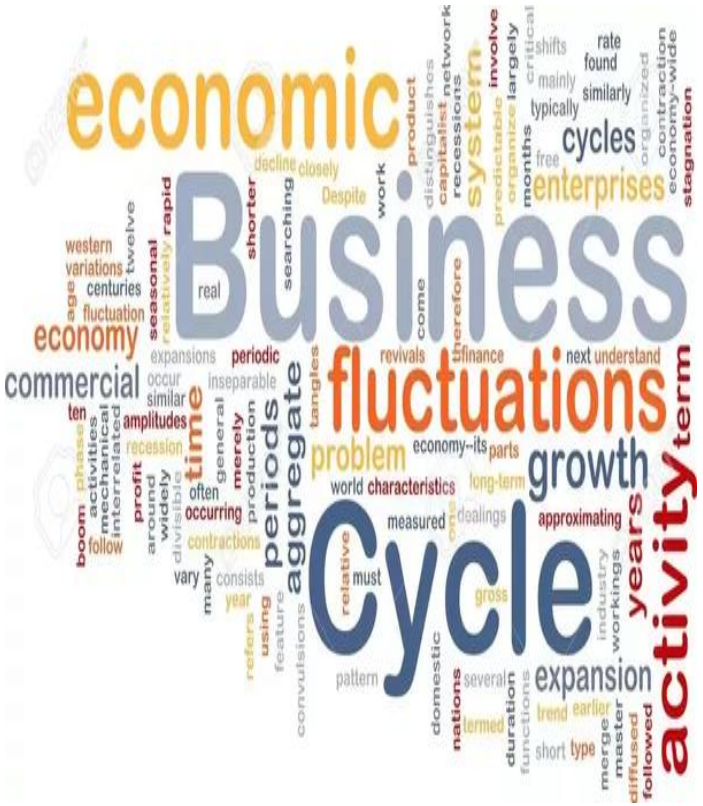

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