Macroeconomics
Exercise 2
(Chs. 4, 5 and 7)

Money (Ch. 4)

Inflation (Ch. 5)

Unemployment (Ch. 7)

Dott.ssa Vitali Beatrice

beatrice.vitali8@unibo.it

Chs. 4 and 5: Money and inflation

Key- concepts

Money: *functions of money* (storage of value, medium of exchange, unit of account) and *types of money* (commodity money, representative money, fiat money)

Seigniorage: gains arising from the legal monopoly of issuing money with a nominal value which is different from its intrinsic value

Quantity theory of money: $MV = PY$,

M = total amount of money in circulation

V = transactions velocity of money (i.e. the number of times one monetary unit is spent to buy goods and services per unit of time)

P = price level associated with transactions

Y = quantity of aggregate production

Quantity theory of money

Classical economics assumes:

- V as constant

- Y as determined by production function Y=F(K,L); the economy always produces the maximum level of output for the given amount of available inputs

Real GDP (i.e. Y) can NOT be affected by a variation in the quantity of money: any increase in M is fully reflected by a corresponding increase in prices (P)

Hence, there exists a positive relationship between money and prices; put it differently, the price level is proportional to the money supply, which is regulated by the central bank

Quantity theory and inflation

$$\% \text{ change } M + \% \text{ change } V \approx$$
$$\% \text{ change } P + \% \text{ change } Y$$

Classical theory: Y and V are constant, which means that % change V = % change Y=0

It follows that: $\% \text{ change } M \approx \% \text{ change } P = \pi$

where π is the rate of inflation

The central bank, by managing money supply, has the control over the rate of inflation

Inflation and interest rates

According to the quantity theory of money, an increase in money supply generates inflation, i.e. an increase in the general level of prices...

% change M = % change P = π

...which, in turn, leads to a rise of the nominal interest rate, accrding to the so-called **Fisher effect**: $i = r + \pi$

i = nominal interest rate

r = real interest rate

In actual fact, the Fisher equation must be modified!

Expectations on interest rates

Borrowers and landers set the *nominal* interest rate based on their expectations about future inflation...

The *ex-post* real interest rate depends on the nominal interest rate and the rate of inflation that is actually observed, namely π

The *ex-ante* real interest rate depends on the nominal interest rate and the rate of inflation which is expected for the future period, i.e. It depends on the expected rate of inflation, π^e

The «correct» formulation of the Fisher equation is therefore: $i = r + \pi^e$

Expectations of a future increase in money supply will induce an increase in the expected rate of inflation (π^e), with a subsequent increase in the nominal interest rate i

The costs of inflation

Inflation, if **unexpected**, hurts:

- creditors (in favor of debtors, including the Government...)
- whoever has a job contract or any kind of income which does not enforce an automatic adjustment to prices
- firms, that must adjust their price lists, and might be not able to correctly forecast future costs and prices
- consumers, which dislike price volatility
- tax-payers, which may be subject to «fiscal-drag»

If very high, inflation may turn into hyperinflation...

In contrast, **deflation** is costly for debtors, as it raises the real cost of the debt, reducing the capability to serve the latter

Multiple choice

1. According to the *quantity theory of money* (**MV = PY**), if V and Y are constant, an increase in money supply by the Central Bank...

    a) will increase national income.

    b) will surely affect the transactions velocity of money.

    c) will have no effect in the short run.

    d) will raise the general level of prices.

2. Consider the Fisher equation: $i = r + \pi$. The nominal interest rate:

    a) is positively affected by the real interest rate.

    b) is always at the level which grants zero inflation.

    c) is always higher than the real interest rate.

    d) is constant, as the inflation rate and the real interest rate offset each other.

Multiple choice

3. If the actual inflation is higher than the one that was expected for the period, creditors are penalized while debtors gain, because:

a) the ex-post real interest rate is larger than the ex-ante real interest rate.

b) the ex-post real interest rate is lower than the ex-ante real interest rate.

c) the real interest rate is reduced.

d) the nominal interest rate is reduced.

$[\textbf{\textit{ex-post}} : \; \textbf{\textit{r}} = \textbf{\textit{i}} - \boldsymbol{\pi} \; ;$
$\textbf{\textit{ex-ante}}: \; \textbf{\textit{r}} = \textbf{\textit{i}} - \boldsymbol{\pi}^{\textbf{\textit{e}}} \; ;$
$\textbf{in this case:} \; \boldsymbol{\pi} > \boldsymbol{\pi}^{\textbf{e}}]$

Multiple choice

4. According to the Fisher effect, a higher inflation will determine:
- a) a reduction in the real interest rate.
- b) an increase in the nominal interest rate.
- c) an increase in the real interest rate.
- d) all of the above answers are correct.

5. If the rate of inflation decreases from 6% to 4%, other things being equal, according to the Fisher effect…
- a) the nominal and the real interest rate will both decrease by 2%.
- b) there will be no variation neither in the nominal nor the real interest rate.
- c) the nominal interest rate approximately decreases by 2%, while the real interest rate stays unchanged.
- d) the real interest rate approximately decreases by 2%, while the nominal interest rate stays unchanged.

Exercise 1

Suppose that the transactions velocity of money is constant, while the nominal interest rate is 11%. The annual growth rate of the real GDP is 5%, while the money supply grows at 14% every year.
What is the level of the real interest rate?

