

Unit 8.

Factor Markets

In accordance with the APT programme objectives of the lecture are to help You to:

- apply the concepts of supply and demand to markets for factors;
- analyze the concept of derived demand;
- understand how a factor's marginal product and the marginal revenue product affect the demand for the factor;
- consider the role of factor prices in the allocation of scarce resources;
- consider labour supply and wage and employment determination;
- explain effects of deviations from perfect competition in labour market;
- explain the determination of economic rent and price for capital;
- consider the role of factor prices in distribution of income and the sources of income inequality in a market economy.

Required reading

Begg, D., R.Dornbusch, S.Fischer. Economics. 8th edition. McGraw Hill. 2005.

Chapter 10. The labour market.

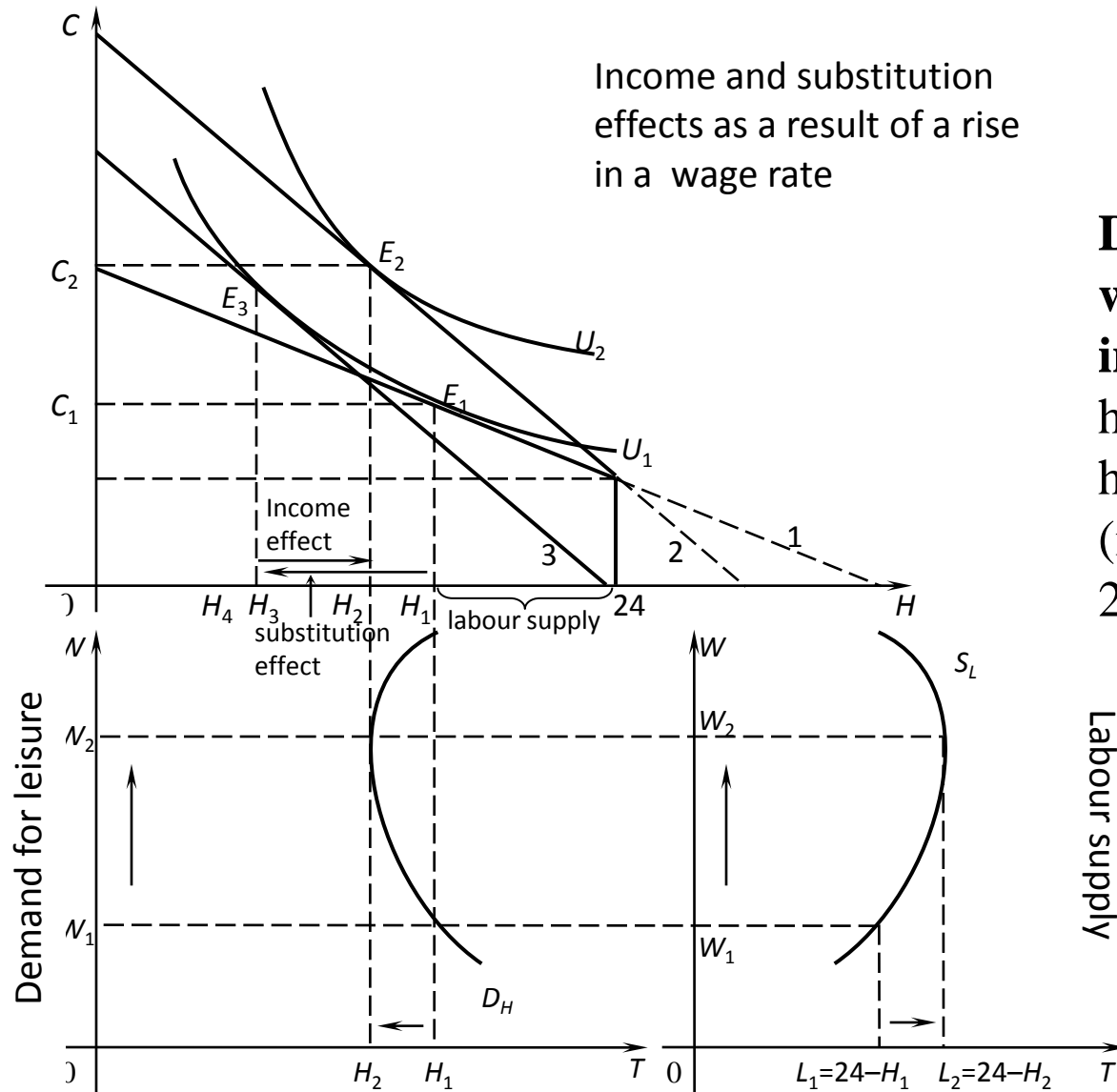
Chapter 11. Different types of labour.