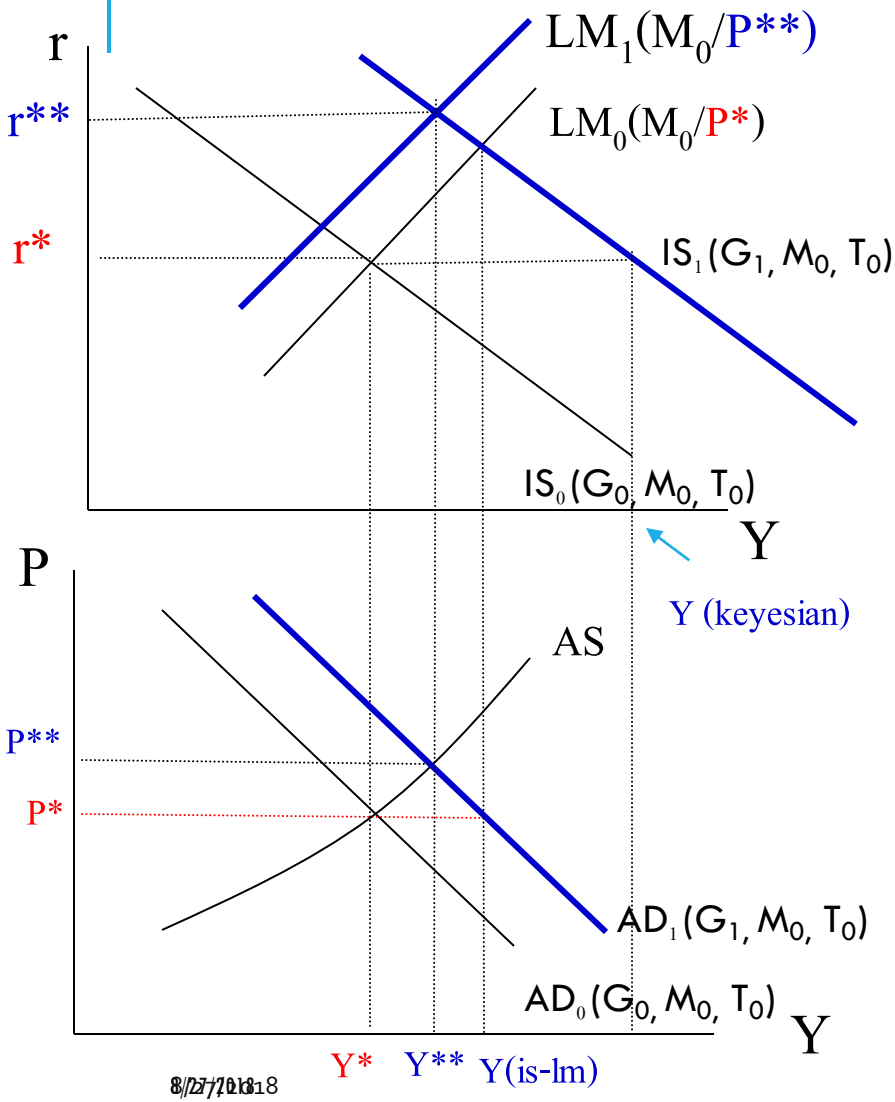
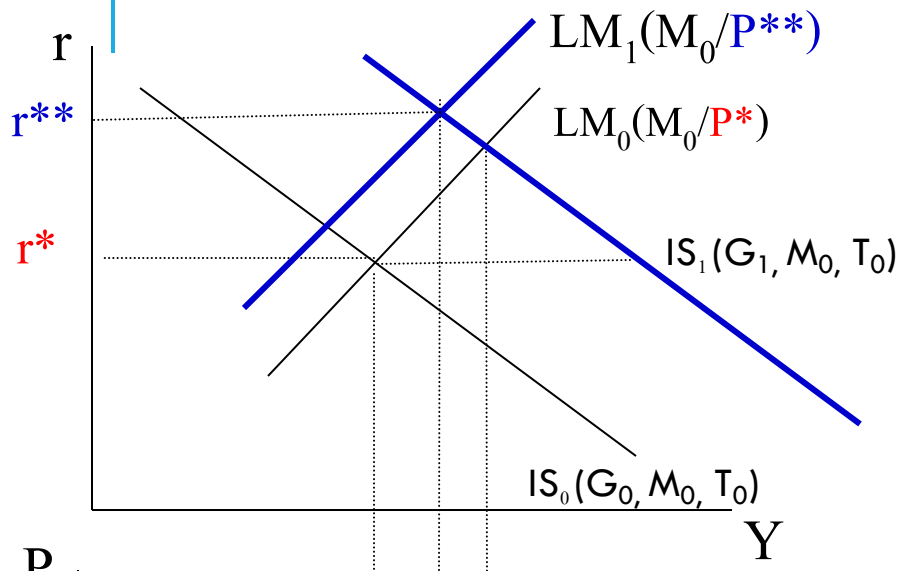
EQUILIBRIUM ANALYSIS: FISCAL POLICY