Solution

The real interest rate is the difference between the nominal interest rate and the rate of inflation.
The former is 11%, while the latter has to be computed by using the quantity theory of money, expressed in terms of % changes:

% change M + % change V ≈ % change P + % change Y

After some simple manipulation, the rate of inflation will be:

π = % change P ≈ % change M + % change V - % change Y

Hence, the rate of inflation is: **π ≈ (+14%) + (0%) − (+5%) = +9%**

The real interest rate is therefore: **$r = i - \pi$ = 11% - 9% = 2%**

Ch. 7: Unemployment

Key- concepts

o The natural rate of unemployment

o Structural and frictional unemployment

o Labor market and equilibrium levels of wage and employment

o Labor market policies

o Features of unemployment (gender or race differentials, participation in the labor market, ...)

Natural rate of unemployment (I)

This is the average unemployment rate which the actual rate of unemployment typically tends to fluctuate around

Compared to the natural rate, **the current rate of unemployment** may be :

- larger (as it typically happens along recessions)
- smaller (as it typically occurs during economic *boom* periods)

The **natural rate of unemployment** is given by: $U/L = s/(f + s)$

L = total labor force

U = stock of unemployed workers at some given time

s = separation rate (share of employed people who lose their jobs in a given time span)

f = job finding rate (share of unemployed people who are able to find a job in a given time span)

Natural rate of unemployment (II)

In each moment in time, there are:

- $s \cdot E$ new unemployed workers
- $f \cdot U$ new employed workers

If the numer of new employed is equal to the number of new unemployed, the rate of unemployment does not change (**steady state equilibrium**)

<u>Let's compute the natural rate of unemployment</u>

In steady state: $f \cdot U = s \cdot E$

Hence: $f \cdot U = s \cdot (L - U) = s \cdot L - s \cdot U \Rightarrow (f + s) \, U = s \cdot L$,

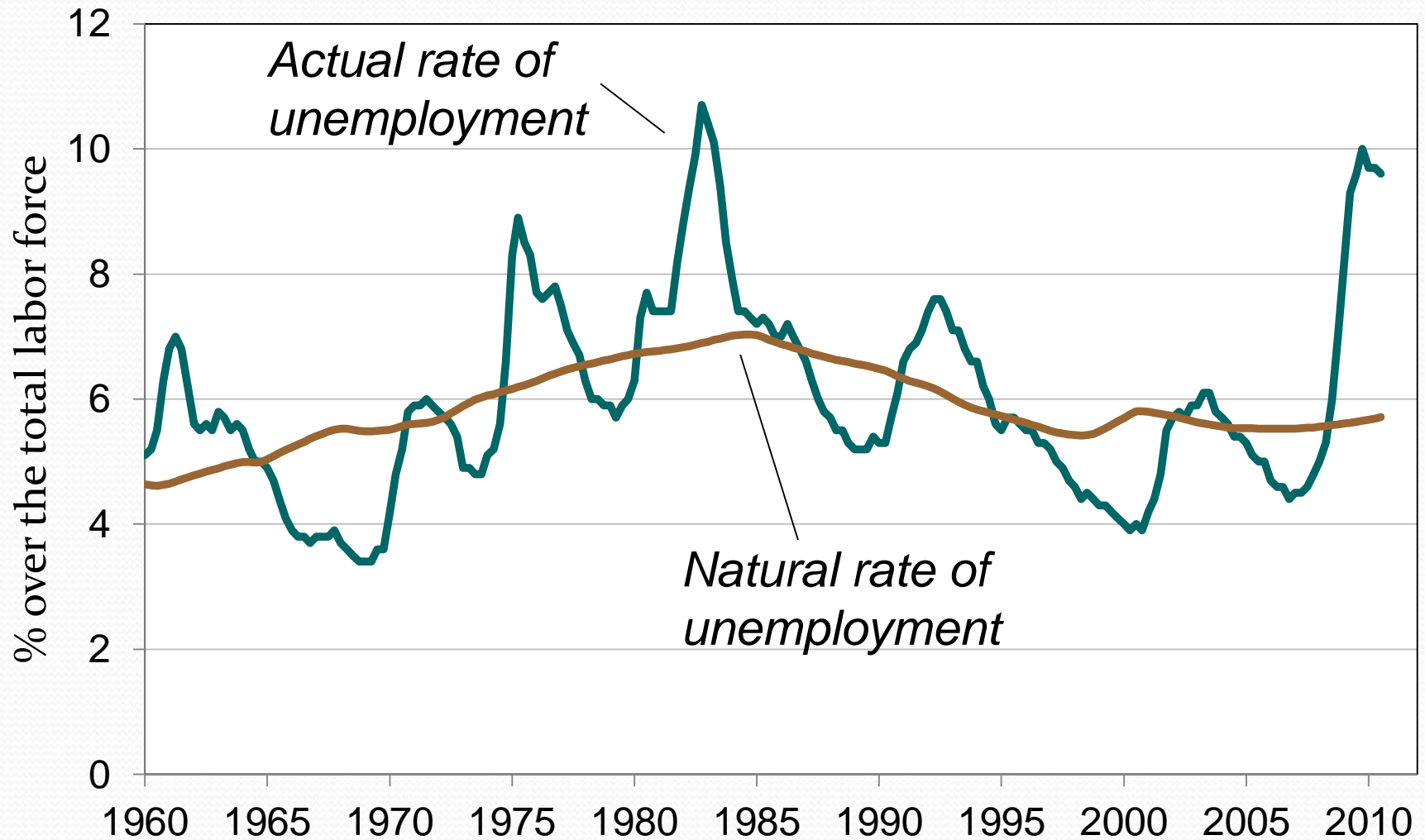which leads to the natural rate of unemployment: $U/L = s/(f + s)$

Natural rate of unemployment (III)

The natural rate of unemployment reduces if:

- f *increases*

- s *decreases*

By identifying the determinants of the rates f and s, it is possible to properly design economic policies specifically aimed at modifying these rates, in such a way to alter the equilibrium conditions in the labor market.

