MACROECONOMIC THEORY PART 3: MEDIUM-TERM ANALYSIS

Kittichai Saelee
EE312
Thammasat university

STATE OF YOUR KNOWLEDGE: SHORT-RUN ANALYSIS

- Shocks can divert output from the long-term trend
  - **Either rise or fall; depending on whether the shock generates positive/negative impact**
- Deviation from the long-term level can be in conjunction with the rising/falling price and other macro aggregate variables
  - **Mechanism towards generating *business cycles vol*atility; big v.s. small impact, and *business cycles co-movements***
- We have studied these issues under two different contexts
  - ***Closed (IS-LM-AD-AS) v.s. opened economy (IS-LM-BP)***

REVISIT WITH THE EVIDENCE ON US BUSINESS CYCLES

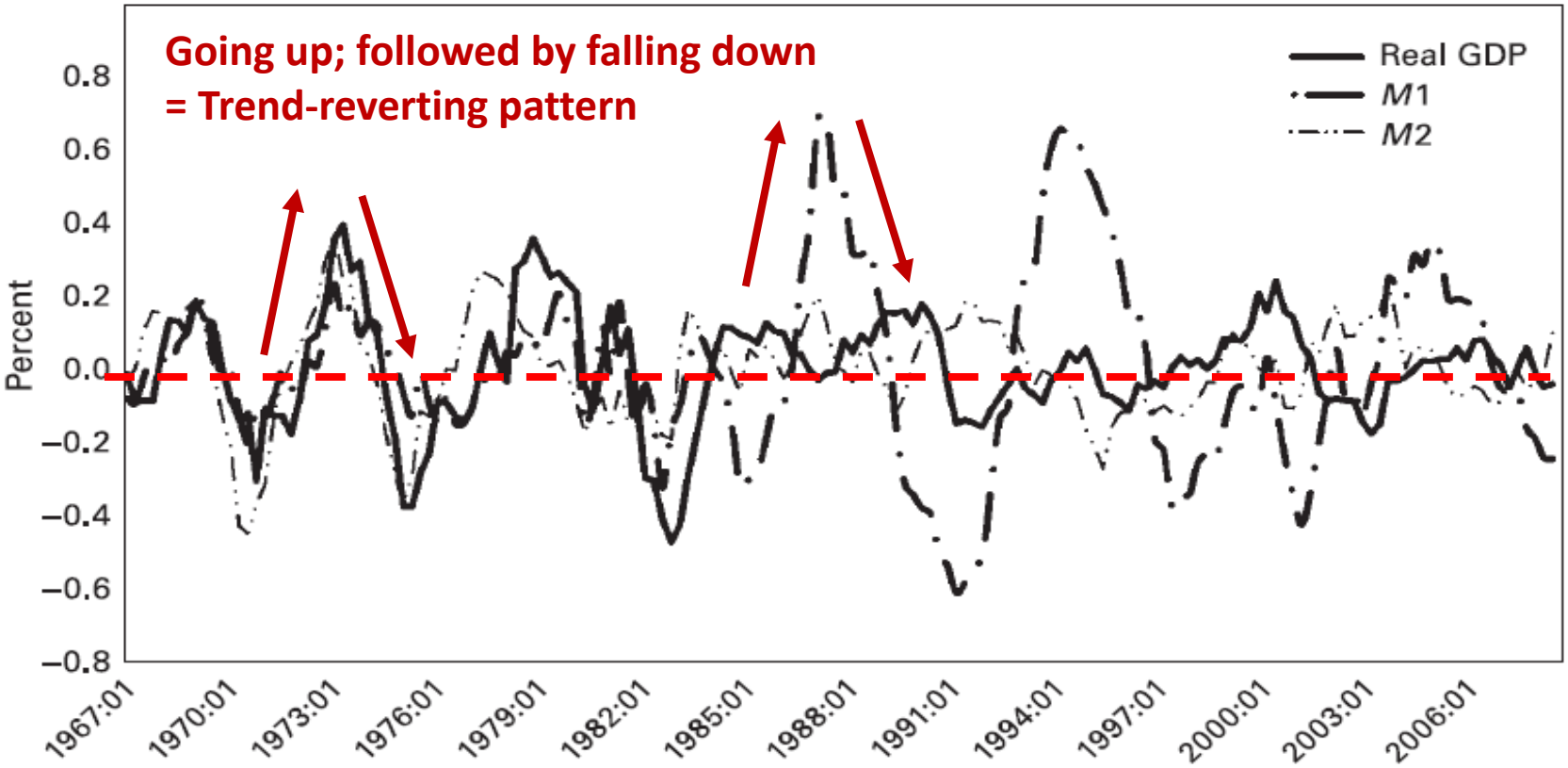
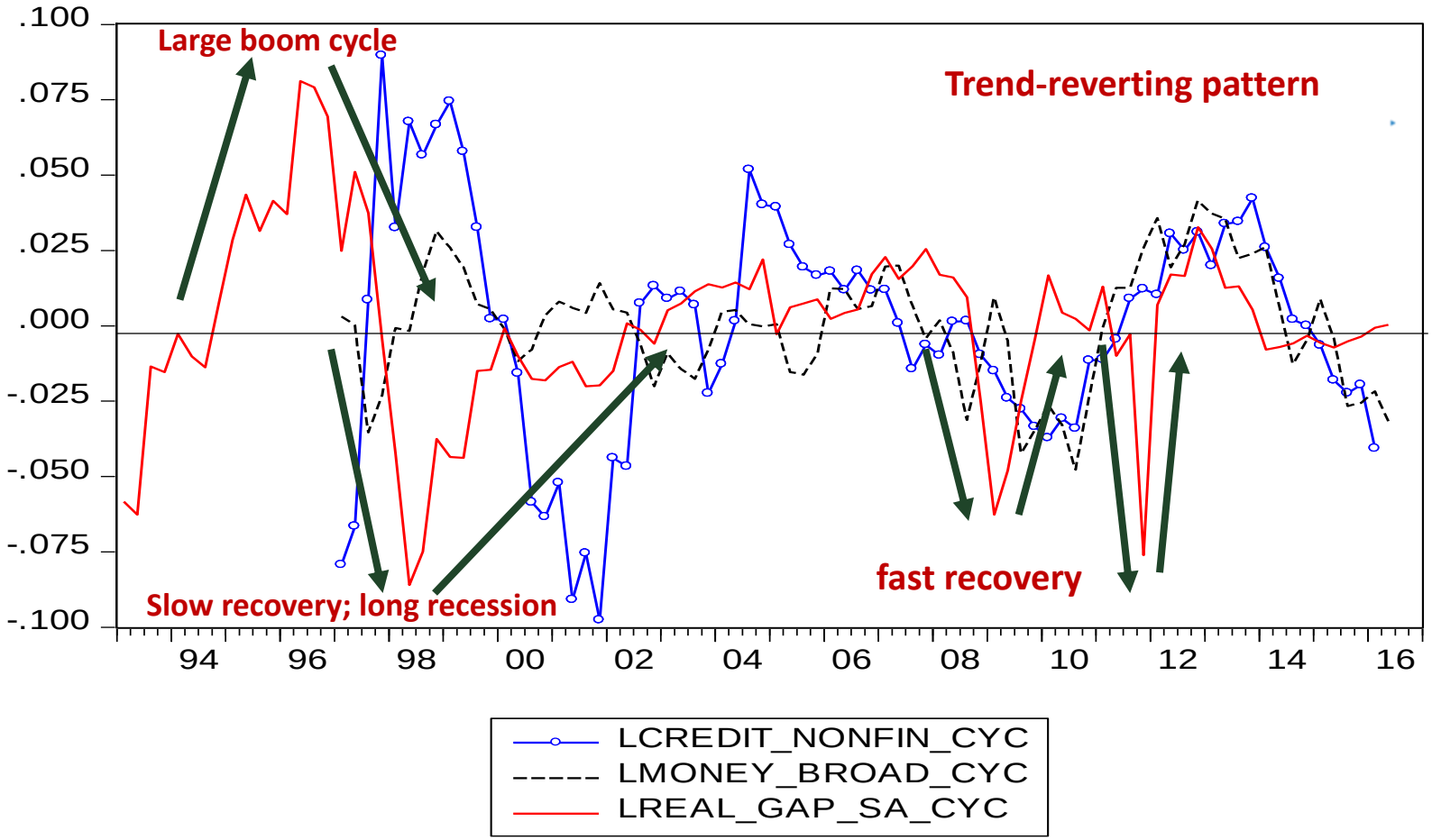


Figure 1.6
Detrended money and real GDP, 1967:1–2008:2.

Based on methodology of (Friedman and Schwartz (1965)
Source Walsh (2014)

REVISIT WITH THE EVIDENCE ON THAILAND BUSINESS CYCLES

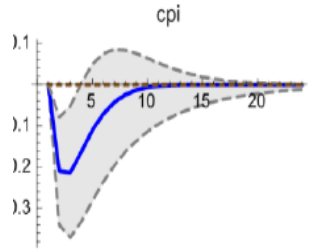


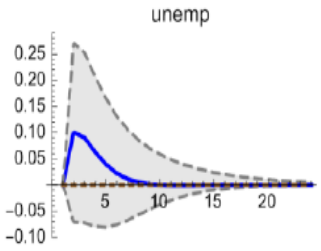
CAUSAL EFFECTS OF MONETARY POLICY: EVIDENCES IN USA

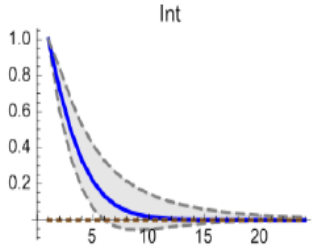
Source: Valerie Ramey (2016)

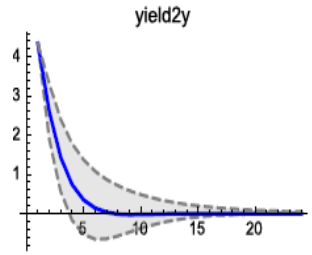
- Common findings:
- Shock: a surprise change in "FED fund rate" would *causally* led to
  - Higher unemployment rate
  - A decline in real economic activities
  - A falling in overall price.
- The effect lasts for several years.

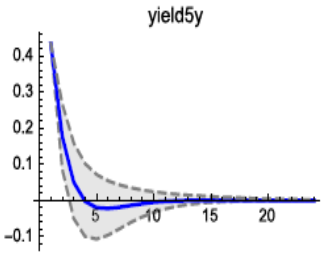
CAUSAL EFFECTS OF MONETARY POLICY: EVIDENCES IN THAILAND

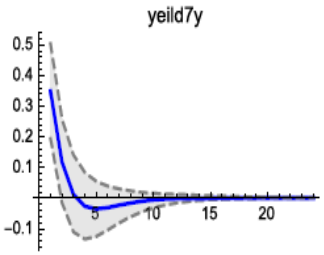


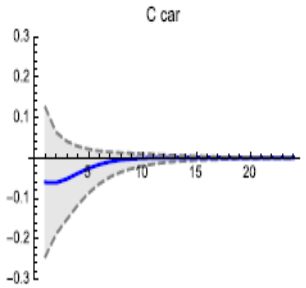


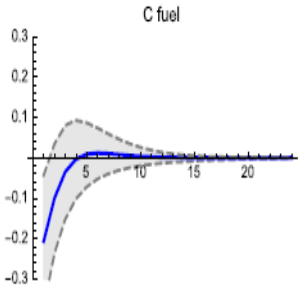


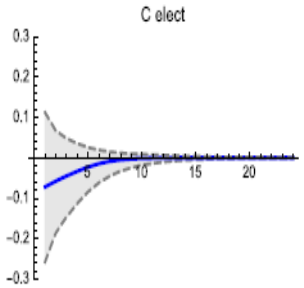


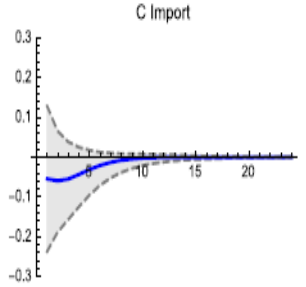


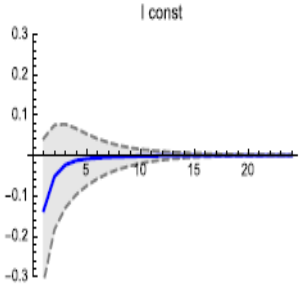


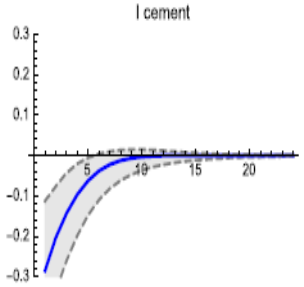












- Bernanke et.al (2005) "*Measuring the effects of monetary policy: FAVAR approach"*

- Sripinit (2017) for Thailand
  - CPI = Y-o-Y CPI inflation (monthly)
  - Unemp = Monthly unemployment rate
  - Int = Rp1day (daily average in each month)

- Offers similar findings!

Source: Sripinit (2017)

PART III: REDIRECT OUR FOCUS TOWARDS THE *MEDIUM-RUN ANALYSIS*

Part III *Business cycles and Economics fluctuations: Medium-term analysis (10 hours)*	
5. **Labor market, aggregate supply and Natural rate of unemployment (4 hours)** 5.1 Business cycle facts *and* medium-term adjustment 5.2 Foundation of aggregate supply 5.2.1 Labour market structure *and* modelling approaches 5.2.2 Long-run aggregate supply curve 5.2.3 Short-run aggregate supply curve *and* Institutional aspects 5.3 The Natural rate of unemployment *and* potential output	B. Ch. 7 M. Ch 14 Activities: Assignment 5 / Quiz 4 (Topic 4.3 onwards)
6. **Phillips curve, inflation and output dynamic, and Medium-run adjustment (6 hours)** 6.1 Phillips relation and History of Phillips curve 6.2 Keynesian interpretation 6.2.1 Trade-off and exploitation 6.2.2 Policy implications 6.3 Monetarist-based and New Classical interpretation 6.3.1 The mutation of Phillips curve: Critique to the Keynesian 6.3.2 Expectation-based Philips curve and derivation 6.3.3 Inflation expectation, Self-adjustment mechanism and Long-run Philips curve 6.3.4 Policy implications 6.4) New-Keynesian based interpretation 6.4.1 Critique to the New Classical Phillips curve 6.4.2 Theory of gradual adjustment a) Nominal and real frictions b) Labor market imperfection c) Coordination problem	*B. Ch 8 – Ch. 9 *M. Ch 14 *F. Ch 10 – Ch. 12

- What is **medium-run analysis** all about?
  - **Medium-run =** Trend-reverting process
  - The process that the economy returns to a level of output associated with the **natural rate of unemployment**, i.e. the **full-employment** or **potential output**
  - Commonly discussed in economics under the so called "***Theory of self-correcting mechanism***" or "***Medium-run adjustment***" or "***Theory of supply-side adjustment***"

MEDIUM-RUN ADJUSTMENT ANALYSIS

- The goal of the medium-run adjustment theorem is to answer the following points
  - **What determine the outcome on the supply side and Natural rate of unemployment (natural rate of output)**
    - Foundation of aggregate supply
    - Fundamental determination of the "natural rate" variables!
    - Practically, discuss about the way to measure it the so called "natural rate"
  - **Why shocks matter at the first place? (Particularly, demand-driven factor)**
    - Frictions or Barriers to the adjustment?
  - **Nature of adjustment process?**
    - What happen along the adjustment path; unemployment, wage, inflation etc.
    - Inflation and unemployment dynamic: Phillips relation? (Exists; policy implications?)
    - Speed of adjustment: Swift or fast? What determine the speed?