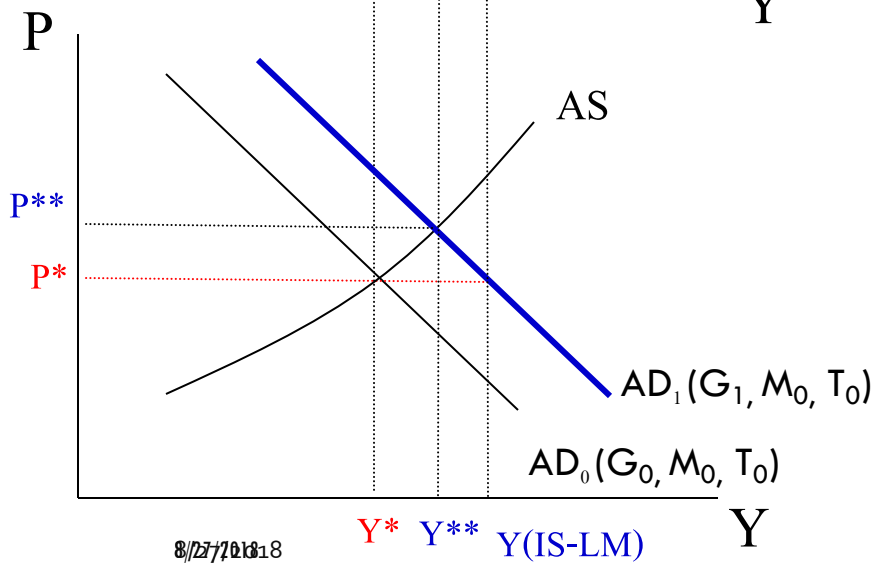


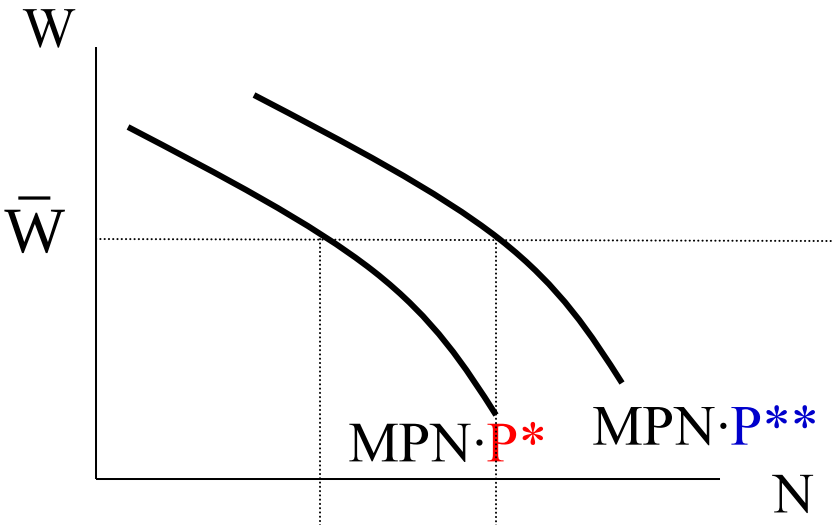
Mechanisms of Fiscal policy

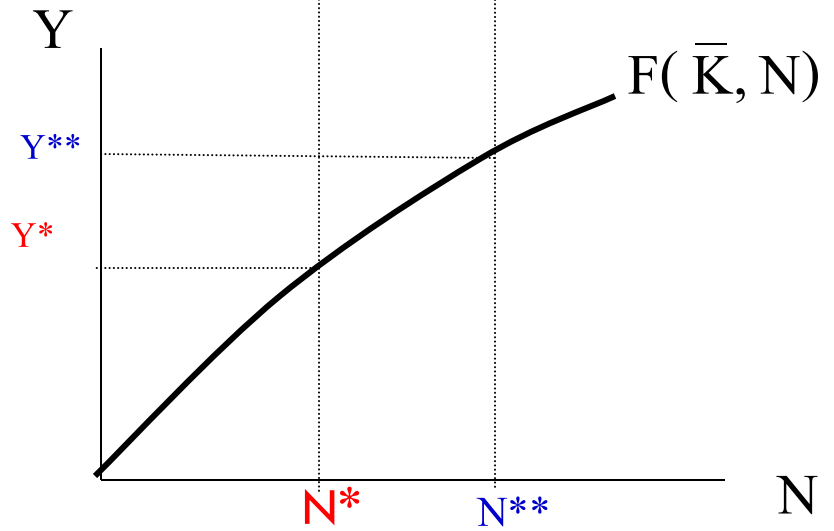
1. Suppose price fixed equal to P*.
2. G0 → G1; IS0 curve shifted to IS1.
3. AD0 shift to AD1. (Horizontal shift?)
4. At P*, we have excess demand; price starts to rise from P* to P**.
5. Rising price offsets the initial impact of "G" as it tends to push up the market interest rate; this is called the price effect.