Unemployment in the US (1960-2010)

Actual rate of unemployment

Natural rate of unemployment

% over the total labor force

12
10
8
6
4
2
0

1960   1965   1970   1975   1980   1985   1990   1995   2000   2005   2010

Unemployment types: frictional or structural

Two causes of unemployment: **job search (frictional)** and **wage rigidities (structural)**

Job search → **temporary unemployement** (FRICTIONAL)

- Job vacancies and workers are heterogeneous (different requirements, different ability/education,...): collecting information on vacancies and job candidates is costly and time-consuming

- Job vacancies and workers are geographically spread out and mobility is also costly and time-consuming

- Technology shocks, innovations and sectoral changes (among agriculture, manufacturing and services) continuously modify labor demand, by requiring new skills and capabilities

Policies aimed at reducing frictional unemployment: employment offices, public workers' training programs, public information on available jobs,...

Structural unemployment

Wage rigidities → persistent unemployment (STRUCTURAL)

Possible causes:

- Minimum wage levels (for those who without it would get a lower equilibrium wage)

- Workers unions and collective barganinig (*insiders* vs. *outsiders*)

- Efficiency wages

- Restrictions and costs in firing workers (makes the hiring process more difficult, raising youth unemployment and unemployment length, and giving rise to a dual labor market)

The lenght of unemployment allows us to infer whether unemployment is structural or frictional

The labor market

This is the market in which labor services are traded; the equilibrium on this market determines the **level of employment** as well as the **real wage**

Labor Demand → Firms

Labor Supply → Workers

Nominal wage (W) = amount of money paid as a remuneration for labor services

Real wage (W/P) = nominal wage divided by the price index, i.e. a measure of the purchasing power of nominal wages; or the price of labor in terms of output
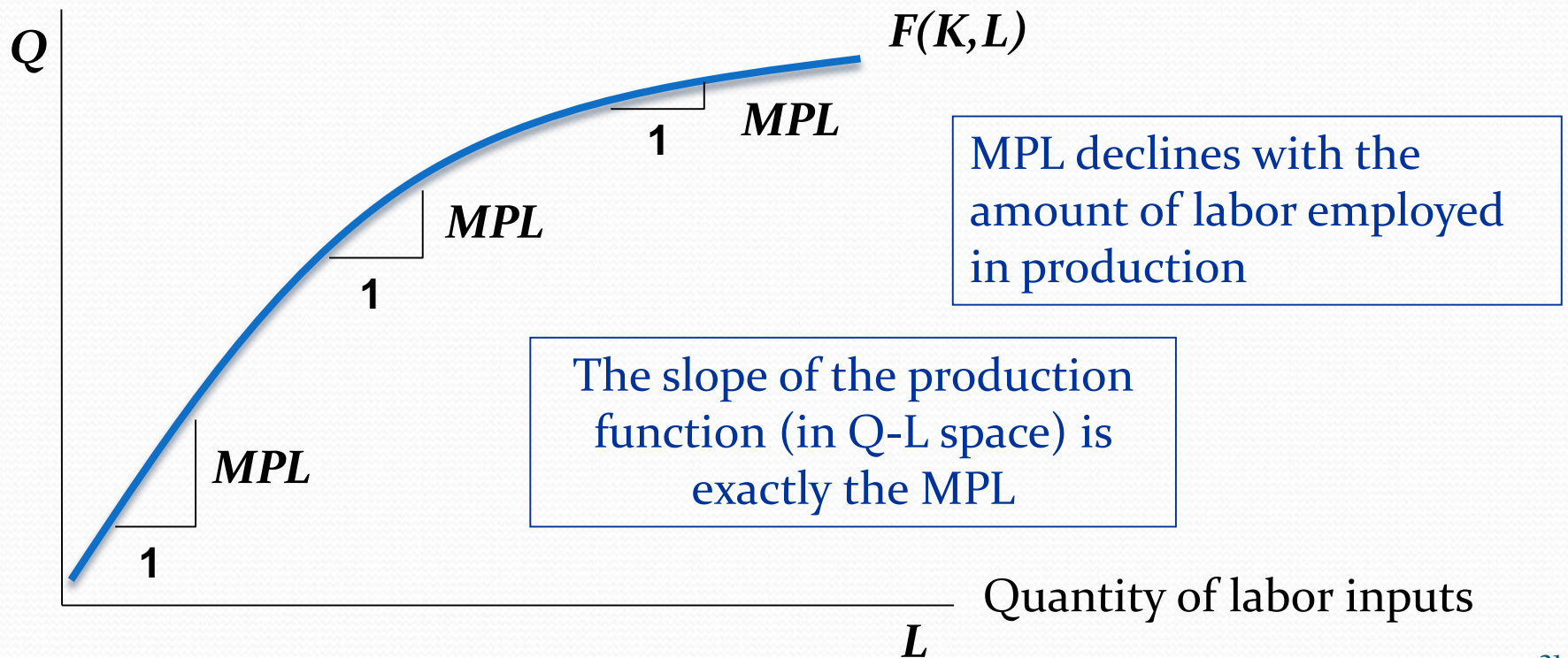
If prices and wages were perfectly elastic («flexible»), a given variation in prices would be fully reflected in a corresponding variation in nominal wages, so that **the real wage would stay unchanged**:

The real wage is determined by real variables only (such as labor productivity)**!**
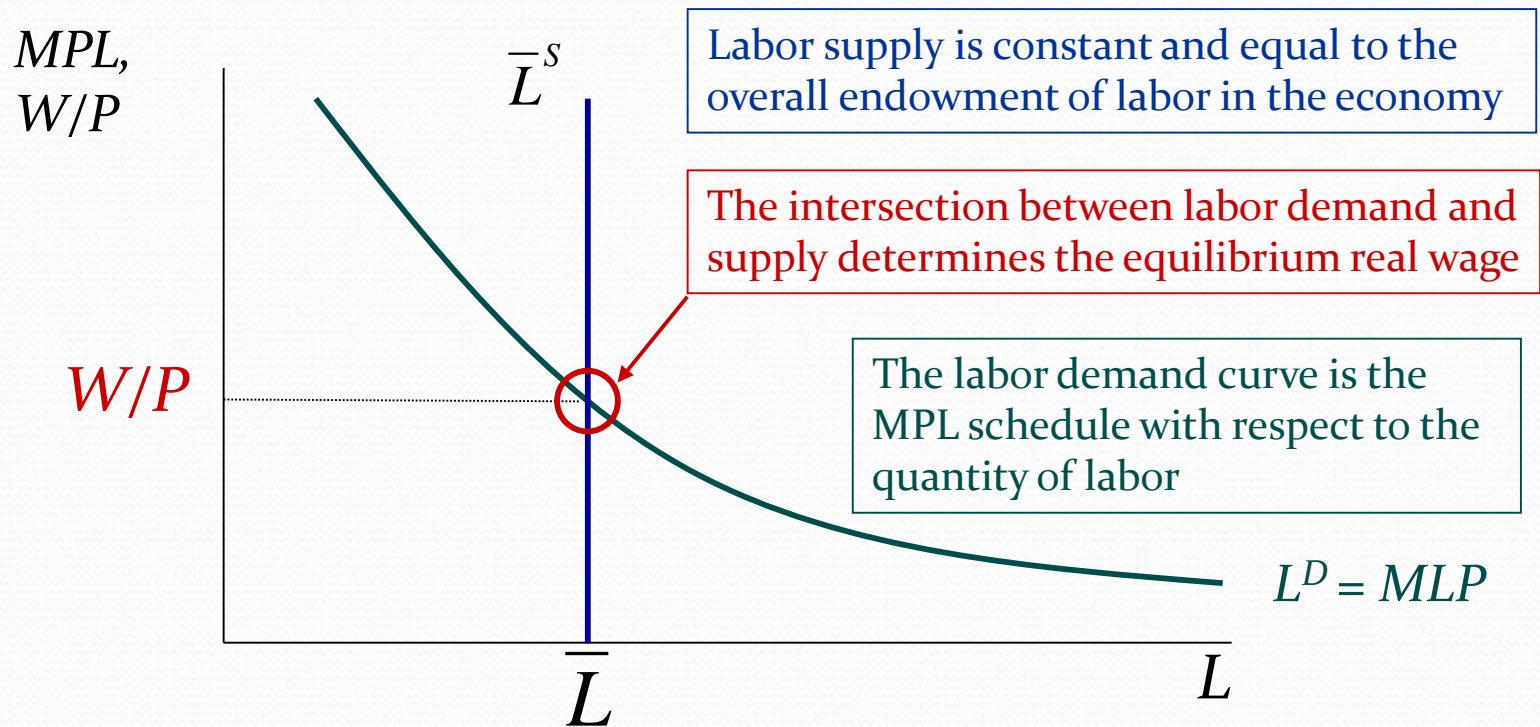
The labor demand

Labor demand (by firms) reflects the **marginal productivity of labor** (MPL), i.e. the additional quantity of output that can be produced with an extra unit of labor input, given the stock of capital available:

MPL = F(K,L+1) – F(K,L)

Q

F(K,L)

MPL

1

MPL

1

MPL

1

MPL declines with the amount of labor employed in production

The slope of the production function (in Q-L space) is exactly the MPL

Quantity of labor inputs

L

The graph of the labor market

Suppose that **labor supply is constant**: workers supply a given quantity of labor services, no matter what the wage rate is (explains why labor supply curve is vertical). It follows that the real wage (equilibrium price of labor in terms of output) is uniquely determined by the demand


Labor supply is constant and equal to the overall endowment of labor in the economy

The intersection between labor demand and supply determines the equilibrium real wage

The labor demand curve is the MPL schedule with respect to the quantity of labor

$MPL, W/P$

$\overline{L}^S$

W/P

$L^D = MLP$

$\overline{L}$

L

Multiple choice:

6. Introducing a minumim wage level by law may create unemployment...
   a) if the minimum wage is below the equilibrium level of nominal wages
   b) if the minimum wage is above the equilibrium level of nominal wages
   c) always
   d) never
   e) if the nominal and the real wage do not correspond

7. If the job finding rate is $f = 0,10$ and the job separation rate is $s = 0,05$, what is the fraction of employed workers in the steady state equilibrium?
   a) 1/2
   b) 0
   c) 2/3
   d) 1/4
   e) 1/3