Chapter 12. Factor markets and income distribution.

Questions to be revised

- ✓ Utility maximization: income and substitution effects
- ✓ Total product and cost curves;
- ✓ Profit maximization by a competitive firm;
- ✓ Equilibrium of a competitive market;
- ✓ Labour input optimization by a perfectly competitive firm;
- ✓ Profit maximization by a monopoly;
- ✓ Price discrimination;
- ✓ Government regulation of a competitive market.

Consumption-leisure trade-off and individual labour supply



Income and substitution effects as a result of a rise in a wage rate

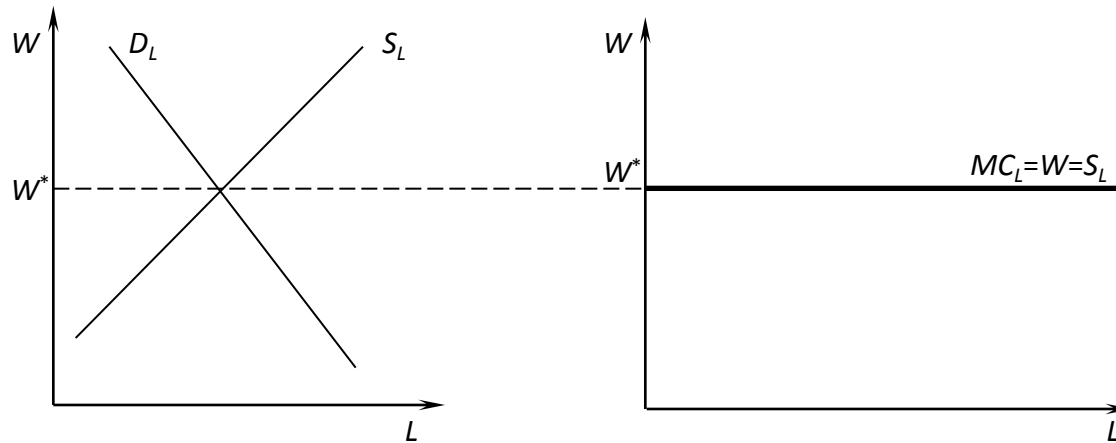
Decision of working individual:
 how many hours to work (maximum is 24)?

Labour demand: 4 possible cases

1. Perfect competition both in product and labour markets: a firm is a price (wage) taker both in the product and labour market;
2. Imperfect competition in product market and perfect competition in labour market: a firm possesses market power in a product market but is a wage taker in labour market;
3. Perfect competition in product market and monopsony in labour market: a firm is a price taker in product market but faces upward sloping labour supply curve (can get more labour only by offering higher wage);
4. Imperfect competition both in product and labour markets: a firm possesses market power both in the product and labour market.

1st case: Perfect competition both in product and labour markets

Labour market equilibrium and a supply of labour for a firm under perfect competition



Demand for factors of production

Output price p .