MEDIUM-TERM ADJUSTMENT ANALYSIS

- Understanding about the **natural rate of unemployment** appears to be commonly agreed.
  - Mainly about **structural factors / Long-term fundamental factors**

- However, economists view differently about the way medium-run adjustment occurs.
  - Why (at the first place), and thus how the economy reverts to the natural levels

School of thoughts	Frictions	Nature of adjustment
New classical	Information problem	Fast adjustment
New Keynesian	Nominal rigidities	Slow adjustment

OUTLINE FOR PART III

- Getting started with the detail understanding about labor market and aggregate supply; features and analysis
  - Getting to know about labor market activities: stylized-facts
  - Modeling labor market outcome: employment and unemployment
  - Foundation of aggregate supply
  - Introduce the concept of **natural rate of unemployment**
- Self-adjustment theory 1: New classical view
  - Inflation theory
  - Policy implications
- Self-adjustment theory 2: New Keynesian view
  - Gradual adjustment theory

Readings: Froyen: Ch 10 – Ch 12; **Blanchard: Ch 7** – Ch 9; Mankiw: Ch. 14

MEDIUM-TERM ADJUSTMENT THEOREM
SECTION 1: LABOR MARKET AND AGGREGATE SUPPLY FOUNDATION

Kittichai Saelee
EE312
Thammasat university

AGENDA

- **Labor market classifications: stylized-fact and dynamic**

- Theoretical frameworks to labor market outcome modelling

- The aggregate supply

- The Natural rate of unemployment

LABOR MARKET CLASSIFICATIONS

- **Working age population :** adult with 15 years above of age

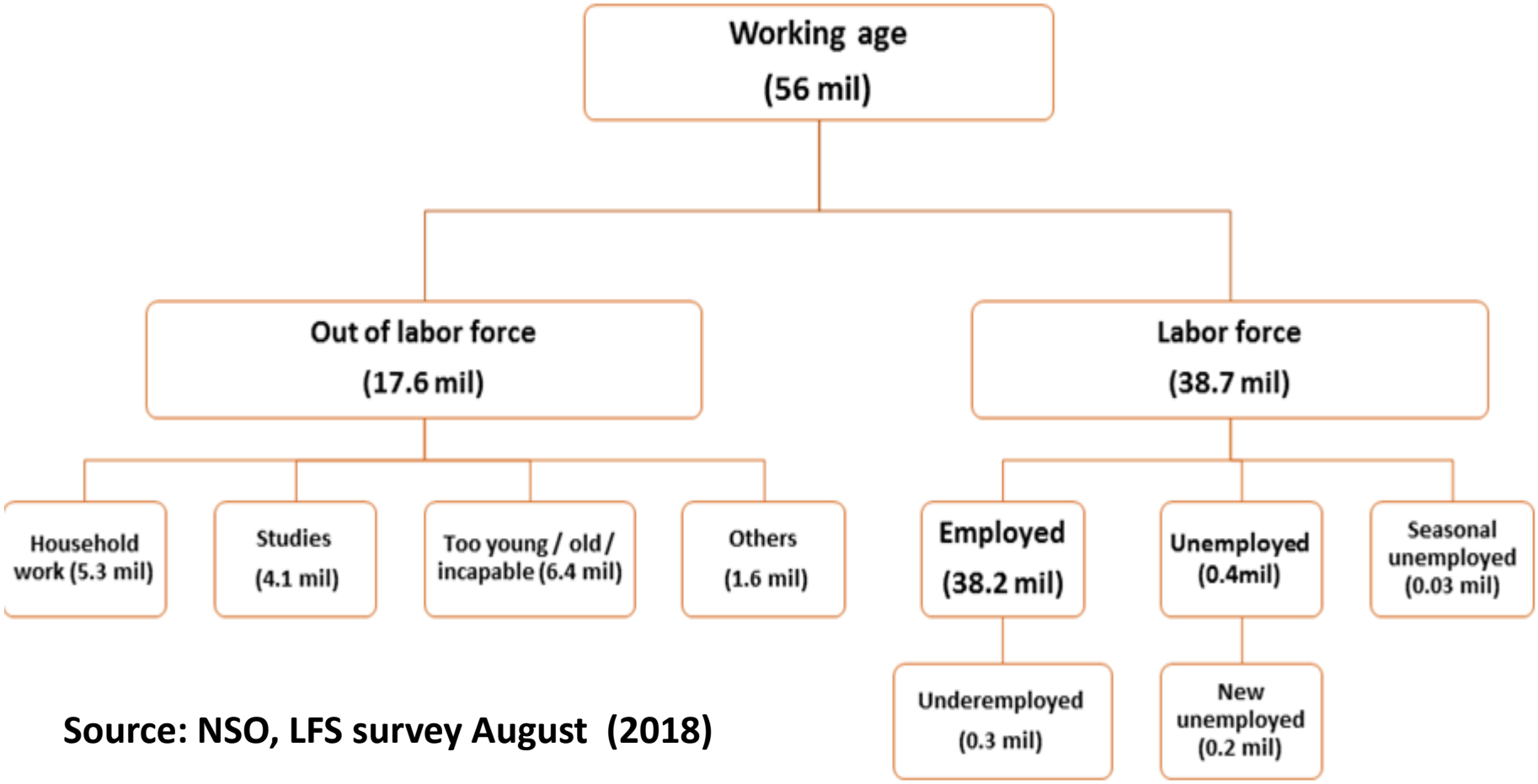
- The **labor force** is the sum of those either working or looking for work; collected from **survey**

- Those who are neither working nor looking for work are **out of the labor force.**

- The **labor force participation rate** is the ratio of the labor force to the working-age population.

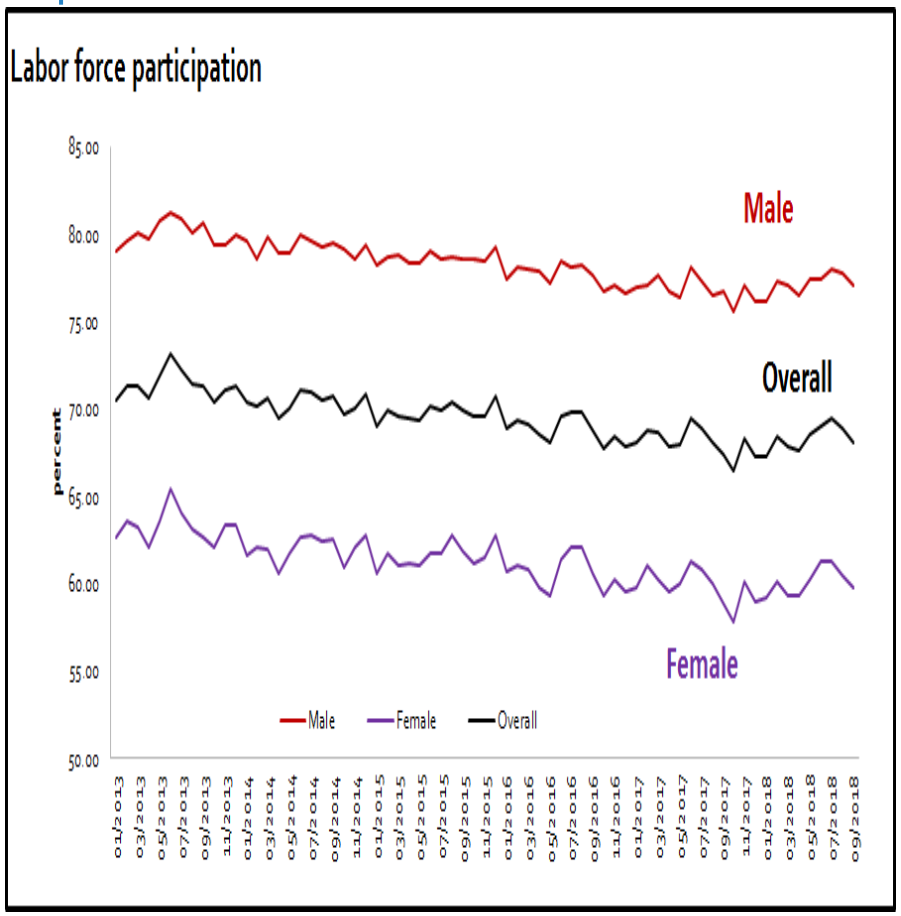
- The **unemployment rate** is the ratio of the unemployed to the labor force.

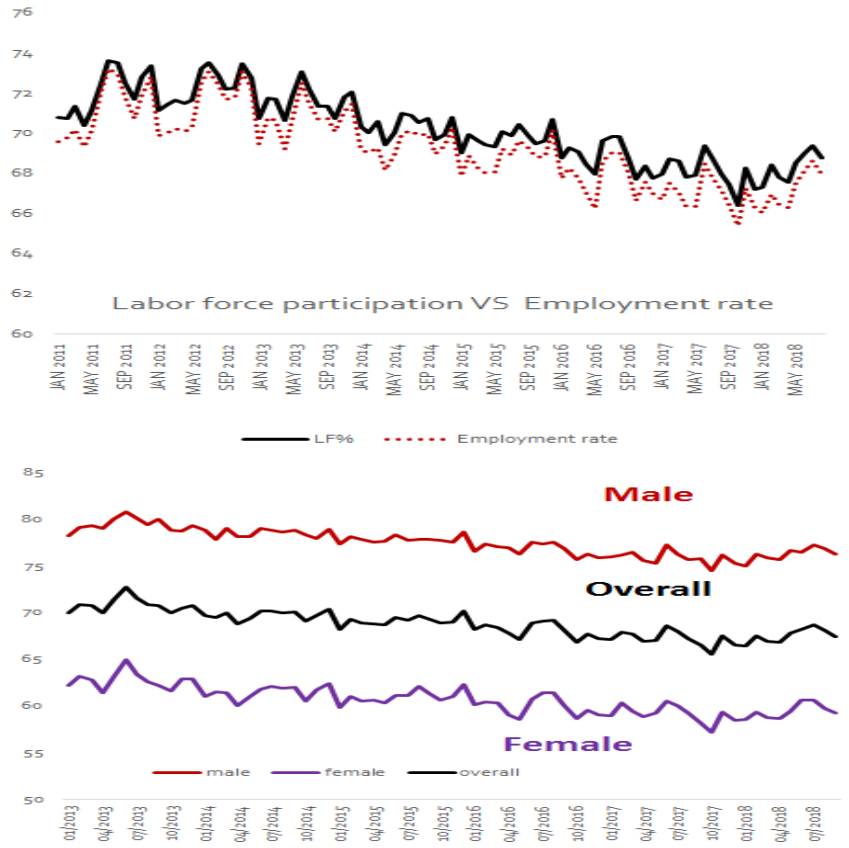
LABOR MARKET CLASSIFICATIONS



Source: NSO, LFS survey August (2018)

LABOR MARKET OUTCOME INDICATORS: LF RATE AND EMPLOYMENT RATE

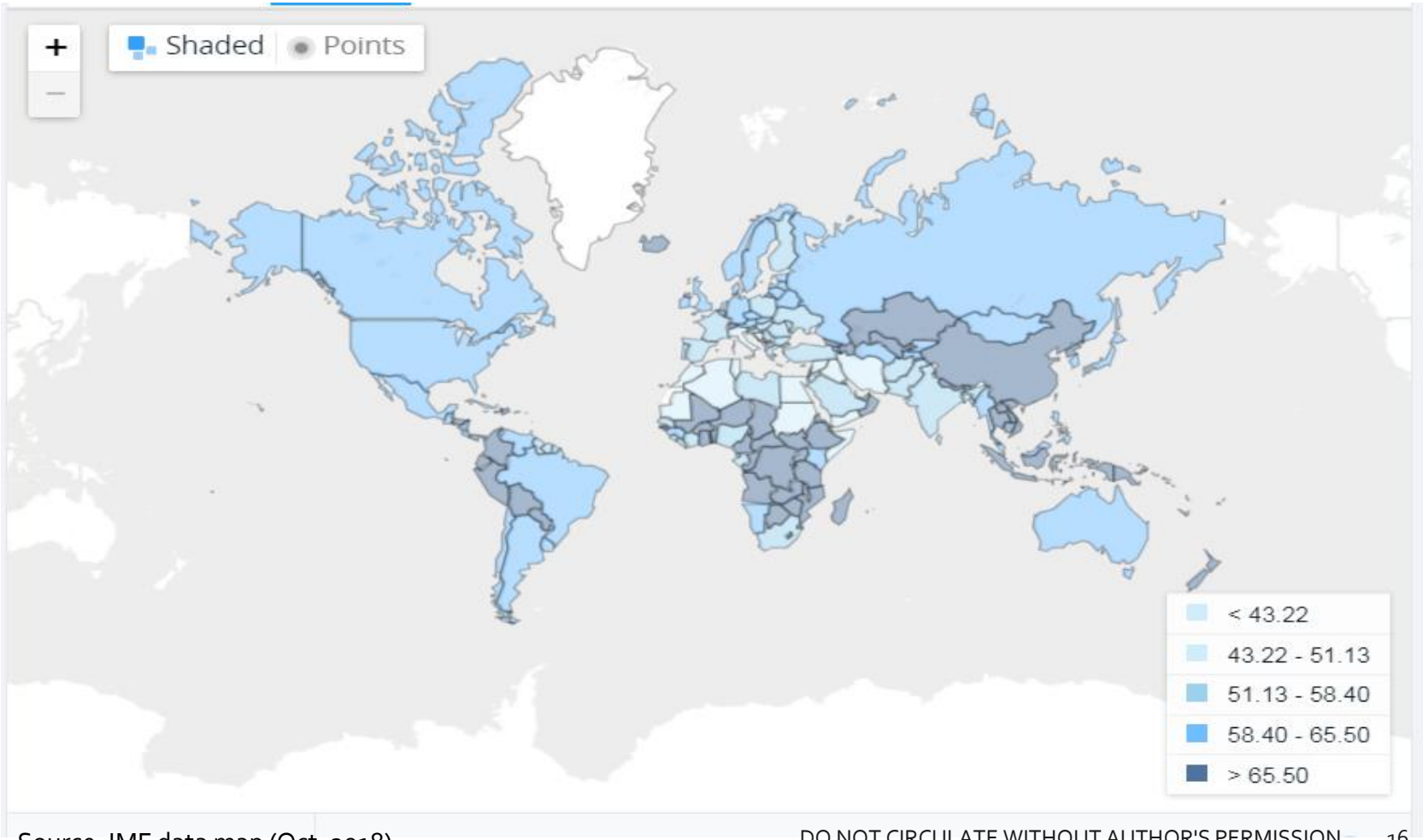




1. **Labor force participation** = Labor force / Pop > 15
2. Male participation rate is higher than that of female.

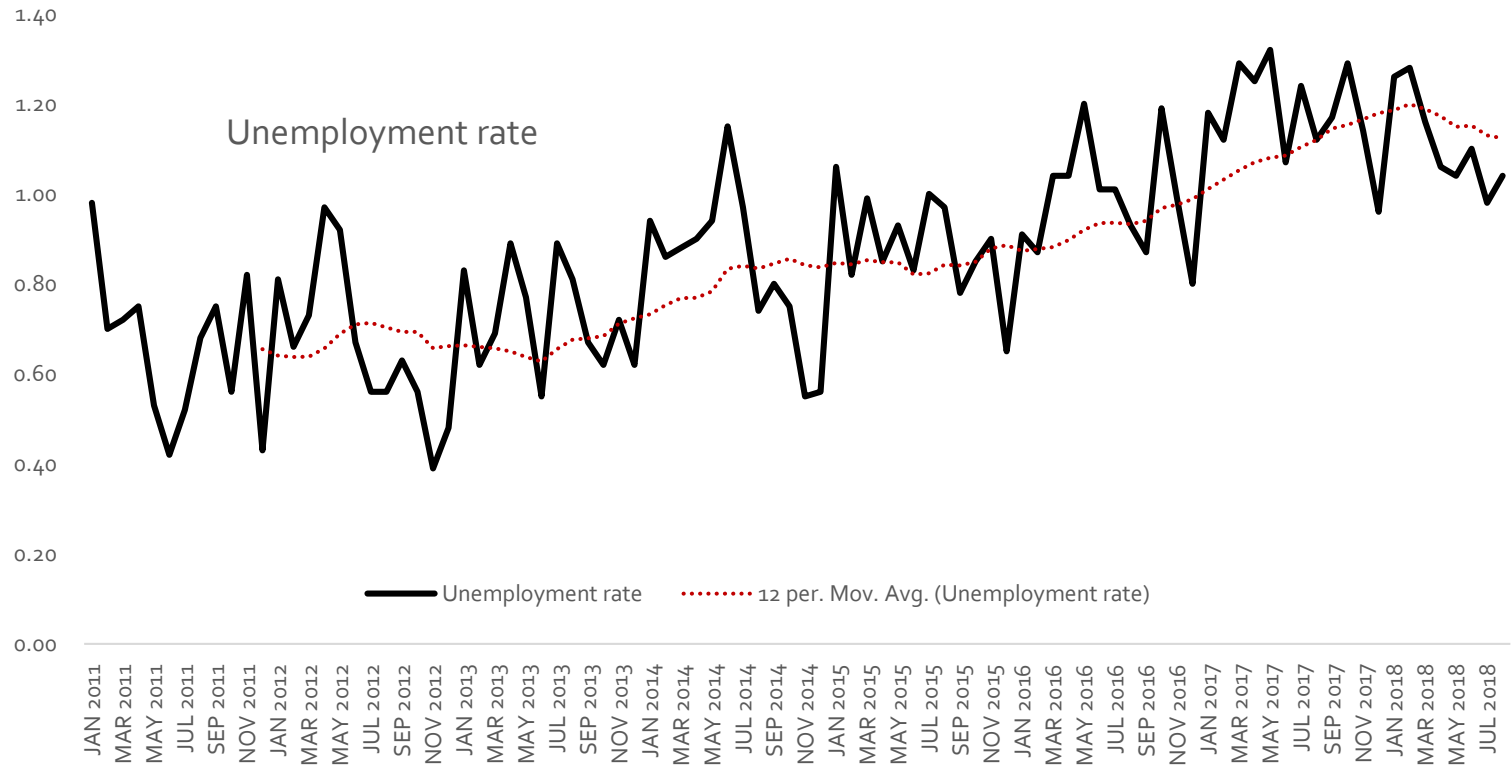
3. Employment rate = Employment / Pop > 15
= (Employment / Labor force) * LF participation rate
Female employment rate is due to lower female LF participation rate.

LABOR FORCE PARTICIPATION RATE AROUND THE WORLD



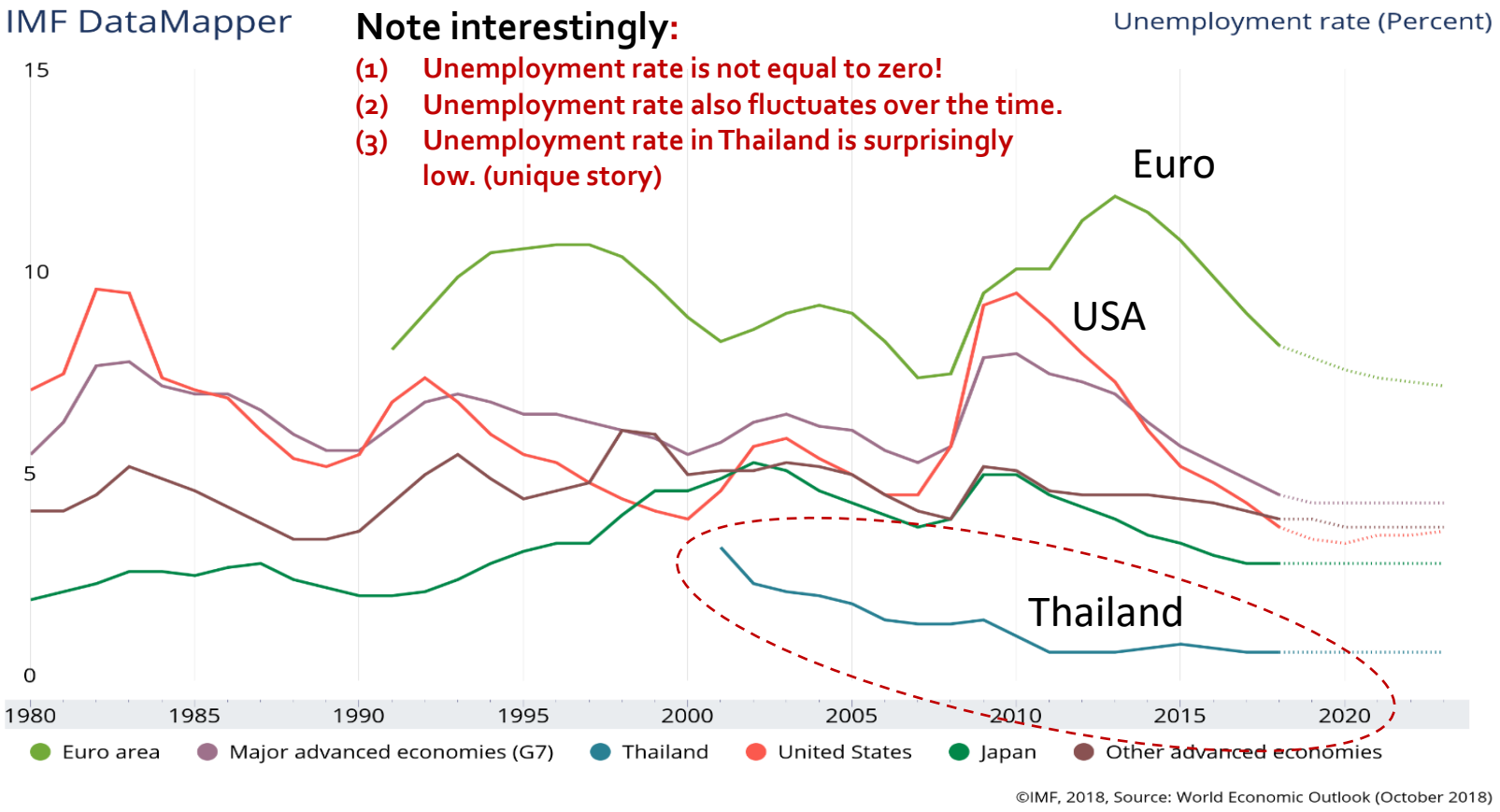
Source: IMF data map (Oct, 2018)

LABOR MARKET OUTCOME INDICATORS: UNEMPLOYMENT RATE



unemployment rate = unemployment / Labor force

UNEMPLOYMENT RATE AROUND THE WORLD



COMPONENTS OF UNEMPLOYMENT AND LABOR MARKET OUTCOME INDICATORS

- Average **NOT** equal to zero: long-run component → **Natural rate of unemployment**
  - Structural factors in the labor market!
  - More than that; differ across countries.