Multiple choice:

8. Introducing an unemployment subsidy by law may...
   a) reduce structural unemployment
   b) increase the labor supply, for each level of nominal wages
   c) increase frictional unemployment
   d) increase the labor demand, for each level of nominal wages
   e) increase structural unemployment

9. Consider an economy with a labor force constant and equal to **L**. Let the job separation rate be **s=0,15**, whereas the job finding rate is **f=0,35.** What is the level of the natural rate of unemployment?
   a) 0
   b) 0.15
   c) 0.3
   d) 0.35
   e) 0.5

Exercise 2 (I)

I) Draw the graph of the labor market, representing both the labor demand and the labor supply and identifying the equilibrium levels of wage and employment, under the assumption that labor supply is fixed
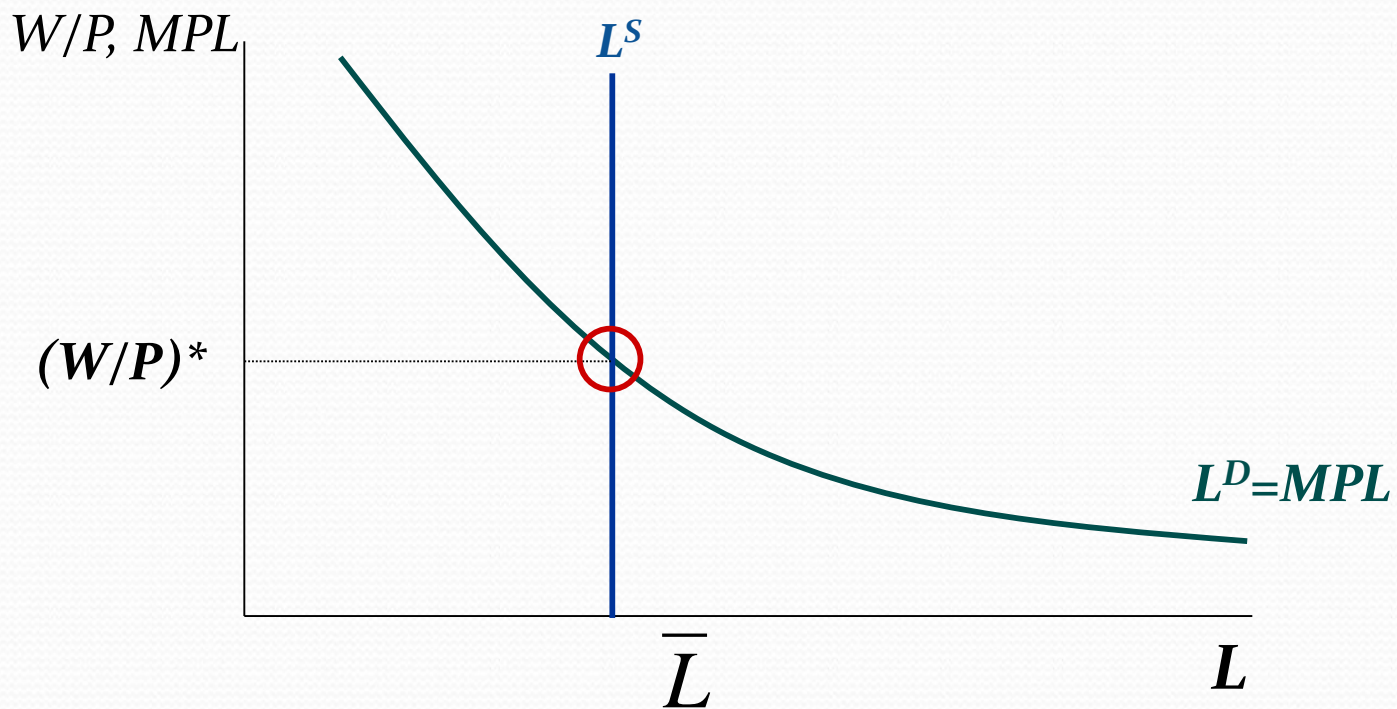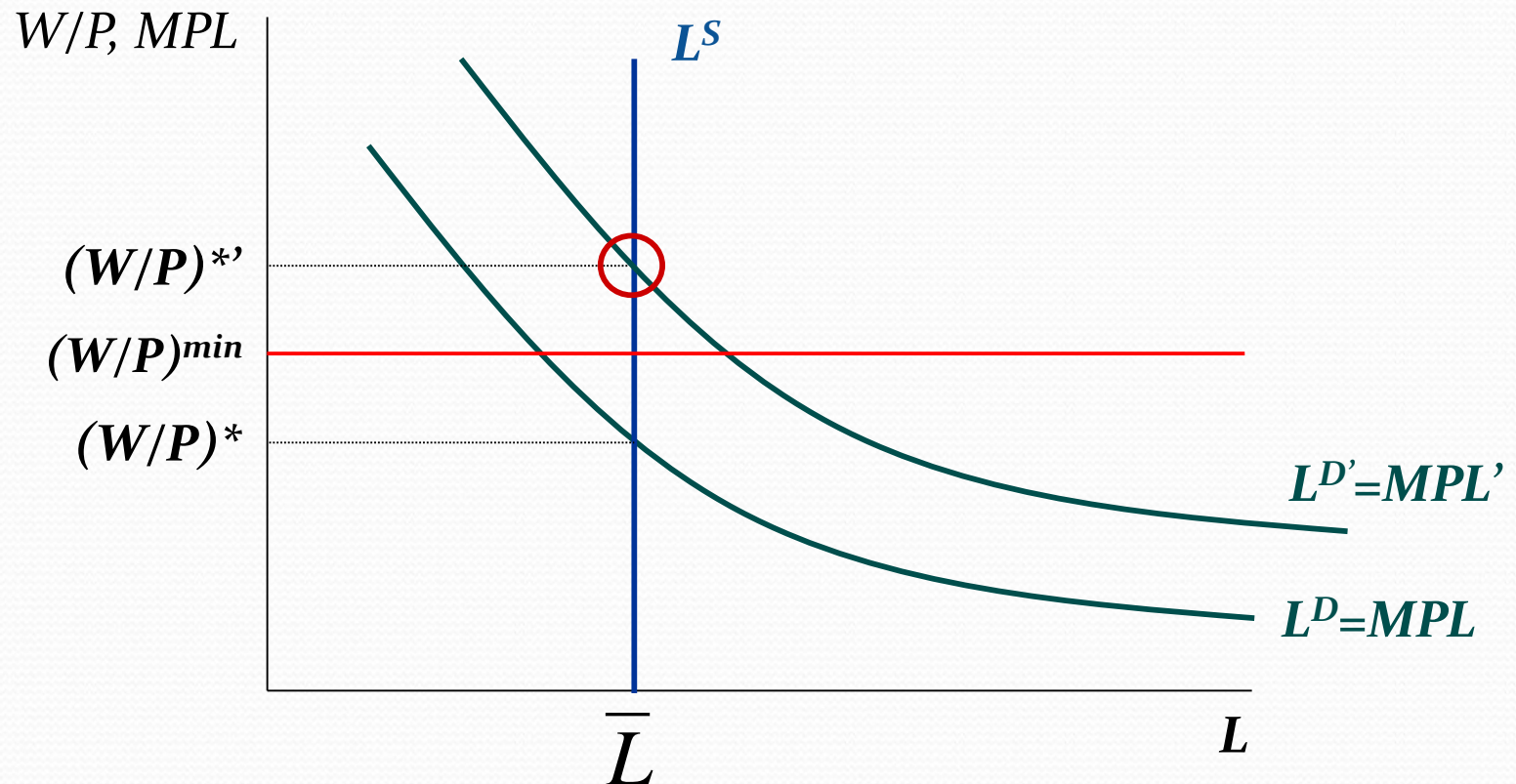
Exercise 2 (II)