- Choose how much output to produce and sell,
- And how to produce it the cheapest way possible:
 - Technology (long run)
 - Input prices

Firm's Demand for Labour

Increase in revenue from selling extra output produced with an extra unit of labour –

Marginal value product of labour ($MVPL = MPL * P$),

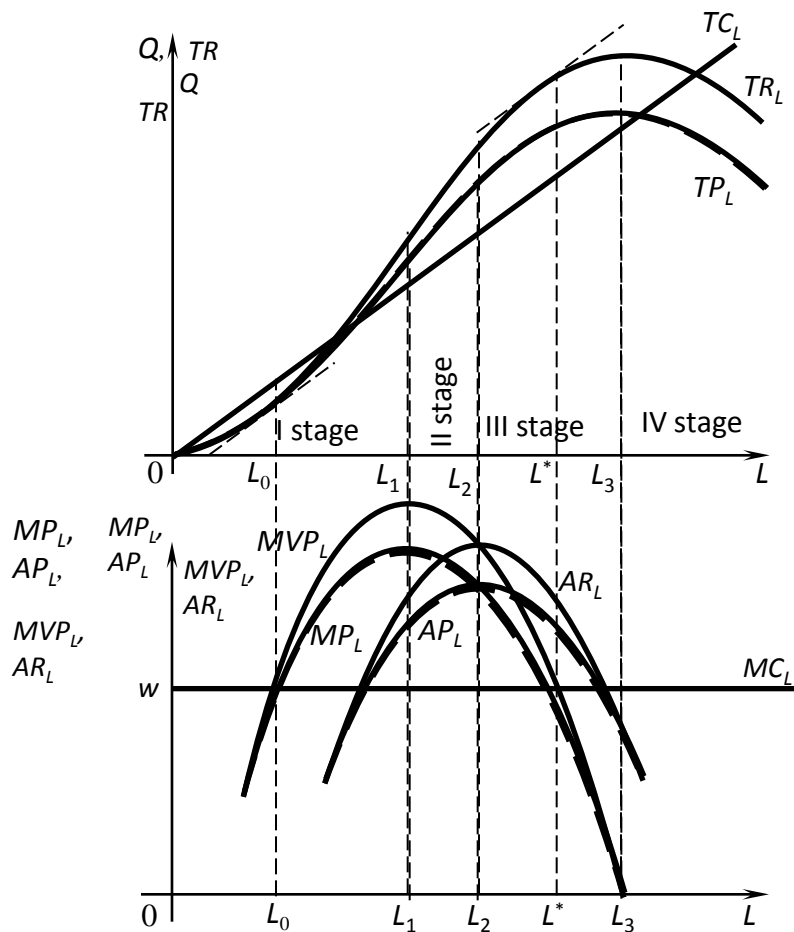
Marginal revenue product of labour ($MRPL = MPL * MR$).

Perfect competition in output market:

$$MRPL = MPL * MR = MPL * P = MVPL$$

1st case: Perfect competition both in product and labour markets

Profit maximization at labour market



$MVP_L = P \cdot MP_L$, where P is a price for a product of the firm, MP_L – marginal product of labour, W – wage rate;

MC_L – marginal factor cost of labour

MVP_L – demand for labour curve

Labour input optimization rule:

$$MRP_L = MVP_L = MC_L = AC_L = w.$$

Example: APT 2000

2. Assume that a firm produces output using one fixed input, capital, and one variable input, labor. The firm can sell all of the output it produces at a market price of \$3 each, can hire all of the workers it wants at a market wage rate of \$11 each, and has fixed costs of \$10. It faces the following production schedule.

<u>Number of Employees</u>	<u>Total Output</u>
0	0
1	14
2	26
3	35
4	42
5	46
6	48

- (a) In what kind of market structure does this firm sell its output? How can you tell?
- (b) In what kind of market structure does this firm hire its employees? How can you tell?
- (c) Using marginal revenue product analysis, how many employees should this firm hire to maximize short-run profits? How can you determine that?
- (d) Based on your answer in part (c), how many units of output will this firm produce?
- (e) At the level of output you identified in part (d), is the firm earning an economic profit, a normal profit, or suffering a loss? How can you tell?