- Cyclical component: **rise and fall over business cycles**
  - Demand and supply;
  - Shocks

AGENDA

- ~~Labor market classifications: stylized-fact and dynamic~~

- **Theoretical frameworks to labor market outcome modelling**

- The aggregate supply

- The Natural rate of unemployment

TWO FRAMEWORKS FOR EQUILIBRIUM UNEMPLOYMENT MODEL

- Search-theoretic approach
  - Often called **Stock-flow approach**
  - Model labor market equilibrium as a result of **decentralized bilateral trade**

- Neoclassicial approach
  - Model labor market equilibrium as a result of **Walrasian auctioneer system**
  - Standard demand and supply

SEARCH-THEORETIC APPROACH TO LABOR MARKET OUTCOME

© The Nobel Foundation. Photo: U. Montan

Peter A. Diamond

Prize share: 1/3

© The Nobel Foundation. Photo: U. Montan

Dale T. Mortensen

Prize share: 1/3

© The Nobel Foundation. Photo: U. Montan

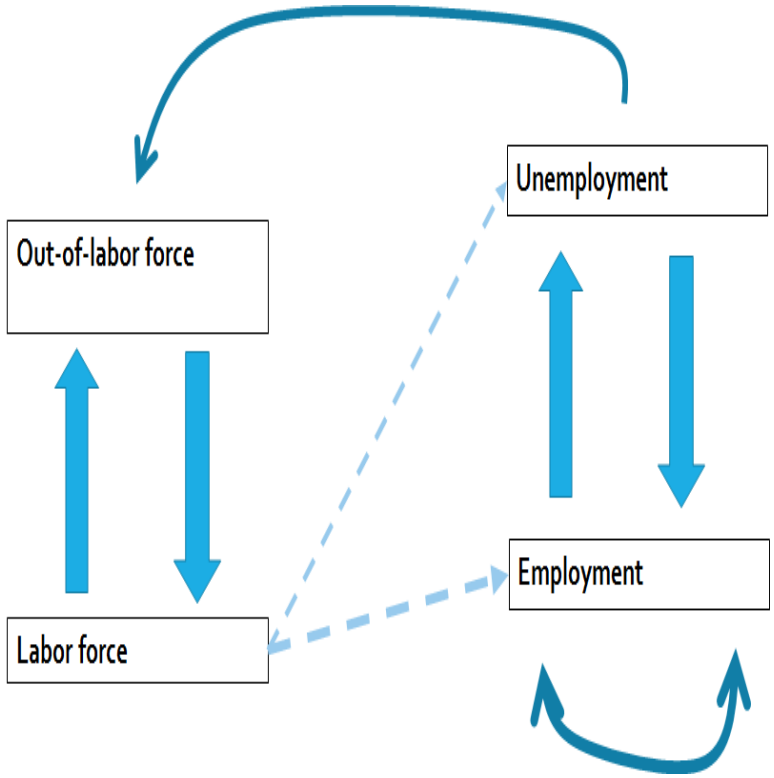
Christopher A. Pissarides

Prize share: 1/3

- Market with trading frictions: **Sellers and Buyers have difficulties to find each other..**
- Many markets are said to have trading frictions that impede the trading process.
  - Barter economy
  - Labor/Agri/Housing market
  - Bond/interbank/FOREX market
- DMP were awarded with the Nobel prize for better our understanding the nature and consequence of **trading frictions** on market allocations.

For the contribution on understanding the market with **"search frictions"**

LABOR MARKET AND ITS STOCK-FLOW DYNAMIC



Status new survey / Status	Employ(t+1)	Unemployed(t+1)	Out of labor force(t+1)
Employ(t)	Same job Switching to new job	Quits + Laid-off Job separation	Exit labor market
Unemployed(t)	New hired	Searching Haven't found a matched one.	Discouraged worker
Out of labor force(t)	Participate, and become a new hire	Searching Haven't found a matched one.	Not looking for a job.

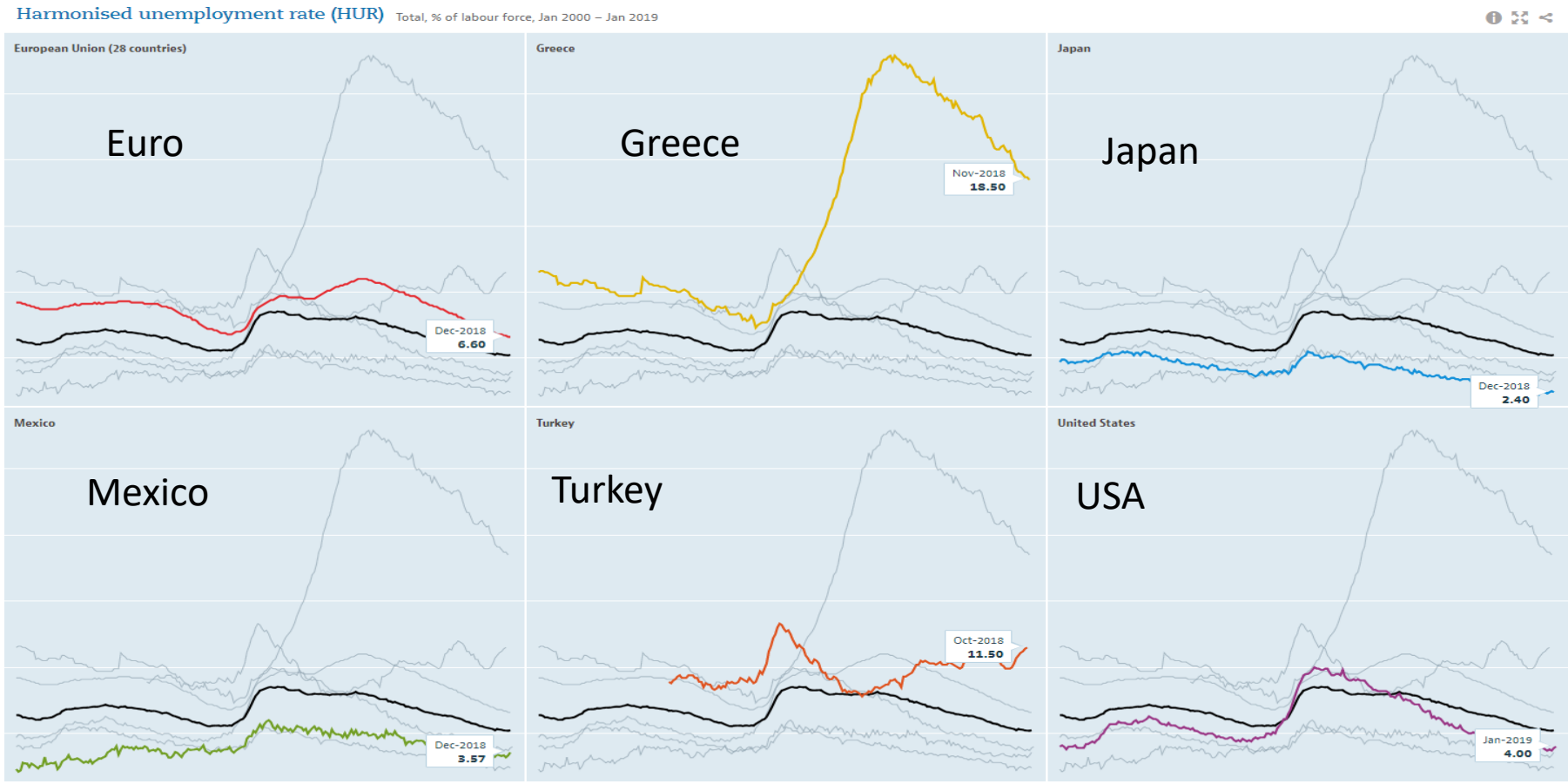
Transition dynamic

UNEMPLOYMENT RATE IS AN EQUILIBRIUM OUTCOME: SEARCH-MATCHING FRICTION

- Matching technology
  - How well is the education system serving the reallocation of workers across sector

- Bargaining power
  - Labor market tightness: Job-seeking worker to the Job-posting position
  - Firms productivity
  - Outside options; e.g. unemployment benefits and labor protection

AVERAGE UNEMPLOYMENT RATE



UNEMPLOYMENT DURATION (MONTHS; AVERAGE)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Average
Australia	10.8	11.2	10.9	10.7	9.3	9.0	7.9	7.6	7.5	8.2	8.5	8.6	8.4	9.5	10.1	10.6	10.7	**9.4**
Canada	3.5	3.7	3.7	3.6	3.5	3.3	3.2	3.2	3.6	4.2	4.3	4.2	4.2	4.3	4.0	4.1	4.1	**3.8**
Czech Republic	21.2	20.3	20.0	21.1	21.3	22.3	22.7	21.2	13.9	16.0	15.9	16.6	17.4	17.6	19.4	18.3	15.6	**18.9**
Finland	10.7	10.5	10.6	9.7	10.1	10.2	10.7	9.5	8.5	9.8	9.8	9.6	9.9	10.7	10.5	10.4	10.7	**10.1**
France	14.5	12.8	14.4	13.6	13.7	14.0	13.7	12.9	12.4	13.2	13.8	..	13.6	14.2	14.6	15.6	15.5	**13.9**
Hungary	15.9	15.8	15.6	16.5	16.0	16.4	17.2	17.8	16.3	17.7	17.7	17.4	17.6	18.2	18.1	18.1	16.0	**17.0**
Norway	3.5	4.0	4.3	4.9	5.0	6.5	5.3	4.2	5.1	6.2	6.4	6.3	6.0	6.4	6.4	7.4	7.9	**5.6**
Slovak Republic	15.4	23.7	24.0	23.9	28.2	34.3	33.4	31.3	23.6	27.1	28.8	30.5	31.7	29.6	31.5	29.1	30.2	**28.0**
Switzerland	14.1	13.8	11.9	13.7	16.2	18.1	19.5	18.8	14.4	15.7	19.2	16.9	15.7	16.9	17.2	17.4	17.1	**16.3**
United States	3.0	3.8	4.4	4.5	4.3	3.9	3.9	4.1	5.6	7.6	9.1	9.1	8.4	7.8	6.7	6.3	5.8	**5.8**

TWO FRAMEWORKS FOR EQUILIBRIUM UNEMPLOYMENT MODEL

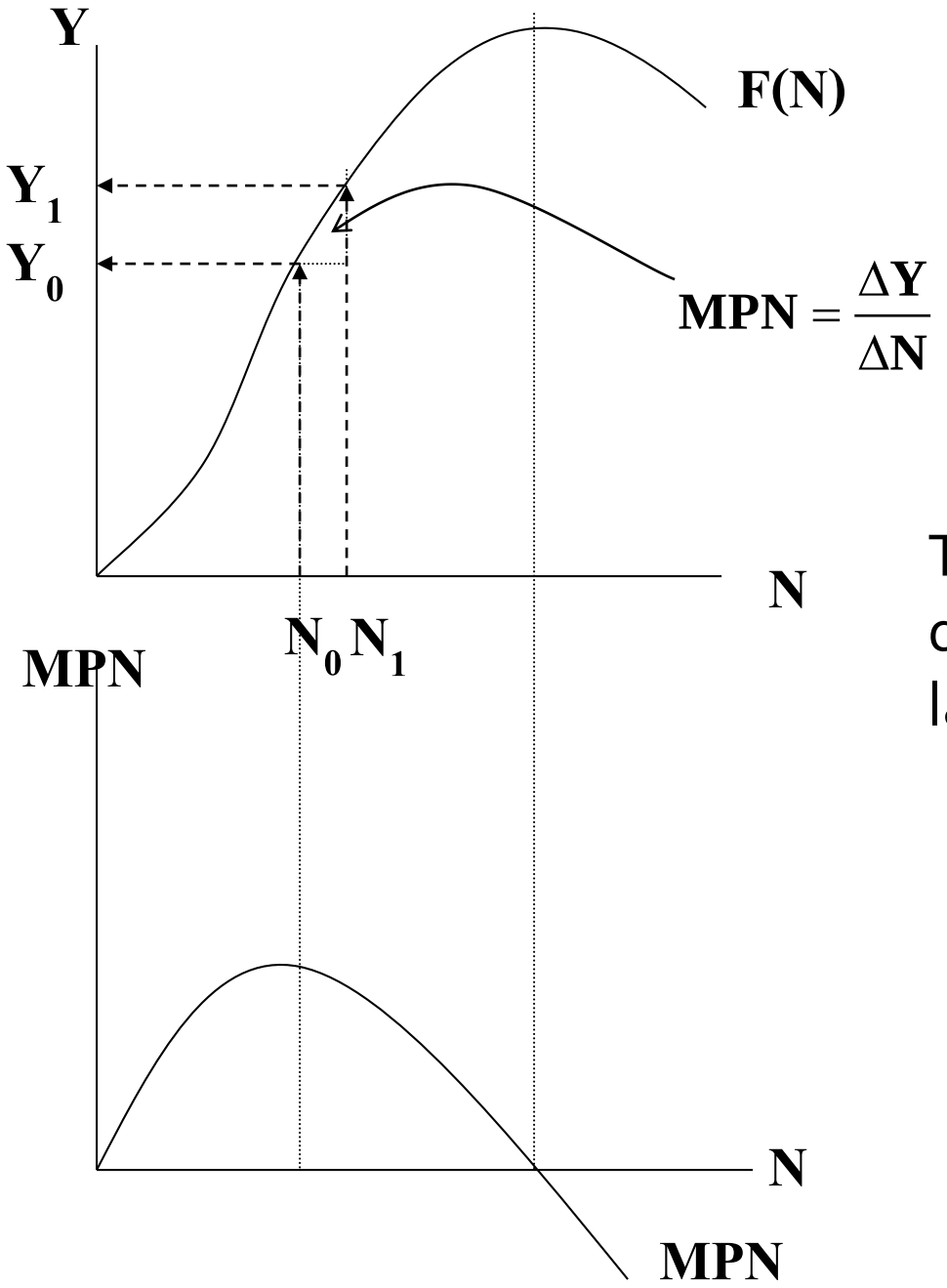
- Search-theoretic approach
  - Often called **Stock-flow approach**
  - Model labor market equilibrium as a result of **decentralized bilateral trade**

- Neo-classical approach
  - Model labor market equilibrium as a result of **Walrasian auctioneer system**
  - Standard demand and supply

THE NEOCLASSICAL APPROACH

- The theorem starts with explaining what firms do

- What is firm?
  - Own a **production technology**: Inputs transformed into output (Y)
  - Concept of **production function**: Y = F(K,N,z)
    - K = Capital, N = Worker, Z = level of technology
  - In short-run, firms' capital is fixed; output is mainly determined by labor (N)



- 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 workers (N)** that maximizes profit.

$$\pi = P * F(\bar{K}, \boldsymbol{N}, \bar{z}) - W\boldsymbol{N}$$

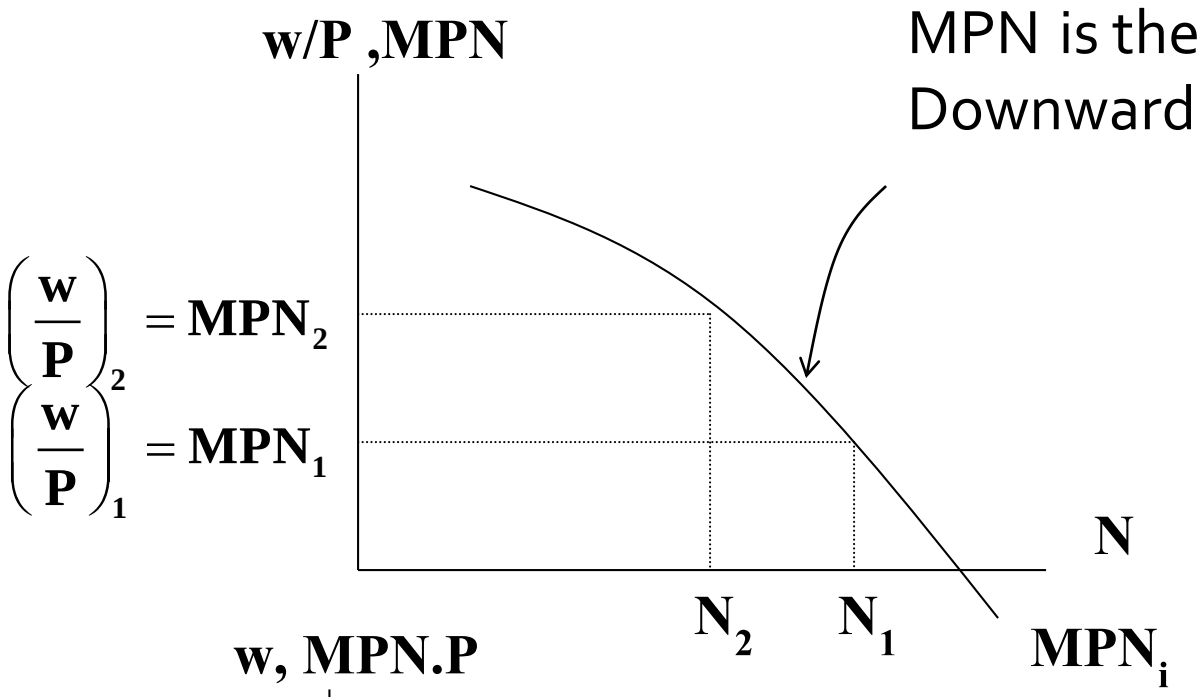
LABOR MARKET DEMAND

- Standard optimality condition indicates that the optimal workers hired can be given by
  - Firms hire workers using the real productivity rule