II) By using the graph, show the effect of an increase in MPL on the equilibrium levels of both wage and employment
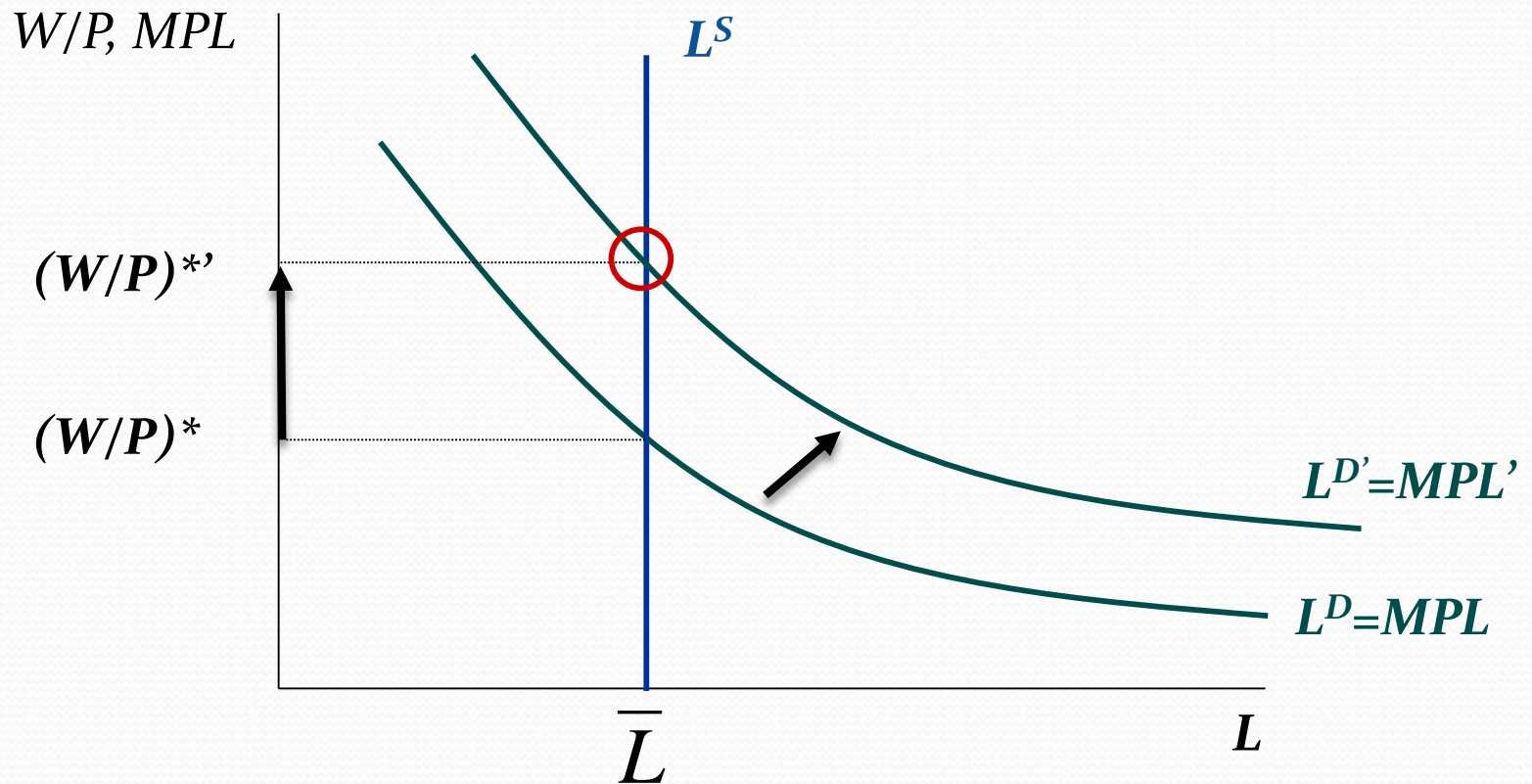
Exercise 2 (III)