Example: APT 2006 (Form B)

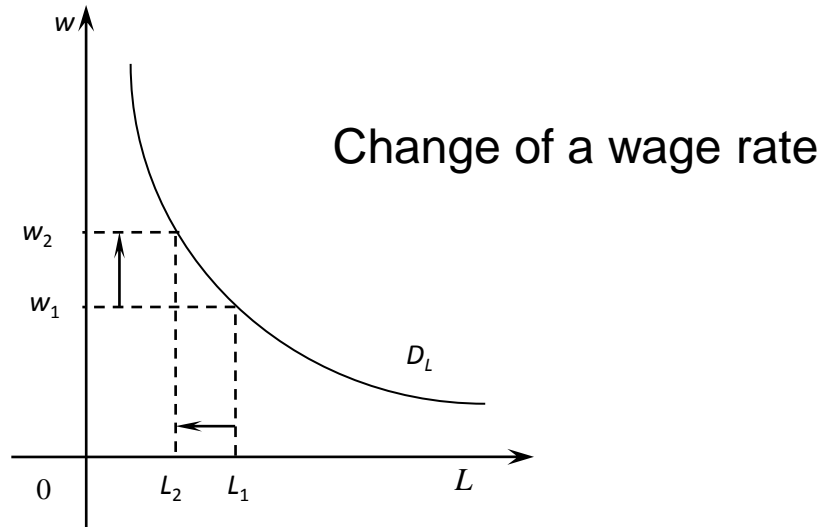
3. Pride Textiles produces and sells towels in a perfectly competitive market. Pride Textiles hires its workers in a perfectly competitive labor market. Assume that the market wage rate for workers is \$80 per day.
- (a) State the conditions necessary for hiring the profit-maximizing amount of labor.
 - (b) At the profit-maximizing level of output, suppose that the marginal product of the last worker hired is 20 towels per day. Calculate the price of a towel.
 - (c) Draw a correctly labeled graph of the labor supply and demand curves for Pride Textiles, and show the equilibrium amount of labor hired.

Example: APT 2003

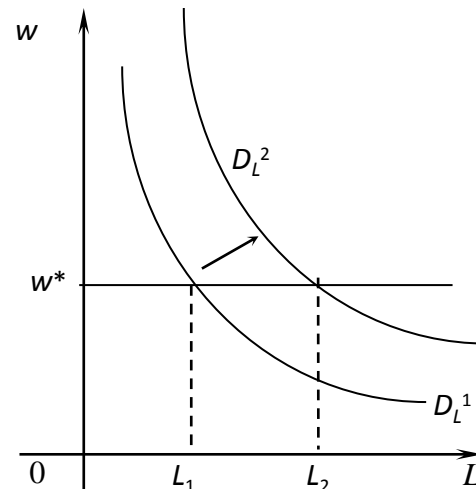
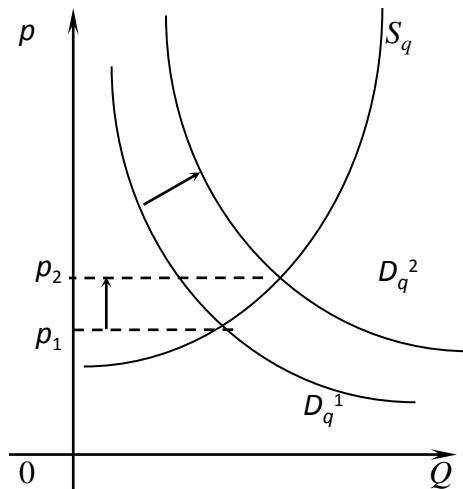
3. Assume that Company XYZ is a profit-maximizing firm that hires its labor in a perfectly competitive labor market and sells its product in a perfectly competitive output market.
 - (a) Define the marginal revenue product of labor (MRP_L).
 - (b) Using correctly labeled side-by-side graphs, show each of the following.
 - (i) The equilibrium wage in the labor market
 - (ii) The labor supply curve the firm faces
 - (iii) The number of workers the firm will hire