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

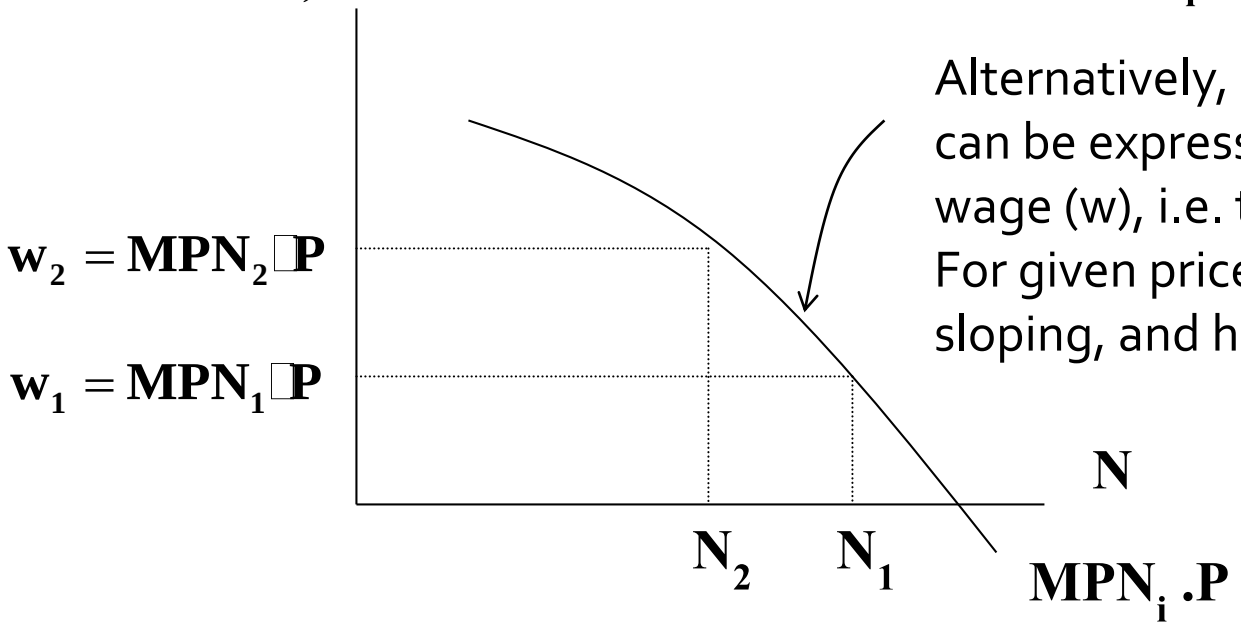
  - Firms hire workers using the nominal value of productivity rule

$$P * MPN = W$$



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.

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.**

CONSUMPTION-LEISURE MODEL

- Key features of consumption-leisure model

  - Households choose for two things: **consumption level (C) and leisure (L).**

  - Households posses a **preference set** defined over the **two-object bundles (C,L)**
    - Preference set allows households to compare the desirability over different bundles.

  - Economists assume that the ranking can be summarized by **utility function** or **indifference curve**

CONSUMPTION-LEISURE MODEL: UTILITY FUNCTION

- U = U(C, L),
  - where U = the utility function;
  - C = amount of consumption goods;
  - L = amount of leisure

- U(C1,L1) = level of utility derived from the **consumption bundle** of C1 and L1.

CONSUMPTION-LEISURE MODEL: PROPERTIES OF UTILITY FUNCTION

- **More is preferred to less.**
  - If U(C2,L2) > U(C1,L1), then U(C2,L2) is strictly preferred to U(C1,L1).

- **The consumer has preference for diversity in his/her consumption bundle.**
  - U (C2,L1) is preferred to U (C3,0).

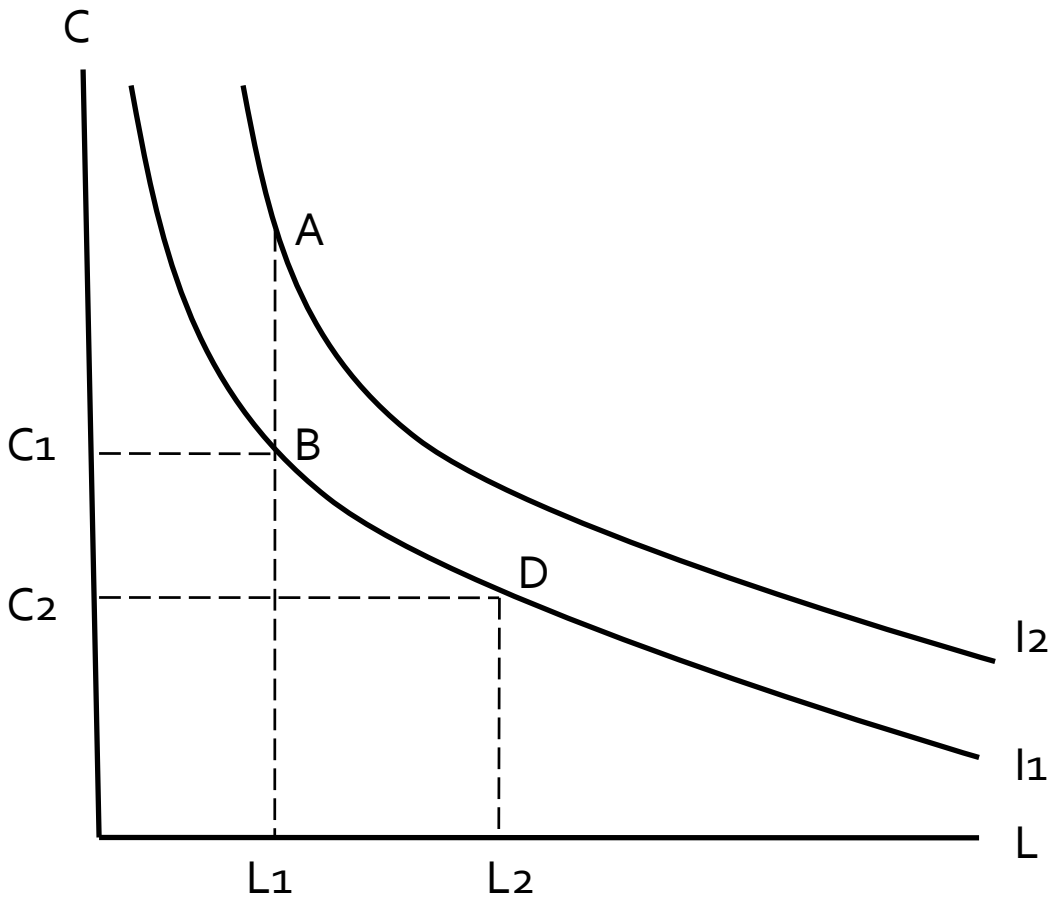
- **Consumption goods and leisure are normal goods.**
  - The consumer demands more as income rises.

CONSUMPTION-LEISURE MODEL: INDIFFERENCE CURVE

- **The indifference curve** (IC) gives different bundles of the two goods which the consumer is indifferent (equal utility).
  - '**More is preferred to less.**': ICs slope downwards.
  - '**Preference for diversity**': ICs are convex towards the origin.
- **The indifference map**: a set of ICs for the representative consumer.

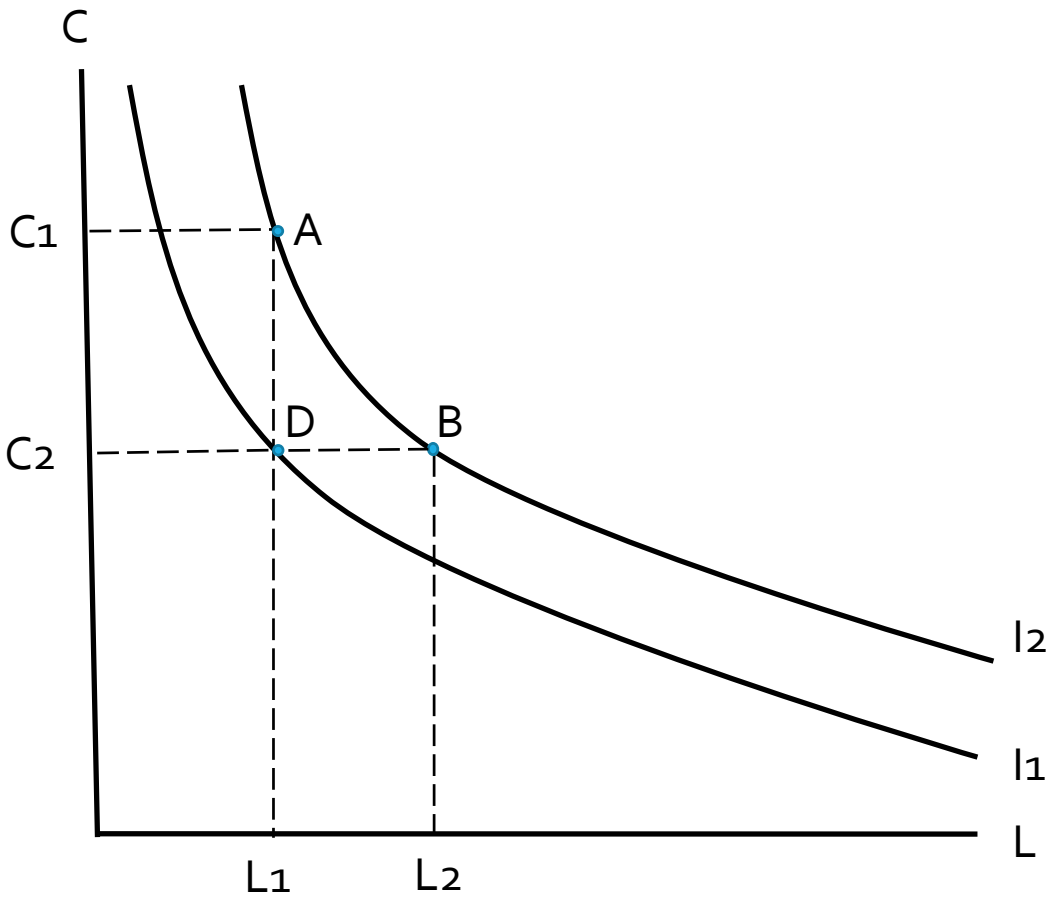
CONSUMPTION-LEISURE MODEL: INDIFFERENCE CURVE

- A is strictly preferred to B.
- The consumer is indifferent between B and D.



CONSUMPTION-LEISURE MODEL: TRADE-OFF RATE

- If C1 (at A) drops to C2 with the same L1, the consumer is on a lower I1.
- To get the initial I2 (with the same C2, raise L1 toL2 (at B).

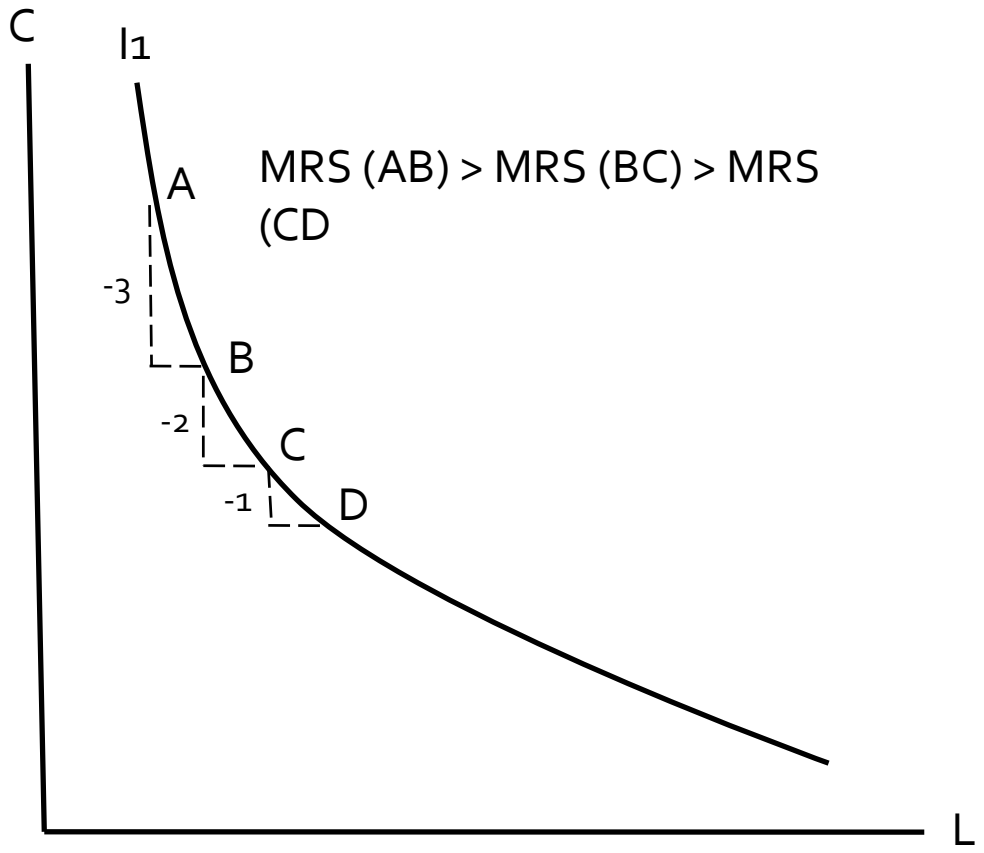


CONSUMPTION-LEISURE MODEL: TRADE-OFF RATE (AKA MRS)

- **The marginal rate of substitution of leisure for consumption goods ($MRS_{L,C}$)** is the rate at which the consumer is willing to substitute leisure for consumption goods.
  - The slope of the IC passing through a given (C, L).
  - Willingness to sacrifice given consumption for more leisure.
  - **$MRS_{L,C}$ is decreasing** as the consumer moves from consumption goods to more leisure.

CONSUMPTION-LEISURE MODEL: PREFERENTIAL TRADE-OFF RATE (AKA MRS)

- **From A to B**, the agent is willing to sacrifice 3 units of C for one unit of L.
- **From B to C**, 2 units of C is sacrificed for one unit of L.
- **From C to D**, one unit of C is sacrificed for one unit of L.



CONSUMPTION-LEISURE MODEL: BUDGET CONSTRAINT

- 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.

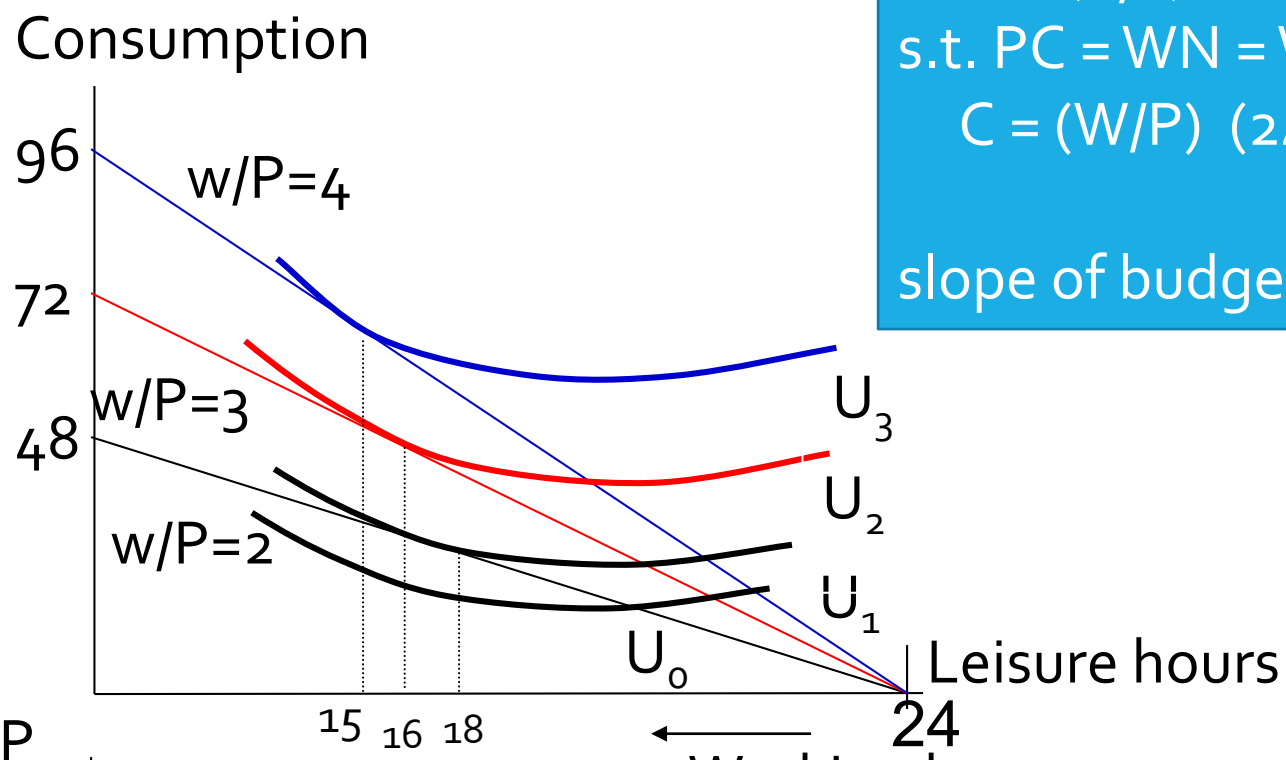
- Household is guided by preference or utility function. Each choose for **optimal C** and **optimal L** under the **constraint** that they face.