EQUILIBRIUM ANALYSIS: FISCAL POLICY





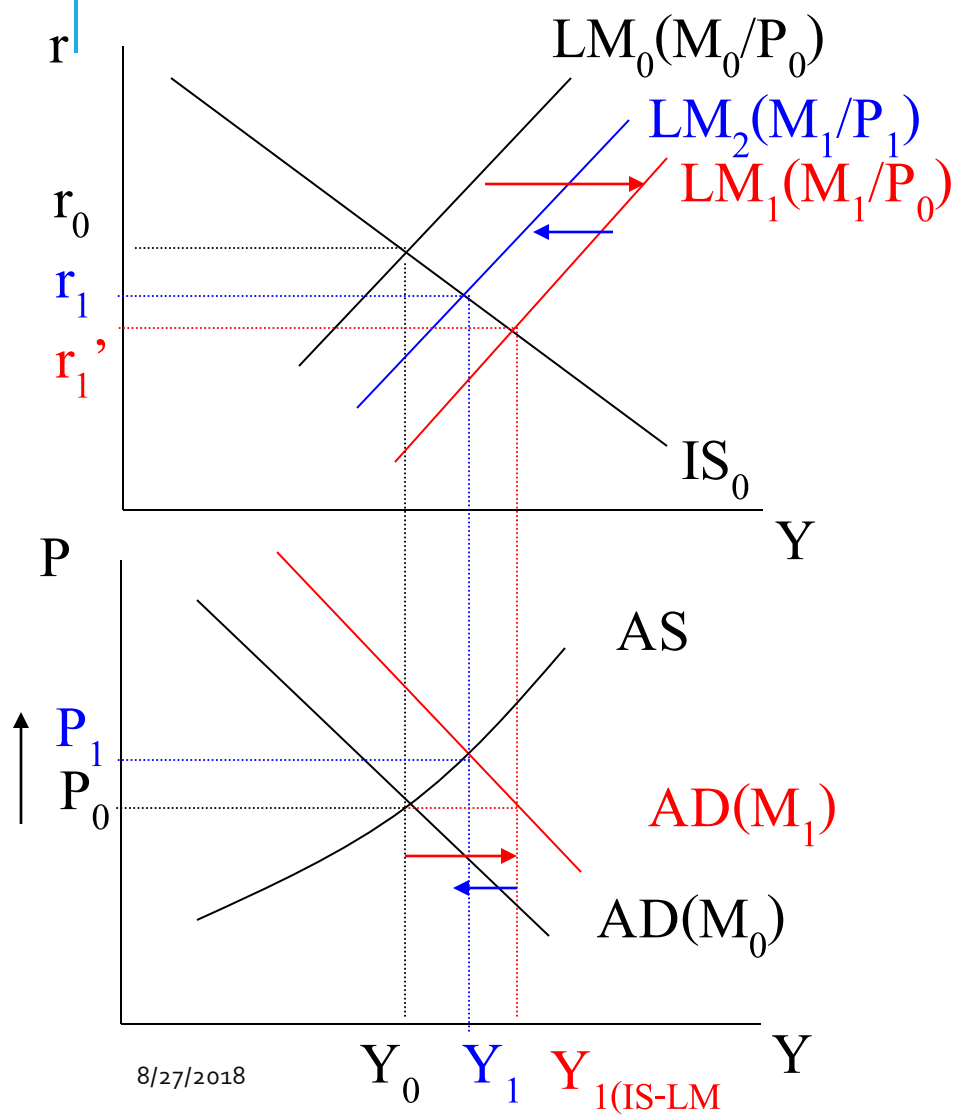




FISCAL MULTIPLIERS

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 P0, AD shift right.
- At P0, 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.