III) What if the Government would decide to introduce a minimum wage, at a level (denoted by $(W/P)^{min}$) which is in between the original and the new equilibrium wage?

Exercise 2 (III)

- In this case, market equilibrium is not altered by the decision by the Government

- Indeed, the minimum wage set by law (=$\mathbf{(W/P)^{min}}$) is lower than the new equilibrium level of nominal wages, after the labor demand has moved upward due to the rise in marginal labor productivity

- Since $(W/P)^{min} < (W/P)^{*'} \Rightarrow$ introducting a minimum wage has no effect on the level of employment!
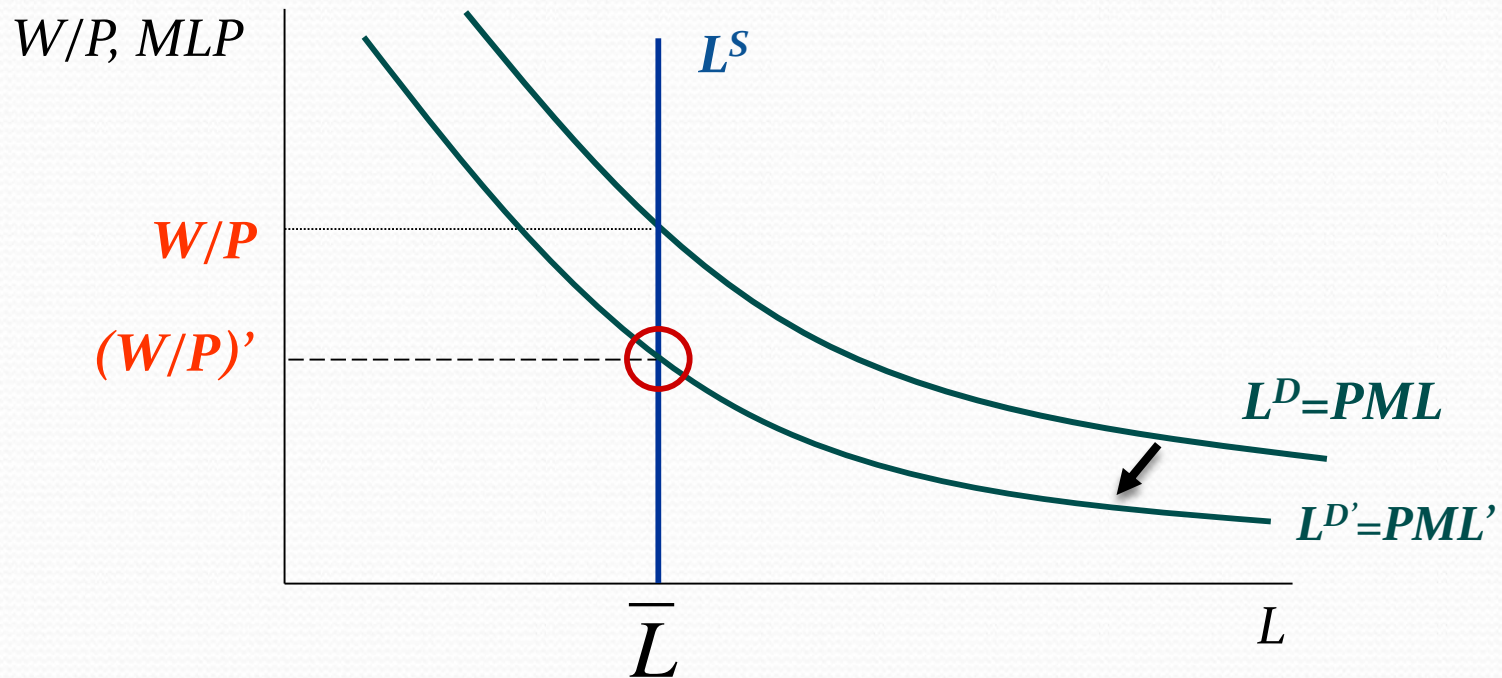
Exercise 3

Draw a graph of the labor market and consider a reduction in the labor marginal productivity (for each level of labor input).