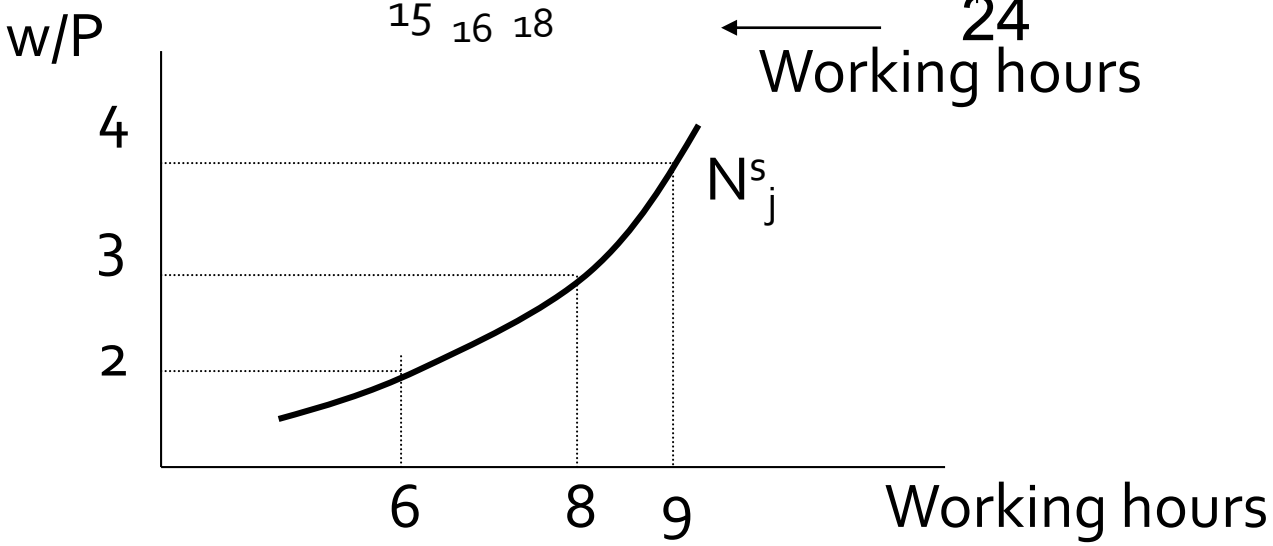
$$P*C = W*N = W*(24-L)$$

Consumption – Leisure problem

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

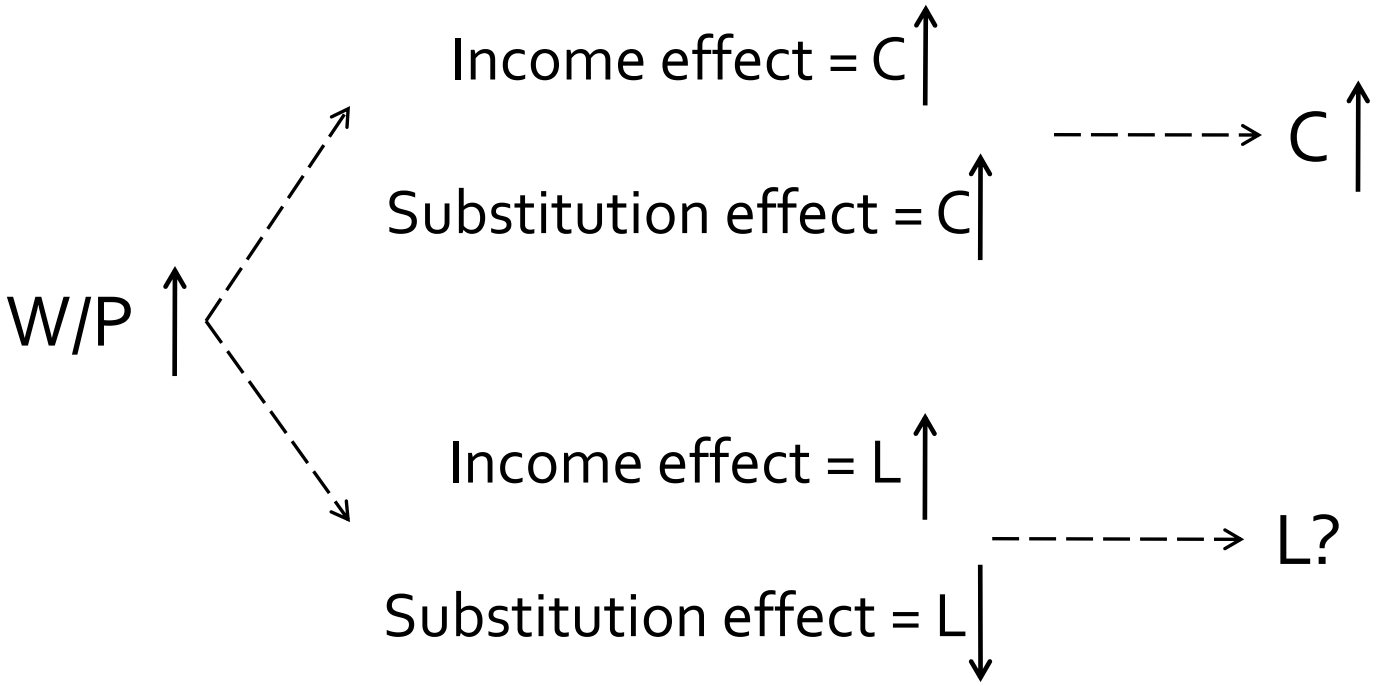
slope of budget line = W/P



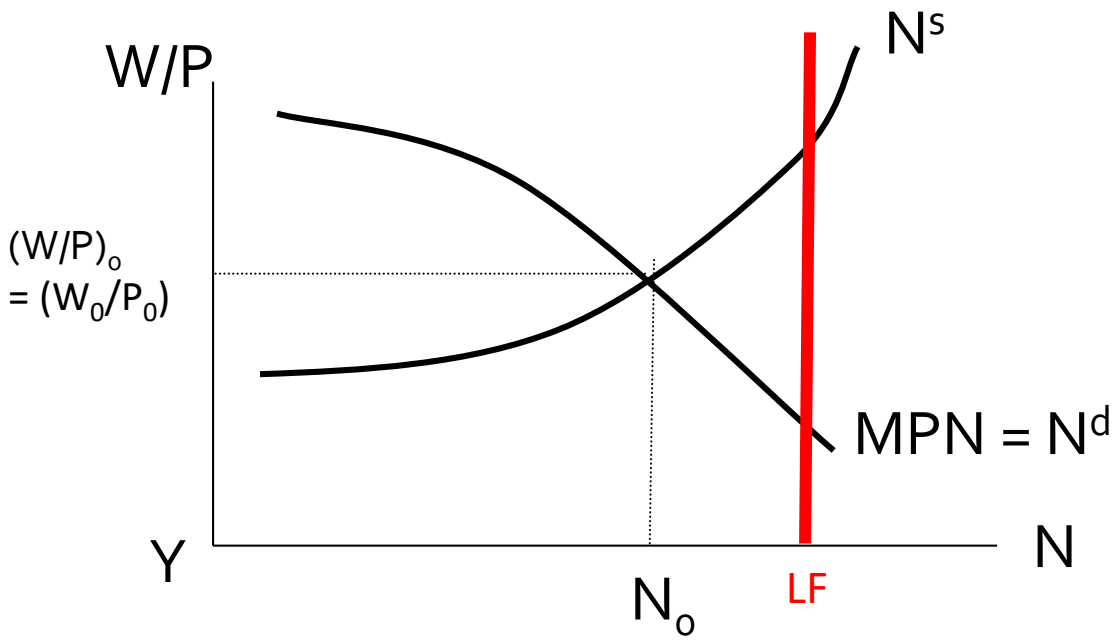


$$N^s = g\left(\frac{w}{P}\right)$$
$$(+)$$

CONSUMPTION-LEISURE MODEL: UPWARD SLOPING LABOR SUPPLY



Equilibrium of labor market and Unemployment rate



Suppose $(W/P)_0$ is the market-clearing real wage.
Assuming fixed labor force (LF)
Unemployment rate = (LF-No)/LF

Following the Neo-classical model, unemployment rate is determined by fundamental drivers of demand and supply for labor.

AGENDA

- ~~Labor market classifications: stylized-fact and dynamic~~
- ~~Theoretical frameworks to labor market outcome modelling~~
- **The aggregate supply**
- The Natural rate of unemployment

AGGREGATE SUPPLY

- Given that we observed the labor market outcome, each firm chooses their level of production.

- The resulting aggregate output can be determined, and the aggregate supply

- **Aggregate supply:** relationship between total output and price.

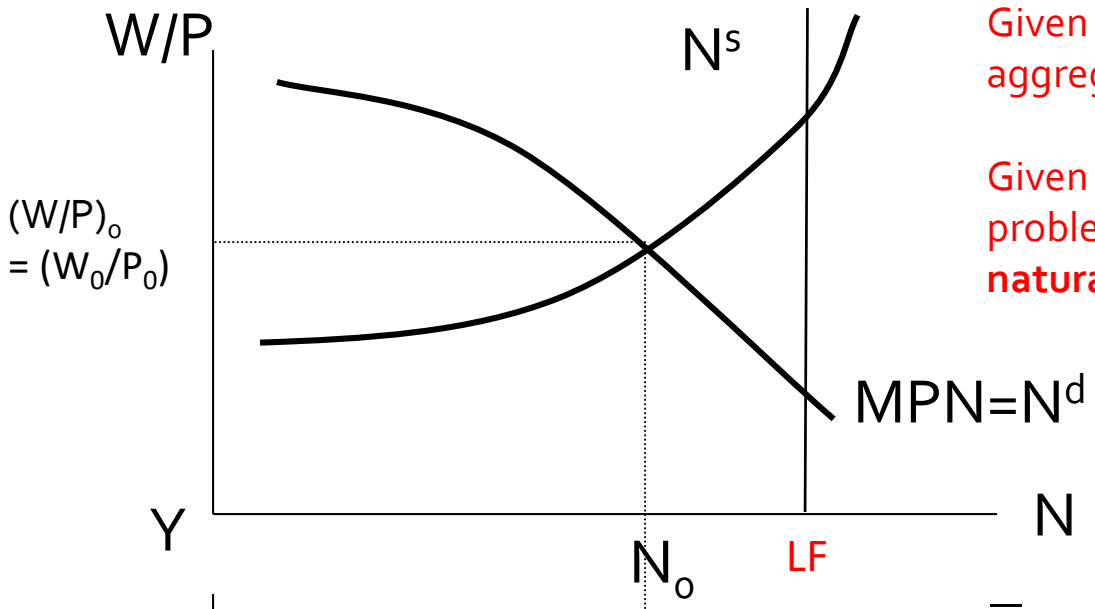
AGGREGATE SUPPLY: LONG-RUN

- The long-run aggregate supply

- **Definition:** the level of aggregate supply when
  - There is flexible price and wage adjustment (no nominal frictions)
  - There is NO information problem (perfect/complete information)

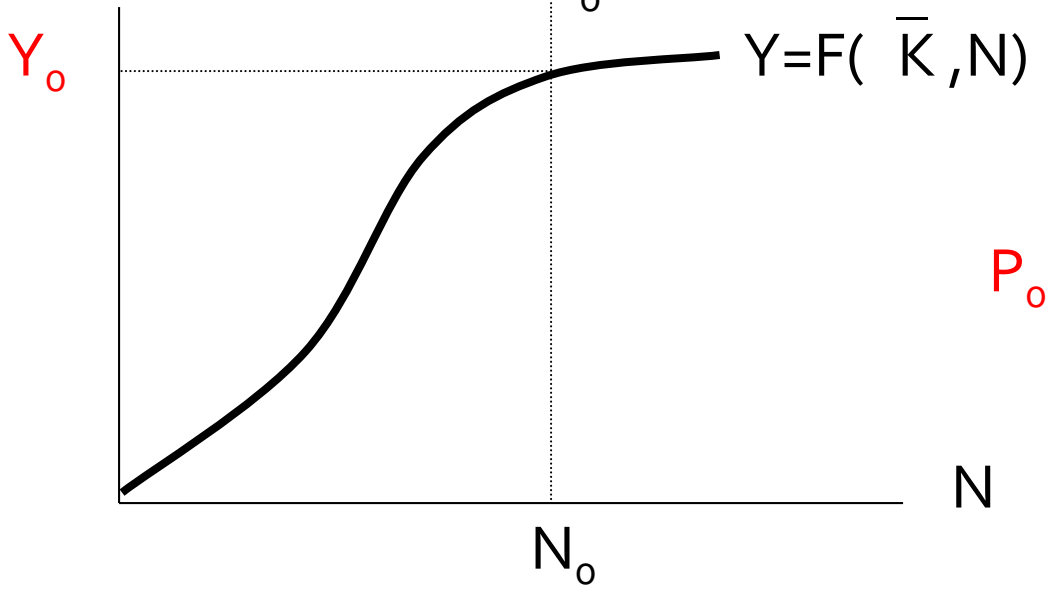
- The supply is a **vertical line**

Equilibrium of labor market and Aggregate supply

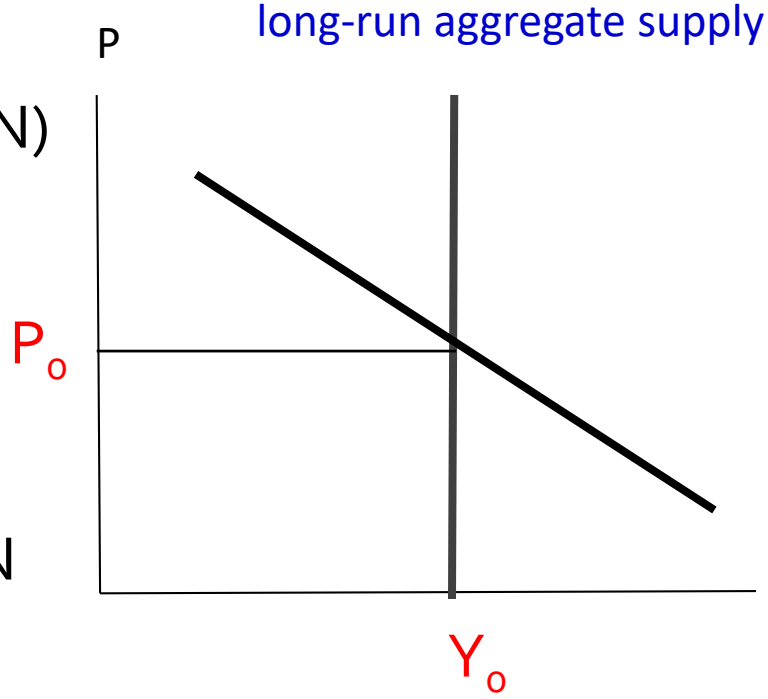


Given the equilibrium labor employment, aggregate output can be determined.

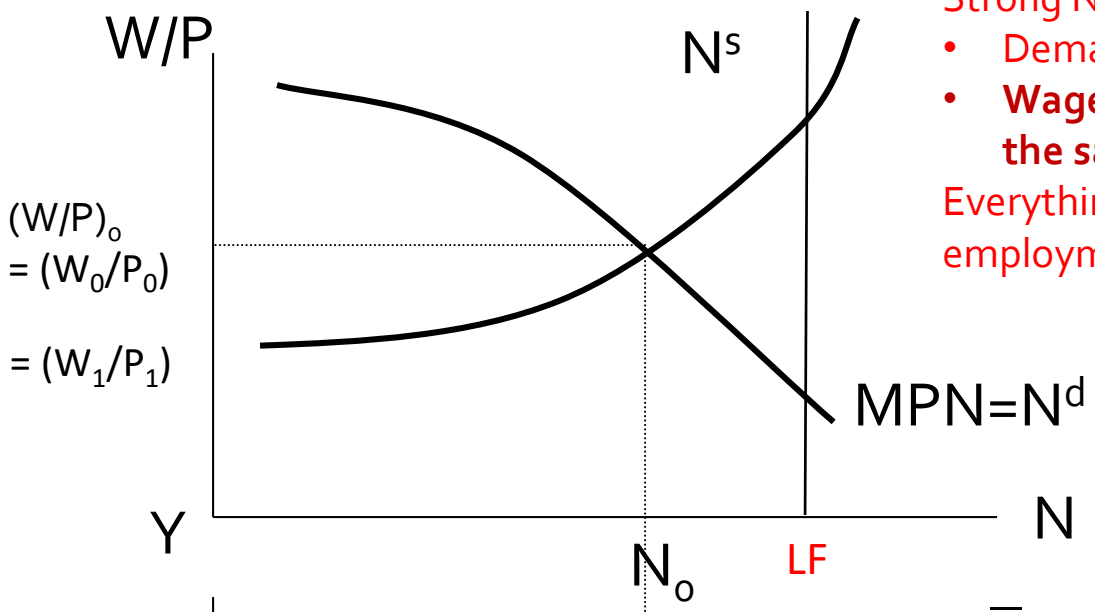
Given no nominal frictions and information problem, economist defines the No, Yo as **natural rate of employment and output.**



long-run aggregate supply



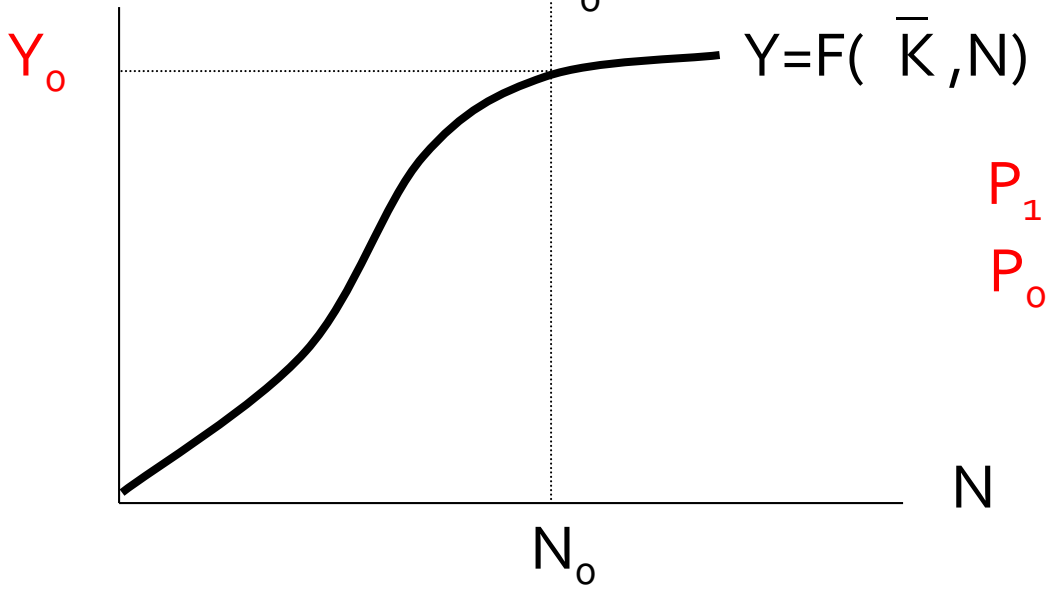
Equilibrium of labor market and Aggregate supply