1st case: Perfect competition both in product and labour markets

Factors of demand for labour in short run



Change in a demand for the product Change in technology



Example: APT 2006 (Form B)

(continued)

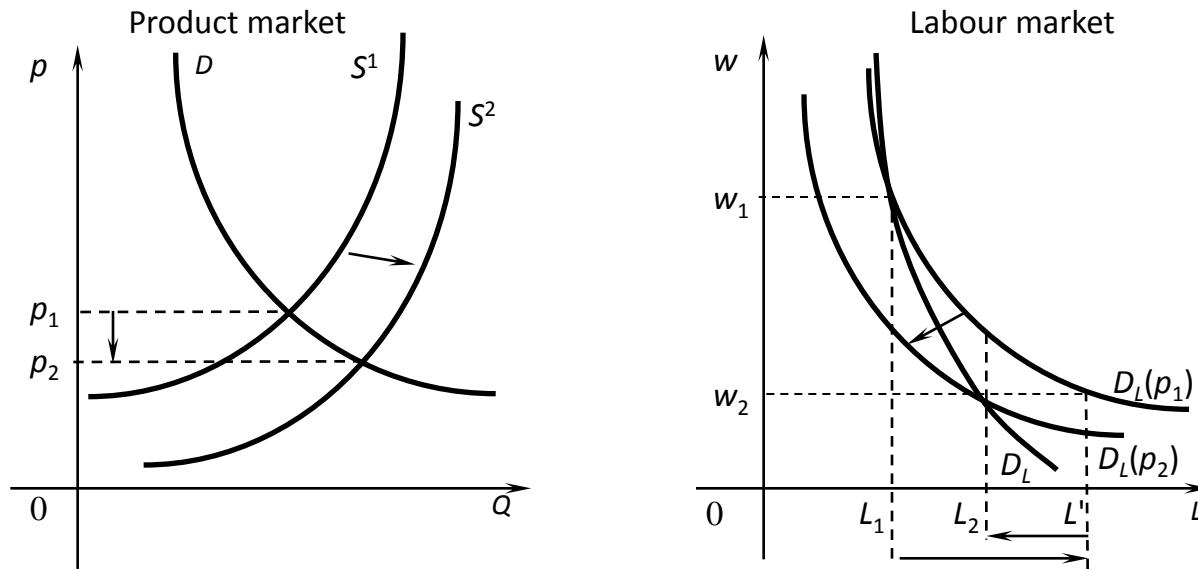
3. Pride Textiles produces and sells towels in a perfectly competitive market. Pride Textiles hires its workers in a perfectly competitive labor market. Assume that the market wage rate for workers is \$80 per day.
- (a) State the conditions necessary for hiring the profit-maximizing amount of labor.
 - (b) At the profit-maximizing level of output, suppose that the marginal product of the last worker hired is 20 towels per day. Calculate the price of a towel.
 - (c) Draw a correctly labeled graph of the labor supply and demand curves for Pride Textiles, and show the equilibrium amount of labor hired.
 - (d) Given your answer to part (b), if the price of a towel increases, explain how Pride's profit-maximizing quantity of labor will be affected.