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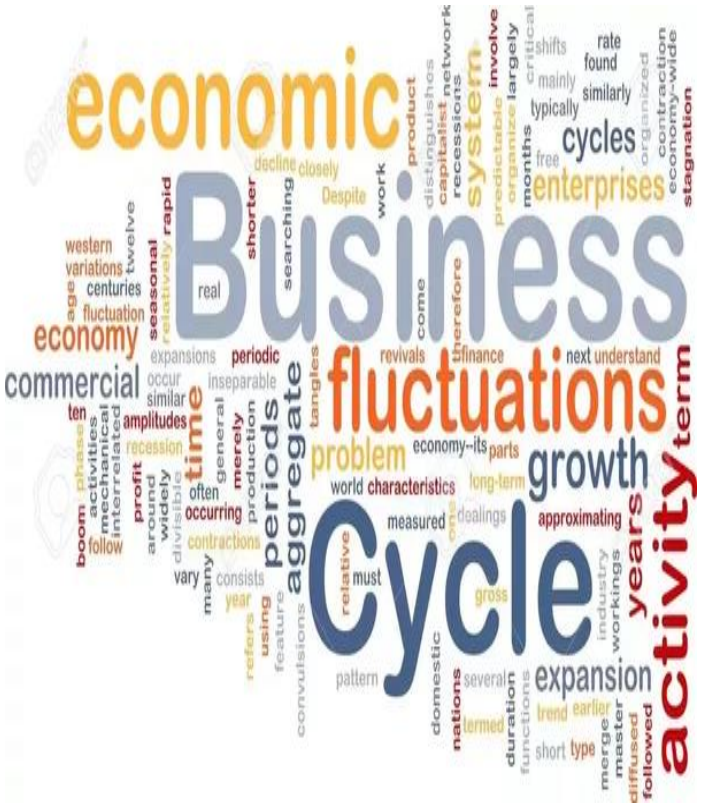

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ACCOUNTING SOME STYLIZED FEATURES IN DATA IN MACROECONOMY WITH MODEL

- **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 theses 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.

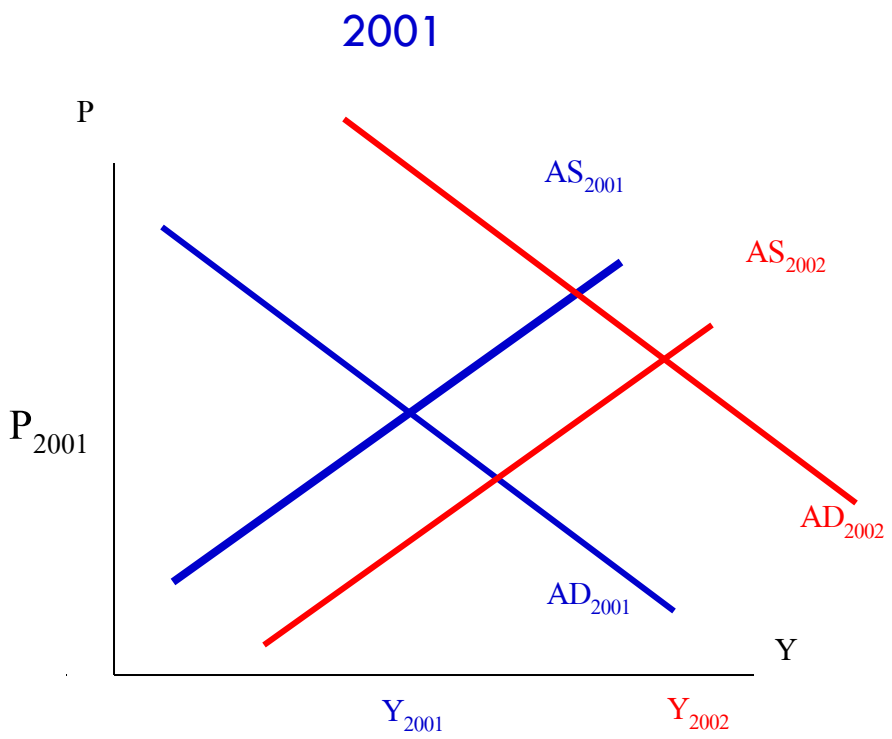
Example:

- 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

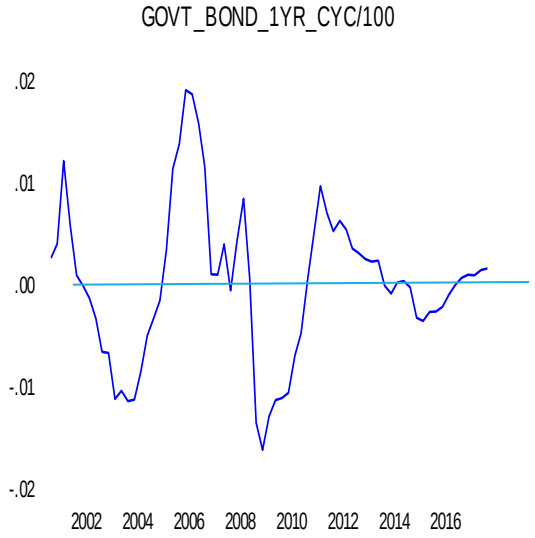
HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

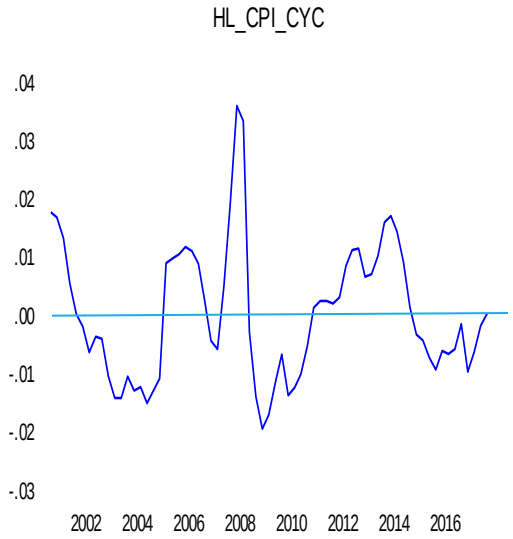
- Compare model's prediction and Real-world data.
- Qualitatively asses the fitness of the model!
- What do see in the data?

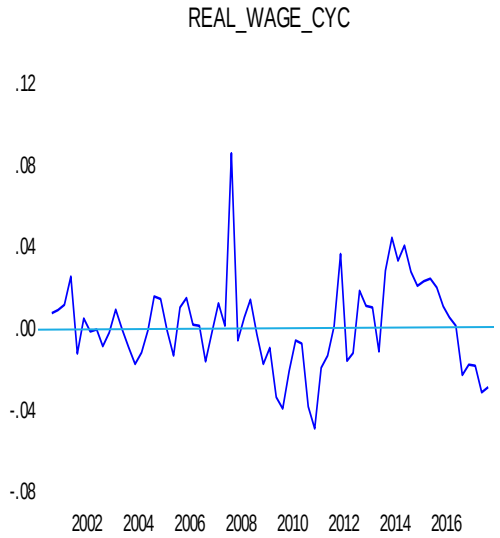
HOW FIT DOES THE AD-AS MODEL EXPLAIN THE WORLD?