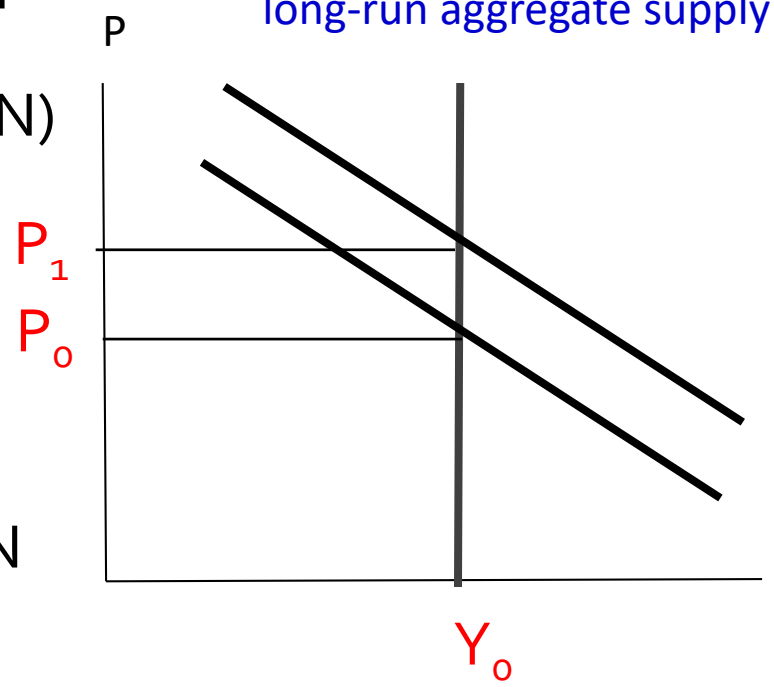
Strong Neutrality result = Classical Dichotomy

- Demand does NOT matter to real variables.
- **Wage and price rise proportionally, leaving the same real wage.**

Everything the same, and hence the total employment and output



long-run aggregate supply



FUNDAMENTAL DRIVERS TO NATURAL RATE OF UNEMPLOYMENT

❑ Market structure

- Monopoly power of firm (Big firm) → lower demand → rising natural rate
- Monopoly power of labor (union) → lower supply → rising natural rate

❑ Firm's productivity

- Productivity slowdown → less job posted → rising natural rate

❑ Institutional aspects

- Stronger labor law → affect recruiting cost of firm → lower recruitment → rising natural rate
- Generous unemployment benefit (size/duration) → Less incentive to look for job → affect supply for labor → rising natural rate

CRITIQUES TO THE NEOCLASSICAL APPROACH

- Prediction does not match with evidences: **demand shocks matter**
- Deep down: **The assumptions do not fall in line with reality.**
  - In the reality, **each party talks and negotiates in nominal term.**
  - Moreover, **nominal wage contracting** is preset at least a period in advance.
  - Given institutional aspects, **the case of real-wage contract (with full indexation) is hardly found**; **the case for nominal wage contract is mostly observed.**

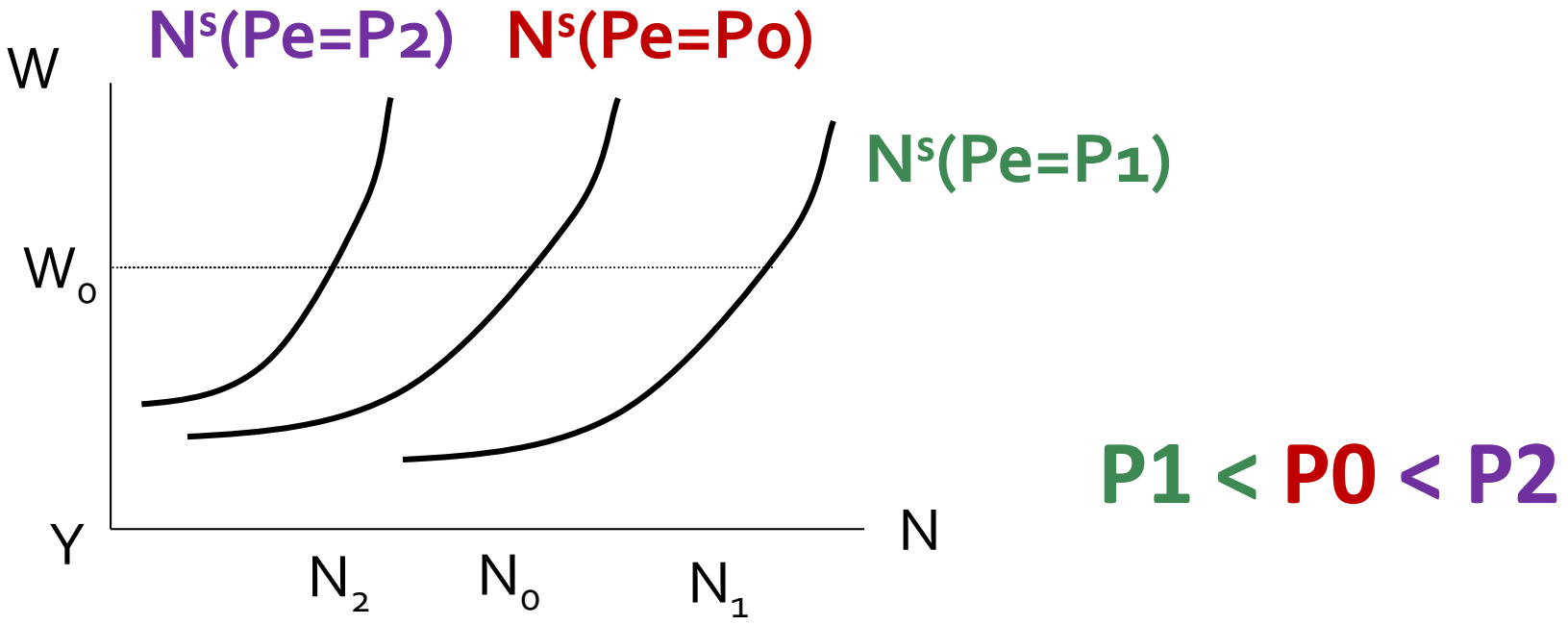
RESPONDING TO THE CRITIQUES: EXPECTATION-DRIVEN LABOR SUPPLY AND AGGREGATE SUPPLY

- Introduce a notion of *"expectation-driven or expectation-augmented labor supply (aggregate supply)"*

- Idea: despite that they don't quote in real wage, each party has their own "**expectation of price"** in their mind, and negotiate accordingly

- Workers have pre-committed to a nominal contract wage contract (variable rate), given an expected level of price.
  - **The labor supply is an upward sloping in nominal wage, but varied with respect to the changing in expected price level.**

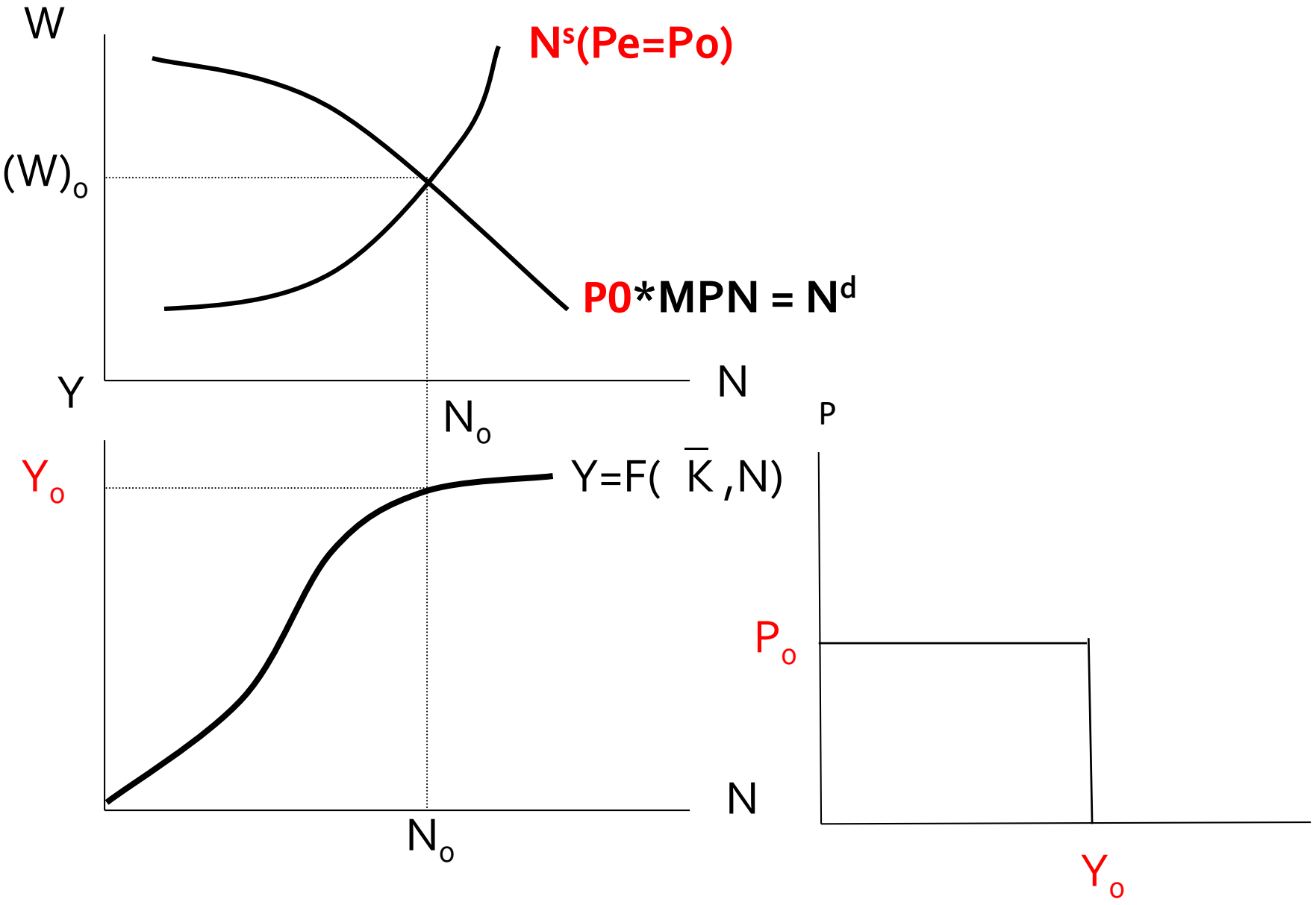
Labor supply with price expectation and pre-committed wage setting



P1 < P0 < P2

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 expectation-based production level

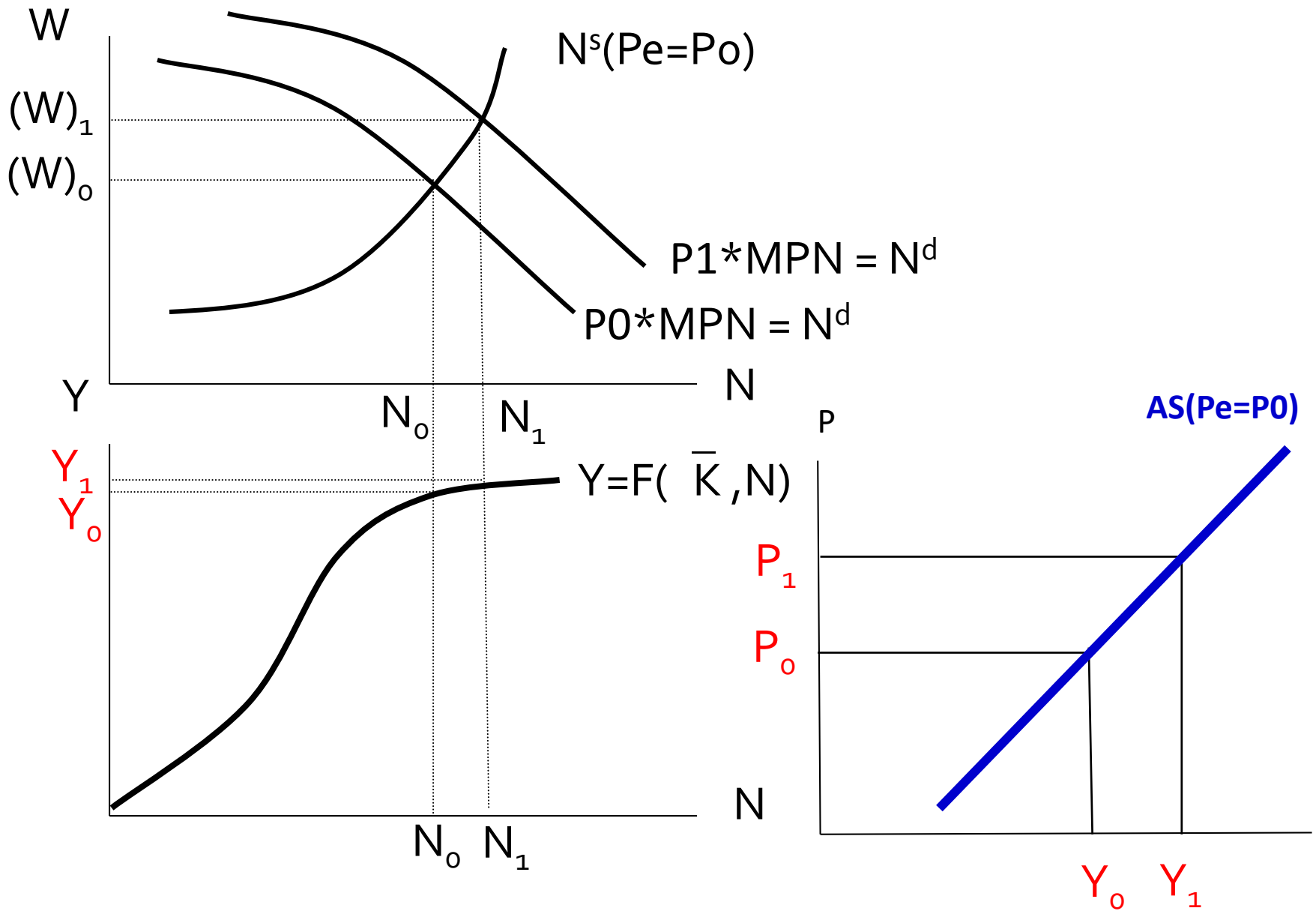


EXPECTATION-DRIVEN AGGREGATE SUPPLY

- In the short-run, the aggregate supply is **NOT** always equal to Yo, **due to the "price surprise"!**
  - The aggregate supply depends on the **"actual price"** and the **"expected price"**

- Suppose that actual price **is higher than** the expected price.
  - Firms will hire more worker as wage cannot catch up along with.
  - Firms get more profit, and hence produce more