Example: APT 2003 (continued)

3. Assume that Company XYZ is a profit-maximizing firm that hires its labor in a perfectly competitive labor market and sells its product in a perfectly competitive output market.
 - (a) Define the marginal revenue product of labor (MRP_L).
 - (b) Using correctly labeled side-by-side graphs, show each of the following.
 - (i) The equilibrium wage in the labor market
 - (ii) The labor supply curve the firm faces
 - (iii) The number of workers the firm will hire
 - (c) Company XYZ develops a new technology that increases its labor productivity. Currently this technology is not available to any other firm. For Company XYZ, explain how the increased productivity will affect each of the following.
 - (i) Wage rates
 - (ii) Number of workers hired

1st case: Perfect competition both in product and labour markets and labour markets

Industry demand for labour



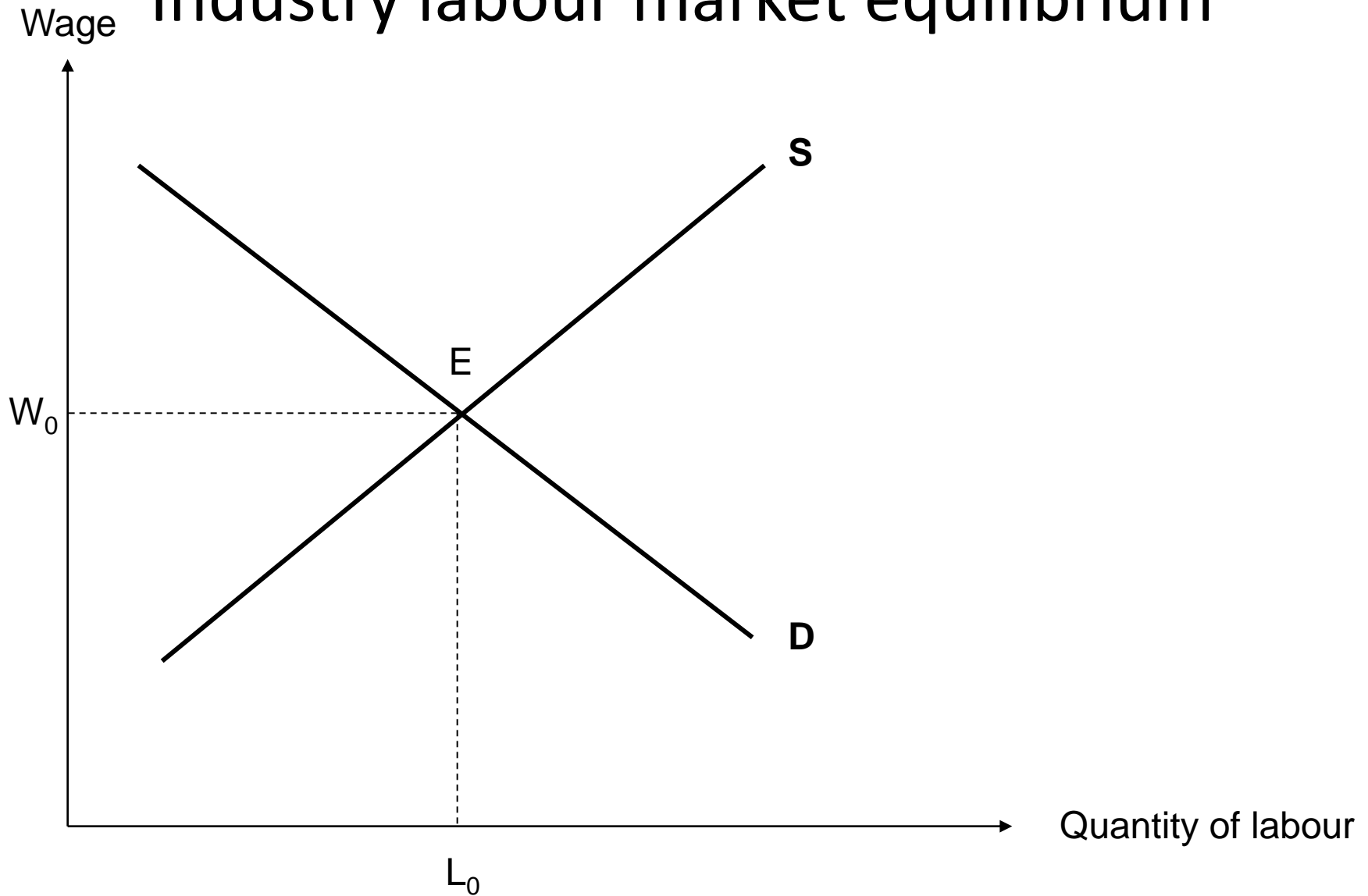
Wage falls to W_2 .