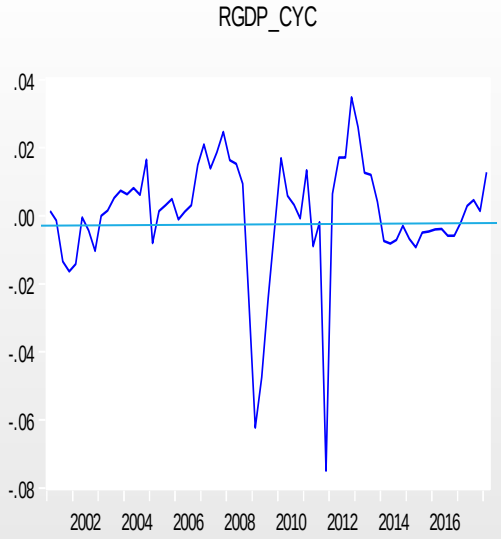
- Data:
  - Real-GDP / Consumption / Private investment
  - Interest rates: 1-year government bond.
  - Real wage: average wage adjusted by headline CPI.
  - Price: headline CPI

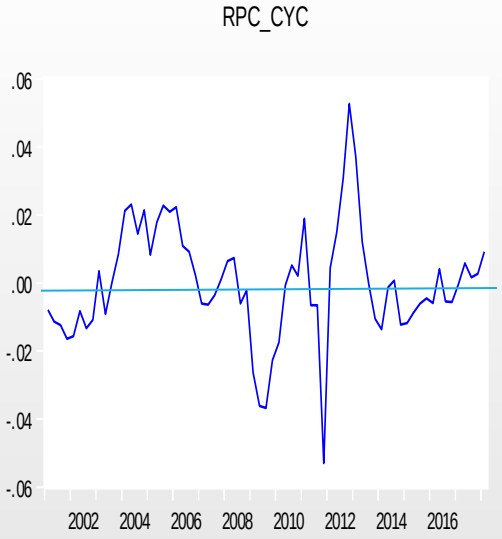
- Treatment:
  - Detrend / Calculate: "Cyclical variations"
  - Compute pair-wise correlation.

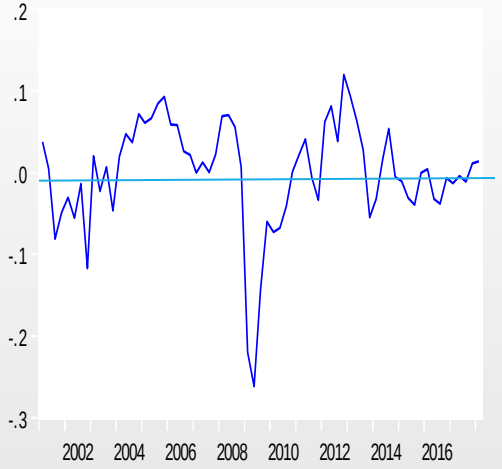

GOVT_BOND_1YR_CYC/100
.02
.01
.00
-.01
-.02
2002
2004
2006
2008
2010
2012
2014
2016


HL_CPI_CYC
.04
.03
.02
.01
.00
-.01
-.02
-.03
2002
2004
2006
2008
2010
2012
2014
2016


REAL_WAGE_CYC
.12
.08
.04
.00
-.04
-.08
2002
2004
2006
2008
2010
2012
2014
2016


RGDP_CYC
.04
.02
.00
-.02
-.04
-.06
-.08
2002
2004
2006
2008
2010
2012
2014
2016


RPC_CYC
.06
.04
.02
.00
-.02
-.04
-.06
2002
2004
2006
2008
2010
2012
2014
2016


RPI_CYC
.2
.1
.0
-.1
-.2
-.3
2002
2004
2006
2008
2010
2012
2014
2016

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 -----

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

- Since 2001, what we have seen in the data is that aggregate variables are **pro-cyclical**.