Equilibrium of labor market and expectation-driven Aggregate Supply



MODERN INTERPRETATION OF SHORT-RUN AGGREGATE SUPPLY: LUCAS SUPPLY CURVE

Robert Jr. Lucas
Nobel Laureate 1995

- **Traditional interpretation**

$$y_t = f(p_t, others)$$

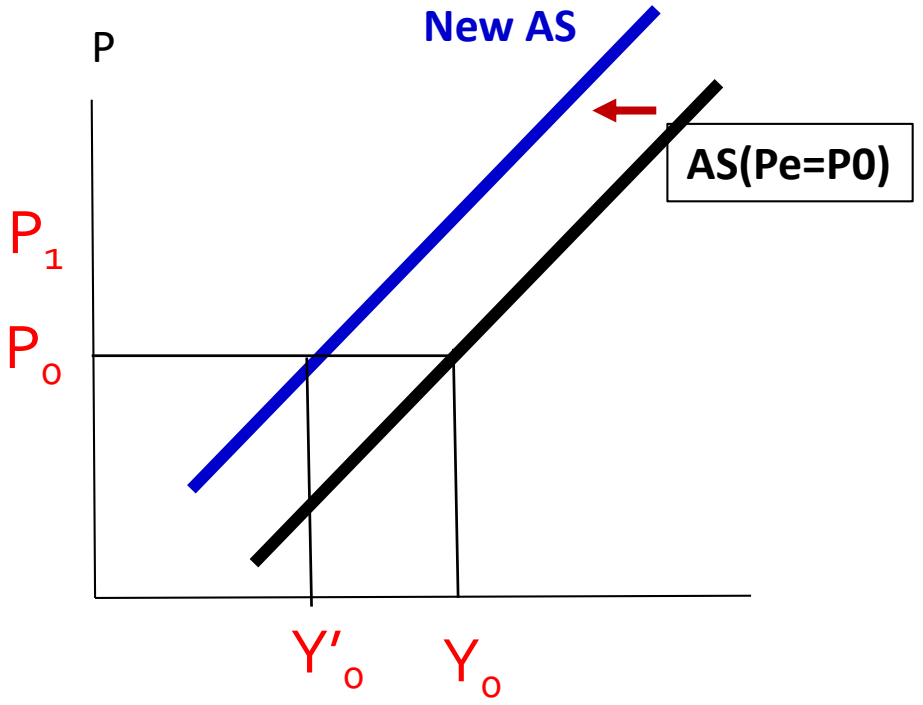
- **Modern interpretation**

$$y_t = f(\boldsymbol{p_t - p_t^e}, others)$$

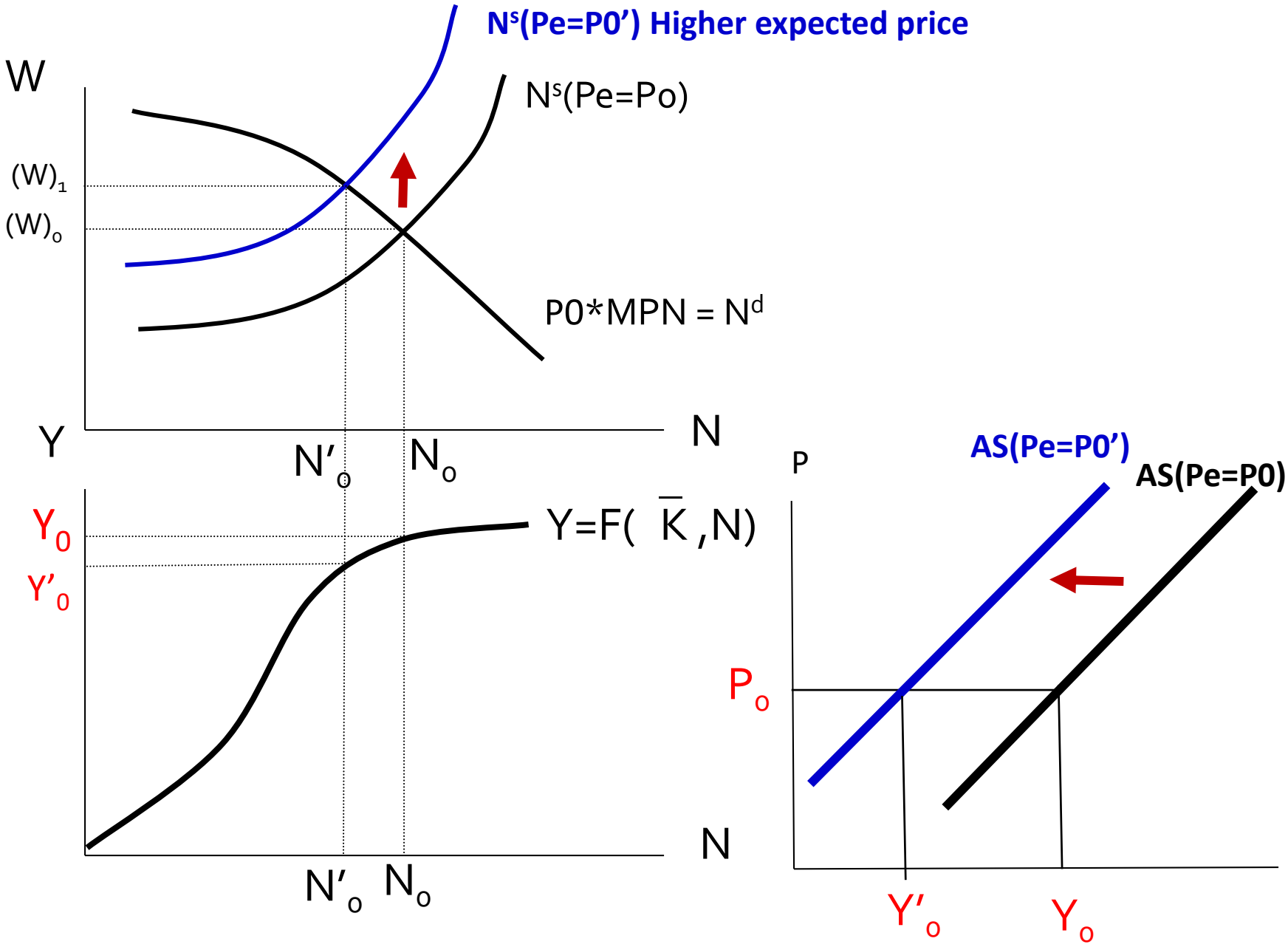
EXPECTATION-DRIVEN AGGREGATE SUPPLY: DETERMINANTS

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

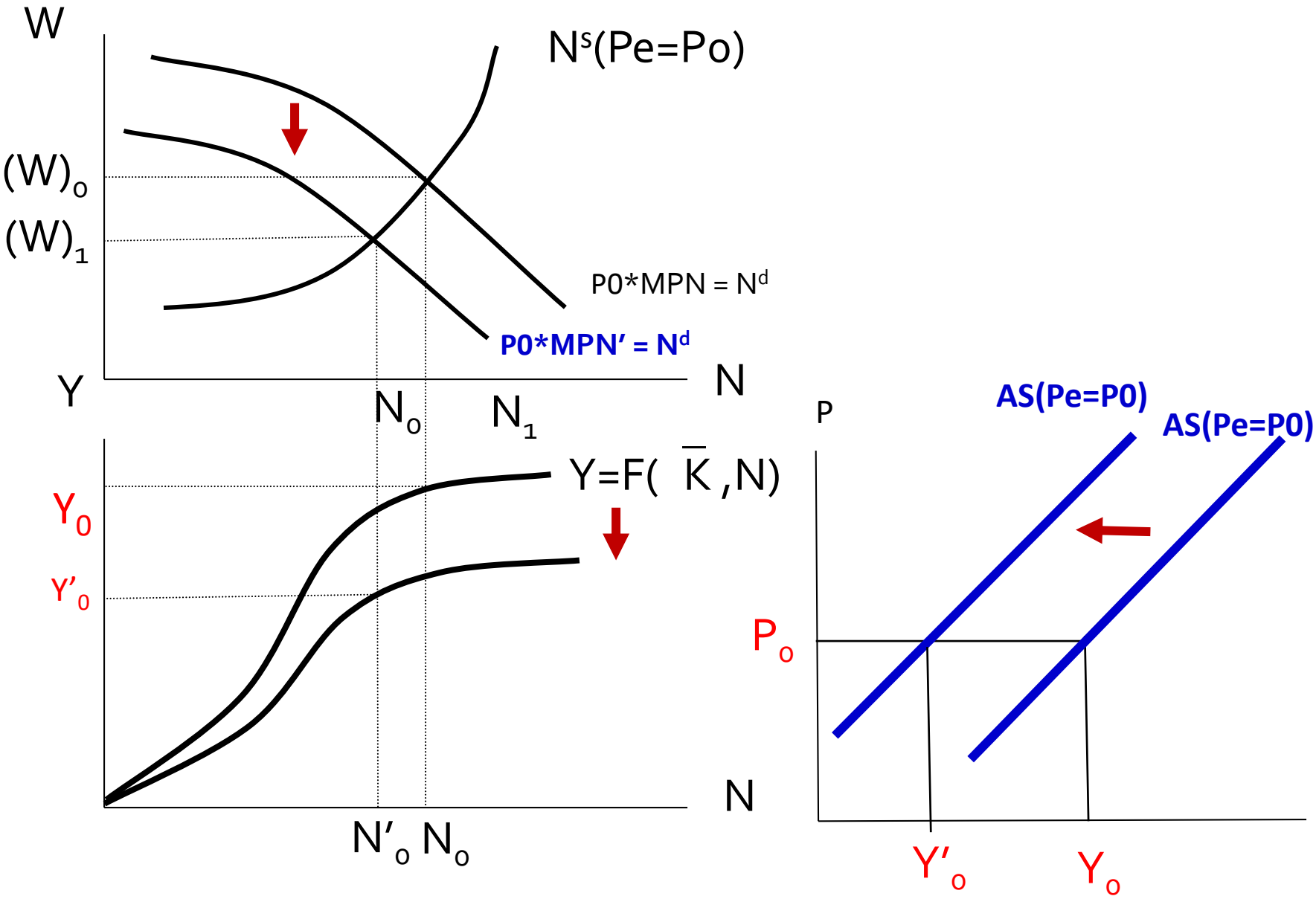
- Examples
  - Change in expected price
  - Production technology
  - Change in market structure
  - Government policies



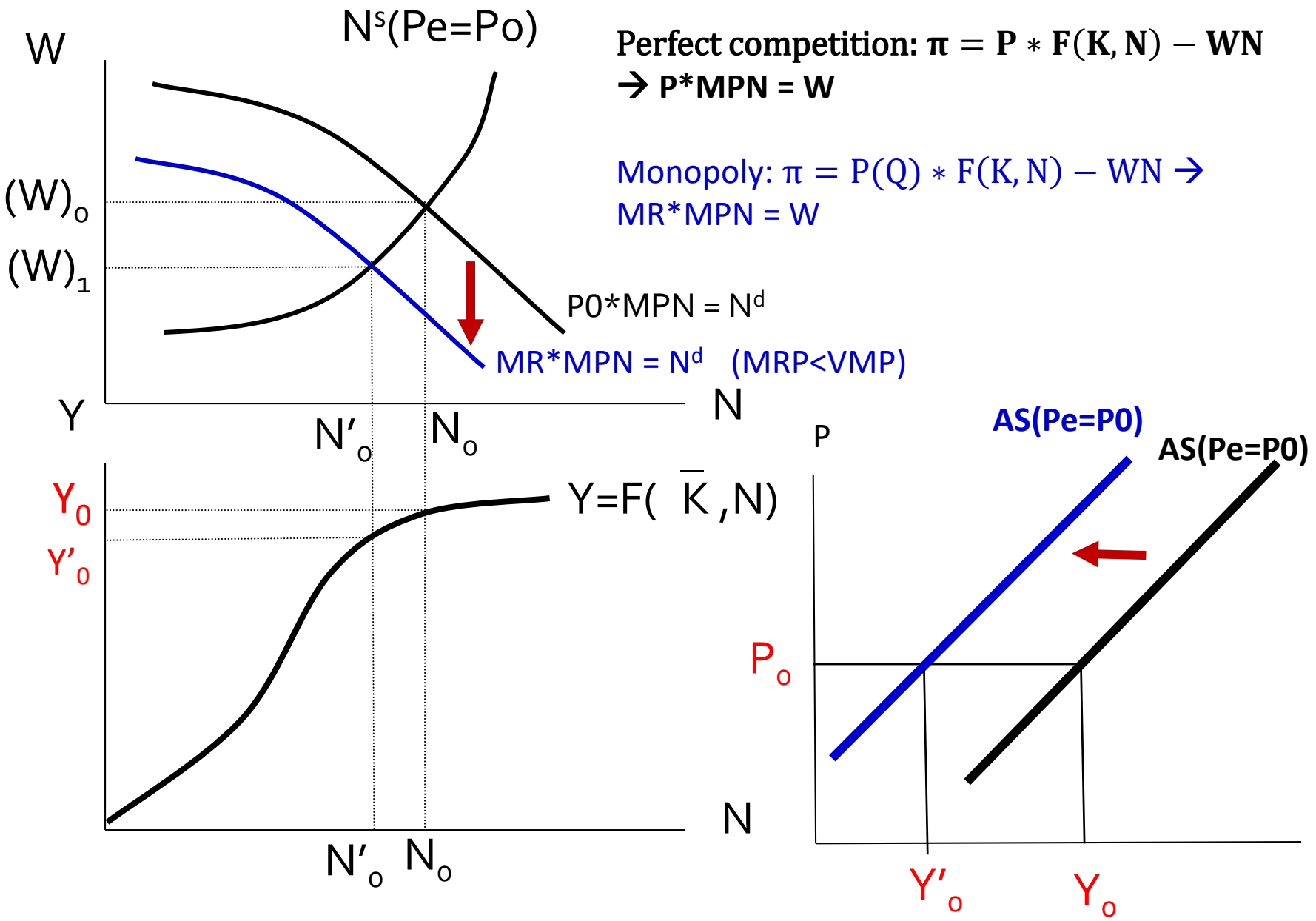
Example: Higher expected price



Example: Negative productivity shocks / Capital destruction



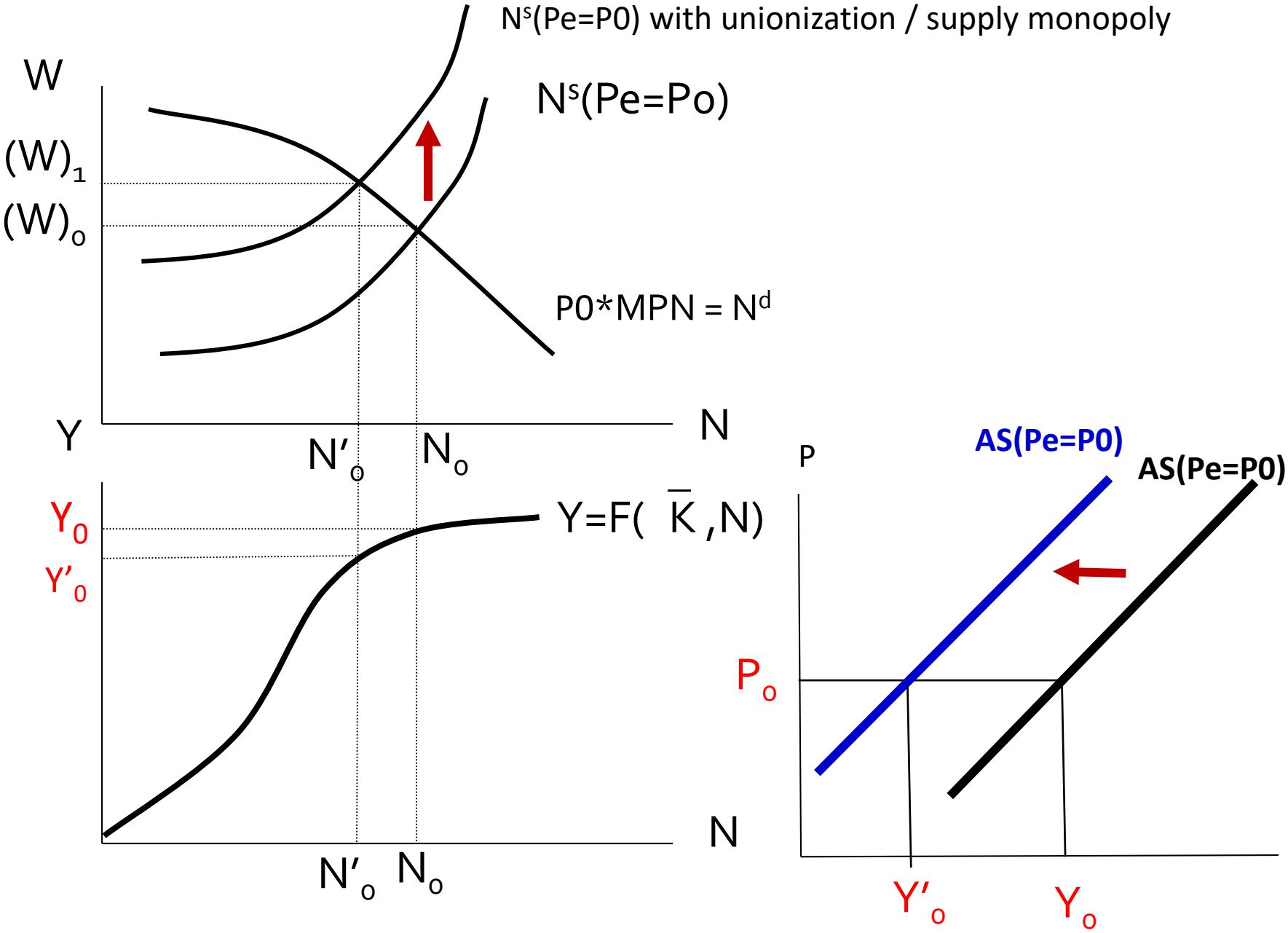
Example: Firm Monopoly power (mark-up power)



Perfect competition: $\pi = P * F(K, N) - WN$
→ P*MPN = W

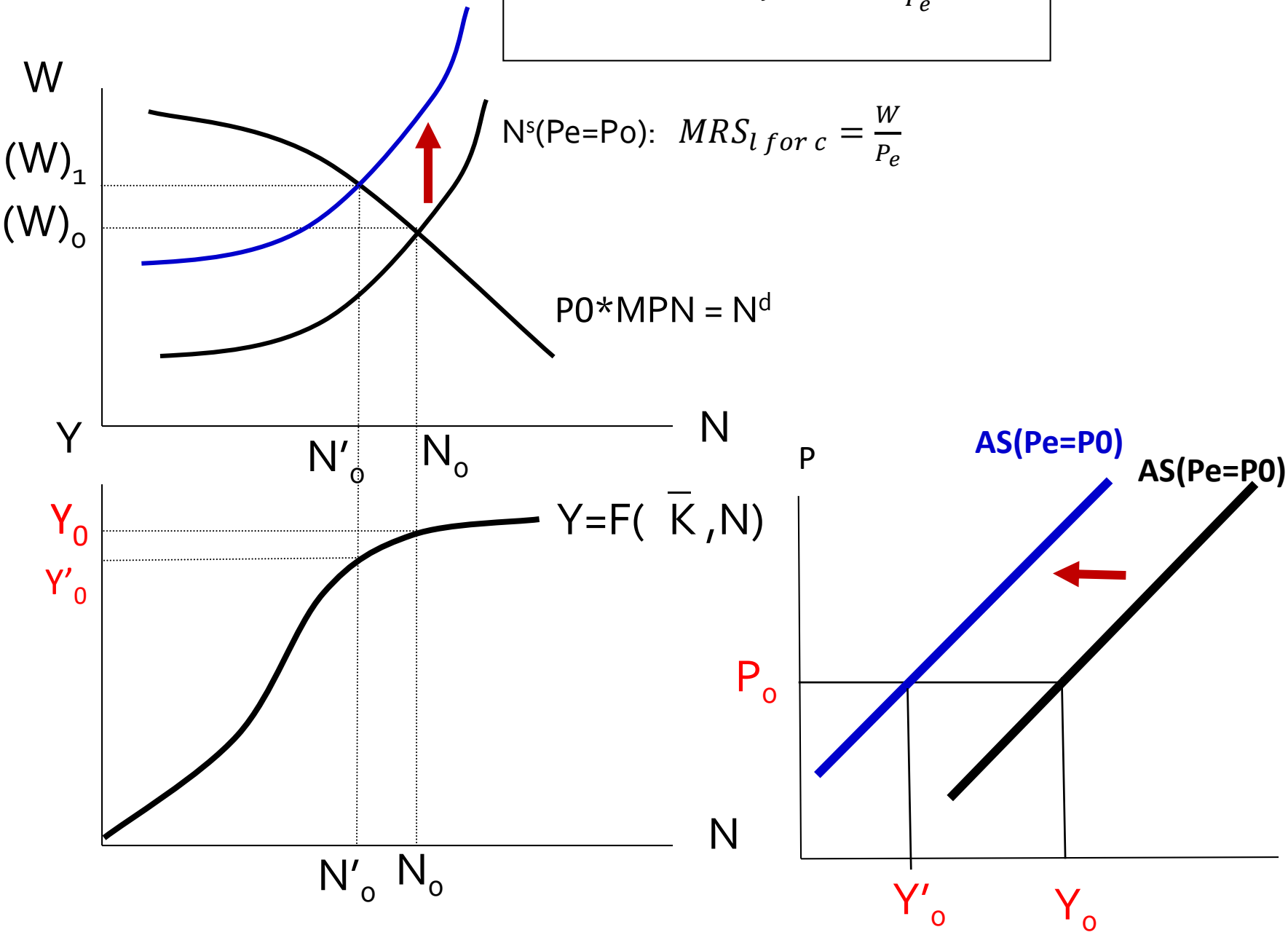
Monopoly: $\pi = P(Q) * F(K, N) - WN$ →
MR*MPN = W