I) Show the shift of the labor demand curve and the subsequent variation in the equilibrium levels of employment an wages

II) Explain what would happen if workers unions inhibit the spontaneous adjustment of nominal wages

III) Explain what other situations could lead to the same outcome

Exercise 3 (I)

If MPL is reduced for each level of labor inputs, the equilibrium wage must fall in order to restore the equilibrium between supply and demand

At the new equilibrium, the number of employed workers does not change, since labor supply is fixed. Hovewer, employed people will receive a lower real wage. Unemployment does not rise, when wages can freely adjust

Exercise 3 (II)

If worker unions prevent nominal wages from freely adjusting, the equilibrium condition would not be satisfied anymore: $MPL' \neq W/P$

Thus, we observe **unemployment**: at the initial level of the real wage, W/P, the new labor demand is lower then labor supply and only L' workers remain employed, while $Lbar-L'$ workers will loose their job
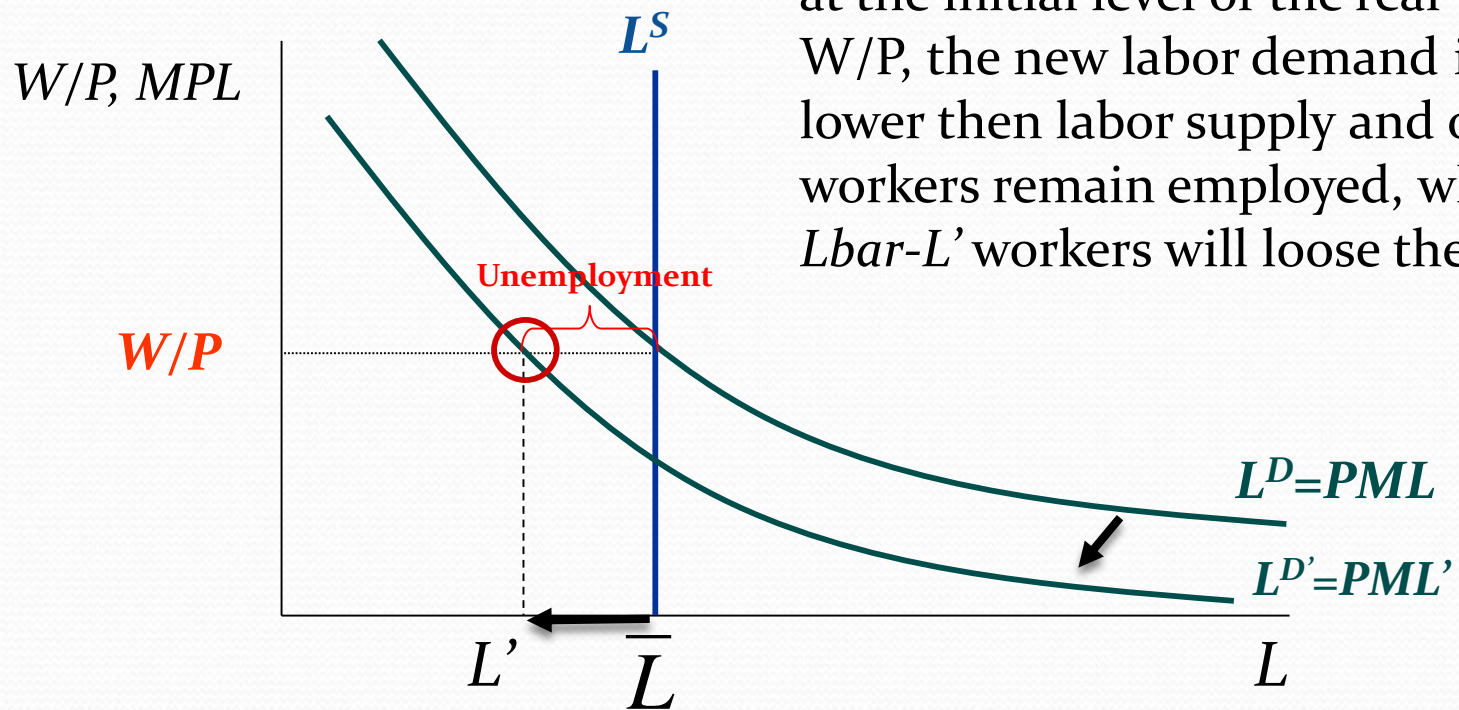
Exercise 3 (III)

What are the other situations which could lead to the same outcome?

Basically, any other policy or shock which introduces some rigidity in the process of adjustment of nominal prices.

For instance, according the *efficiency wage theory*, firms might be willing to pay a real wage higher than the equilibrium level, in order to foster the productivity of their employed workers and reduce the turn over with all the costs associated with the traineeship of new workers

Multiple choice:

10. According to the theory of the efficiency wages...

a) firms may want to pay wages higher than the equilibrium wage, in order to reduce workers' turnover

b) firms may want to pay wages higher than the equilibrium wage, in order to enhance workers' productivity

c) both of the above answers are correct

d) none of the above answers is correct

11. What is the reservation wage?

a) the lowest wage rate at which a worker would be willing to accept a given job

b) the wage rate at which a worker is indifferent between accepting and refusing a job offer

c) both of the above answers are correct

d) none of the above answers is correct

Multiple choice

12. Which of the following sentences is correct?

   a) the rate of unemployment is always at its natural level

   b) the number of unemployed is a rough measure of the numer of people that are not employed, but would like to be

   c) the rate of unemployment is the ratio between the number of unemployed workers and the population in working age

   d) the rate of unemployment is the inverse of the job finding rate

   e) the rate of unemployment is the ratio between the labor force and the population in working age