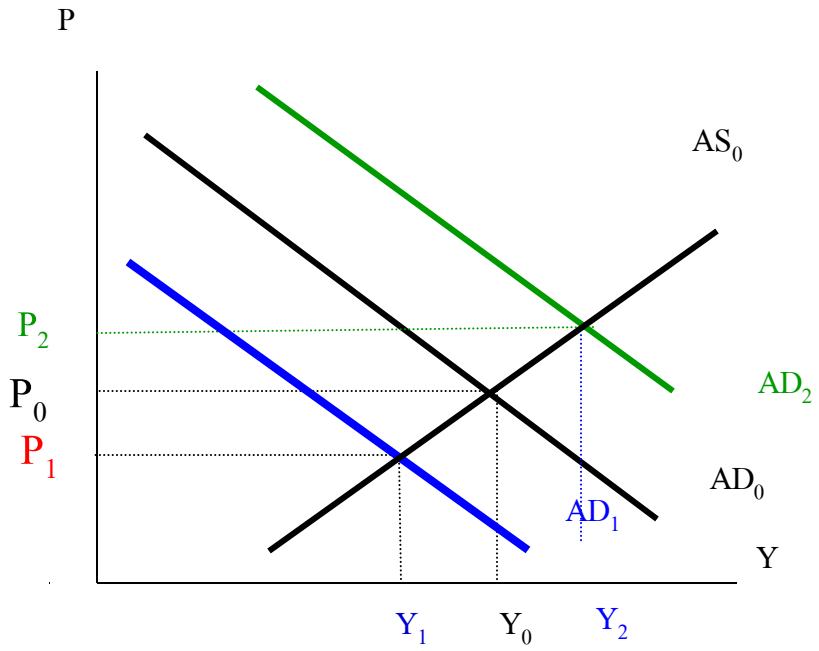
- Real-wage is might be an exception – e.g. **weakly pro-cyclical** (**statistically acyclical**).

DATA V.S. MODEL: TESTABLE IMPLICATIONS

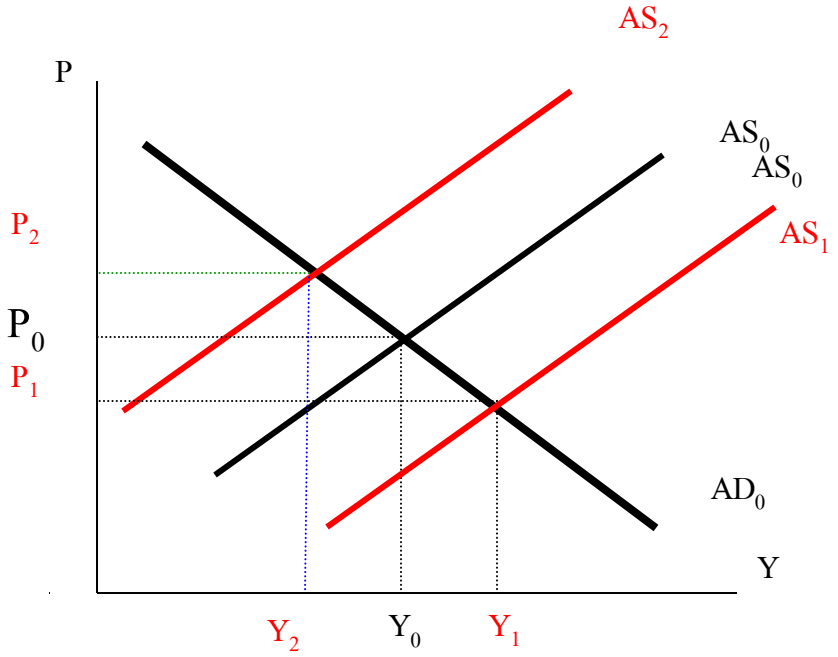
- **Can the AD-AS model account for these stylized facts?**
  - If you believe that your AD-AS story is right, the answer is yes.
  - To generate the qualitative pattern, our economy must be pre-dominantly driven by demand factor.

SUPPLY V.S. DEMAND SHOCKS

Demand shocks



Supply shocks



Positive correlation: output and inflation

Negative correlation: output and inflation