Example: Unionization



Example: Pay-roll tax

$N^s(Pe=P0)$: $MRS_{l\ for\ c} = \frac{W(1-t)}{P_e}$



AGENDA

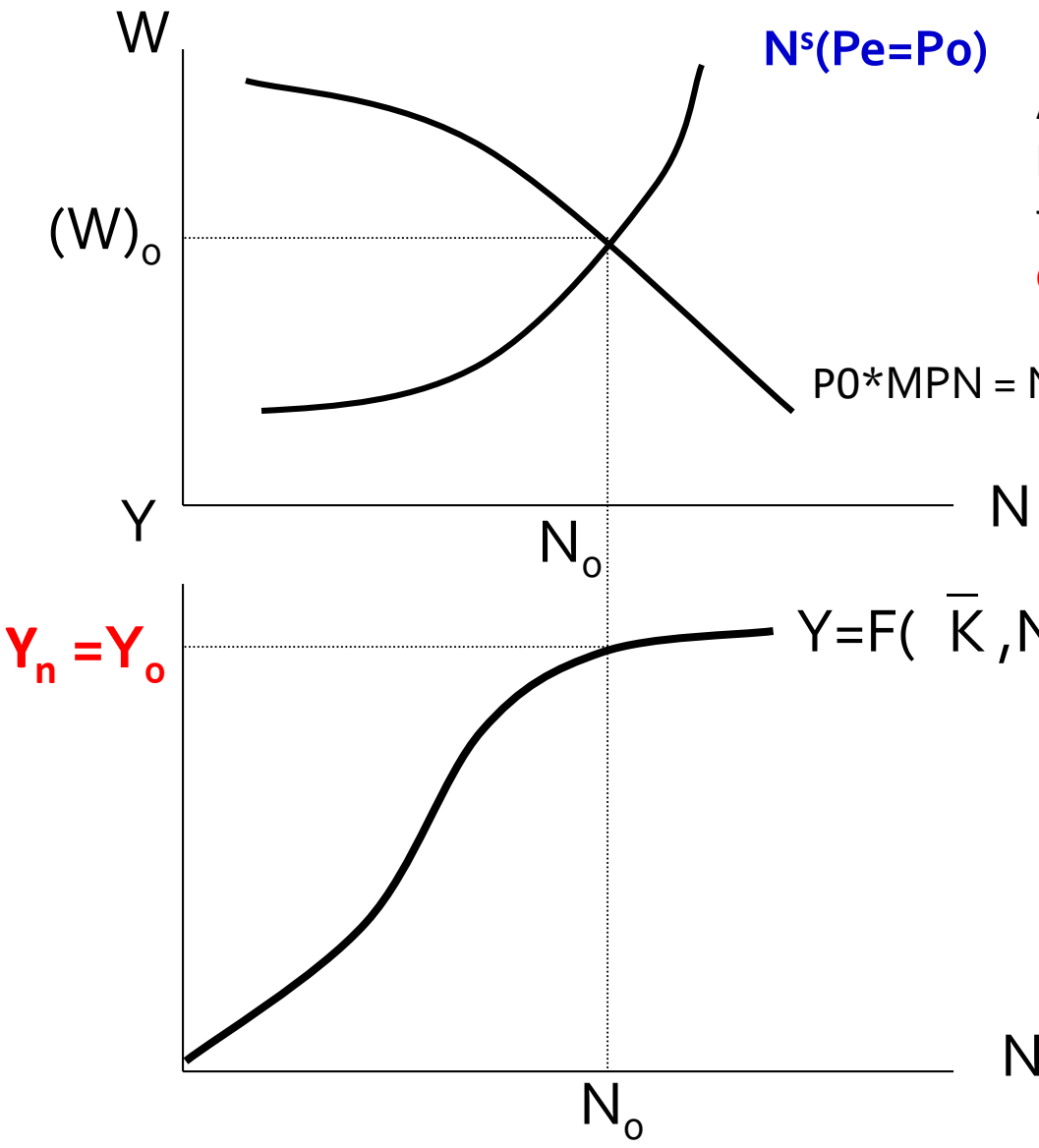
- ~~Labor market classifications: stylized-fact and dynamic~~
- ~~Theoretical frameworks to labor market outcome modelling~~
- ~~The aggregate supply~~
- **The Natural rate of unemployment**

NATURAL RATE OF UNEMPLOYMENT UNDER EXPECTATION-DRIVEN FRAMEWORK

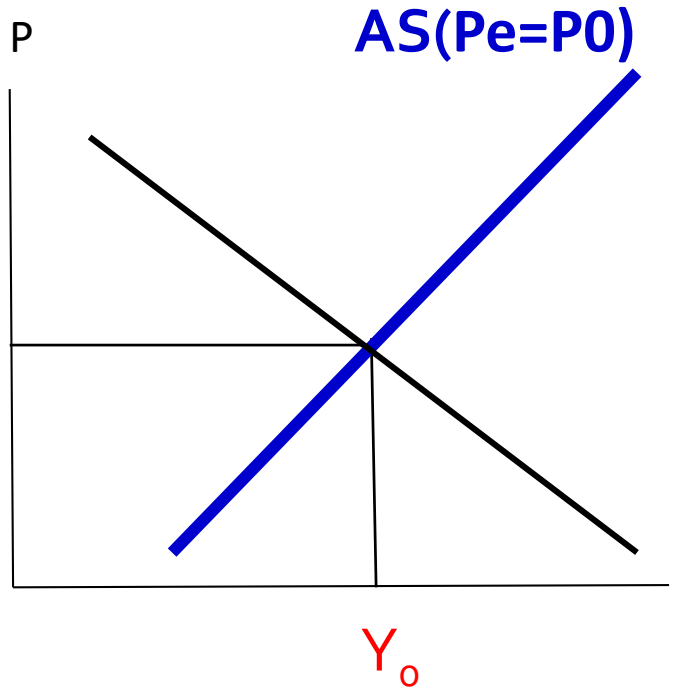
- We have seen the definition of Natural rate of unemployment under the **neo-classical framework**
  - **Equilibrium under no nominal frictions and no institutional restrictions on wage-price setting (Ideal full-indexation)**

- With the institutional elements, the concept of natural rate of unemployment can be reinterpreted in our modified framework as **the equilibrium when workers make a *correct* price expectation!**
  - **Actual price = Expected price**

Expectation-driven Aggregate Supply and **Natural rate of unemployment**



A natural rate of output $Y_n = Y_0$ because the equilibrium represents the situation when agents make a **correct expectation on price level**.



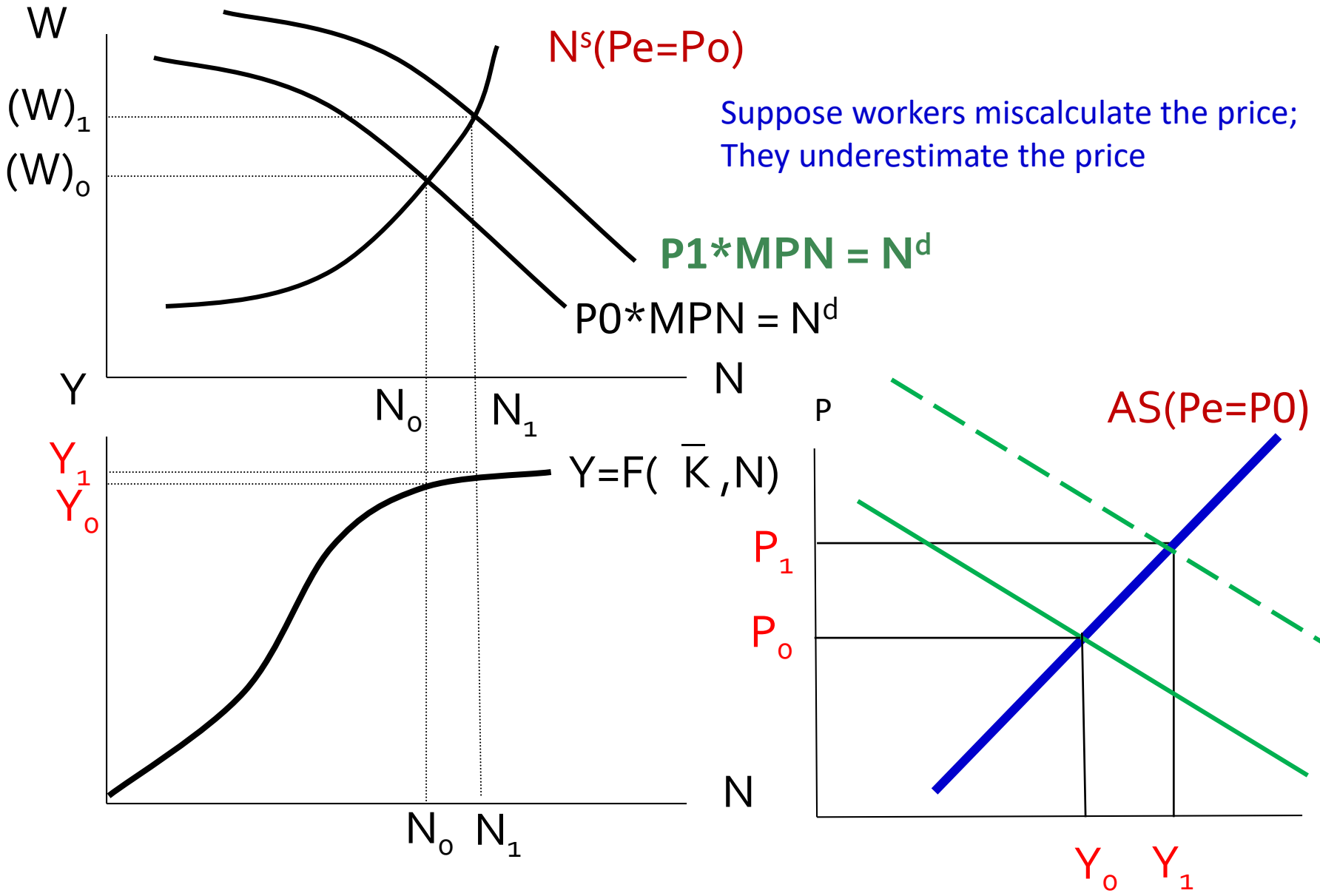
EFFECT OF DEMAND SHOCKS

- Given the possibility that actual price can be **higher** or **lower** than expected price, demand shocks can have real effect on output.

- For example, central bank surprisingly increases money supply (**and workers didn't aware of this**.)

- Their price expectation was initially set too low when they chose to supply labor, (and hence pre-committing nominal wage offers.)

Expectation-driven Aggregate Supply and Effect of demand shock

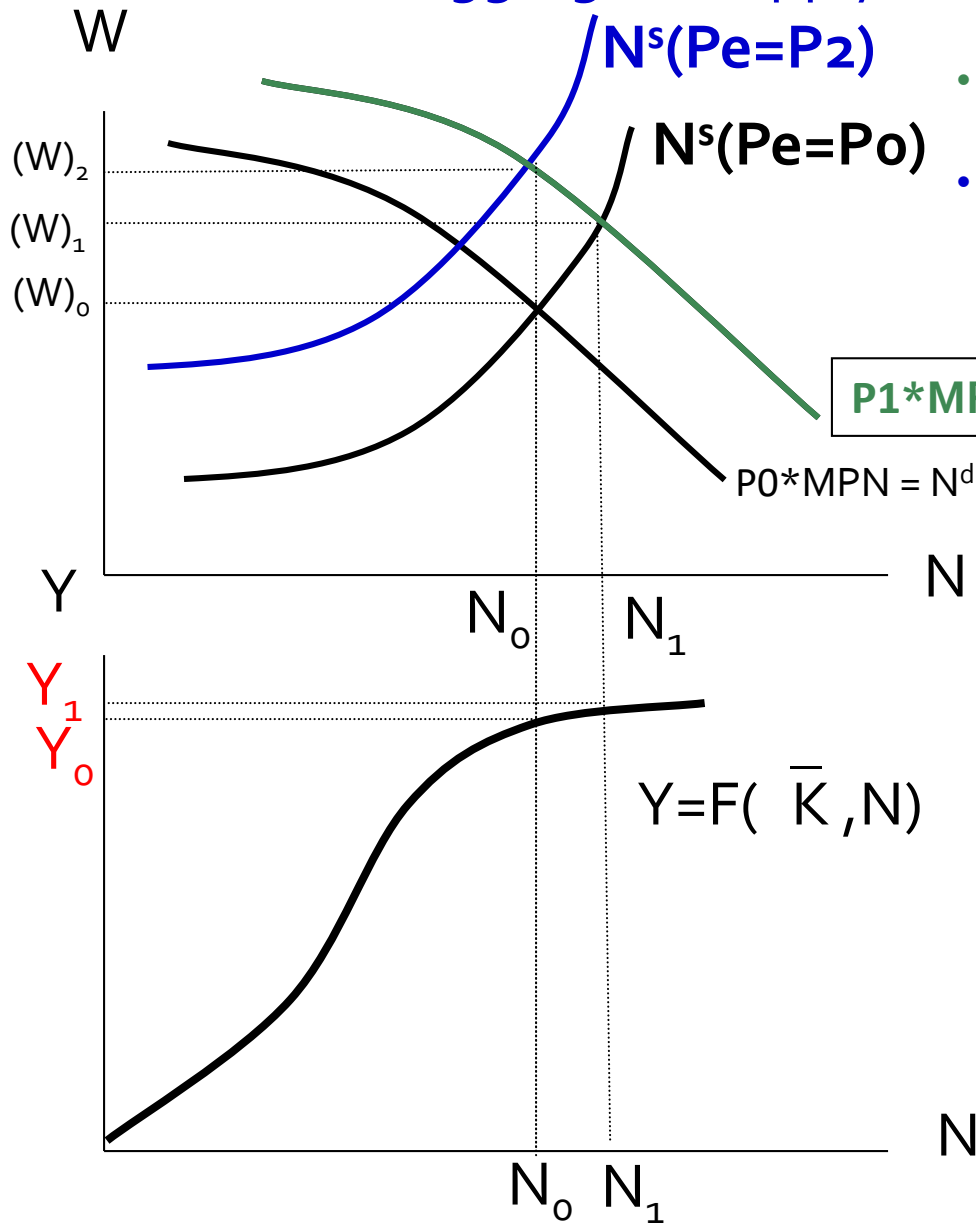


THE SELF-CORRECT MECHANISM

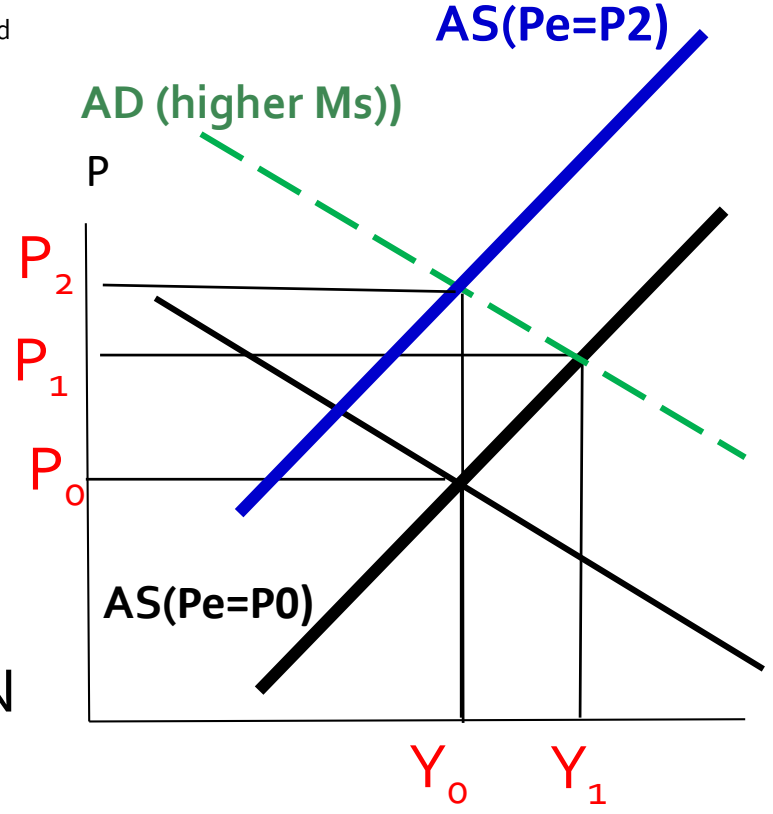
❑ Self-correcting mechanism

- 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 level can be restored with the medium-term adjustment process**

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



PRACTICAL IMPLICATION FOR NATURAL RATE OF UNEMPLOYMENT

- Both natural rate of unemployment and potential output are **unobservable**!

- However, the measurement concept can be guided by our theoretical consideration

- **Natural rate of unemployment** *or* **Full-employment output** should be consistent to the level that ***price pressure does not exist*** –i.e. **no further adjustment in price expectation, and hence wage-setting, required**