$D_L(p_i)$ – sum of individual firms' MVPLs at given output price p_i .

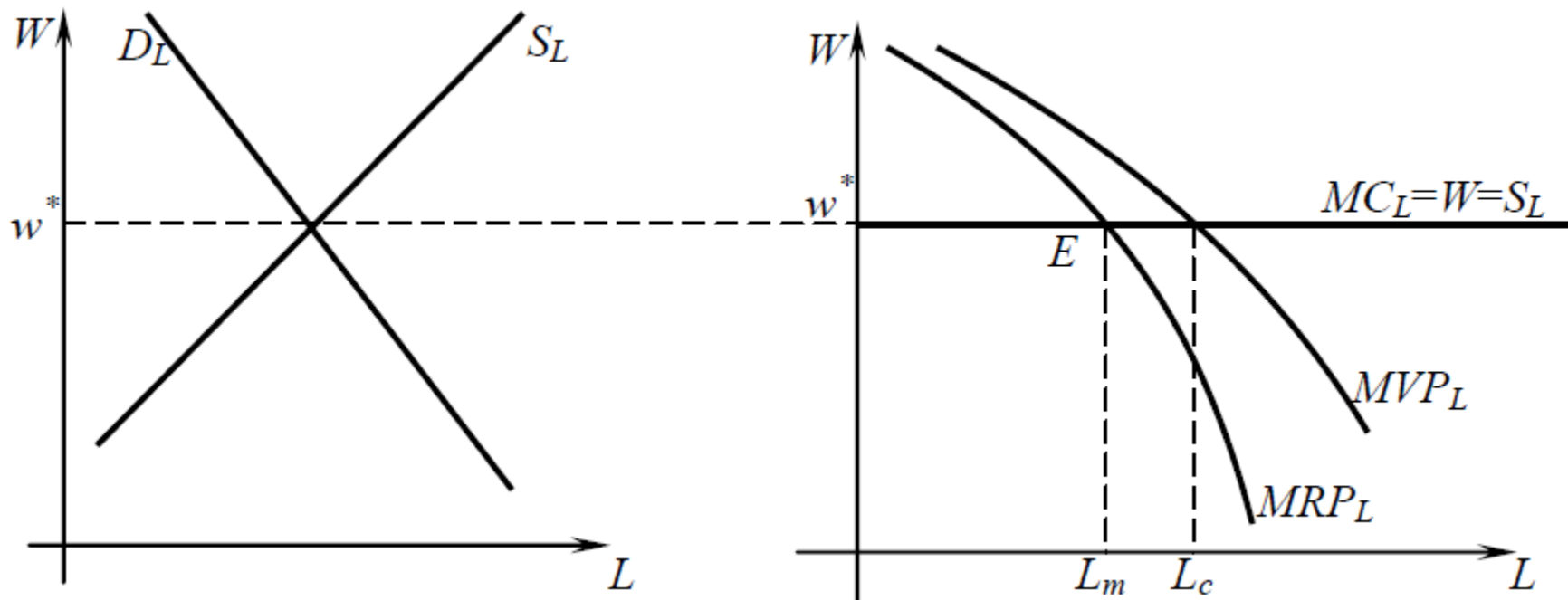
Do we just add demand curves (MVPL) for individual firms? No!

1st case: Perfect competition both in product and labour markets
and labour markets

Industry labour market equilibrium



2nd case: Imperfect competition in product market and perfect competition in labour market



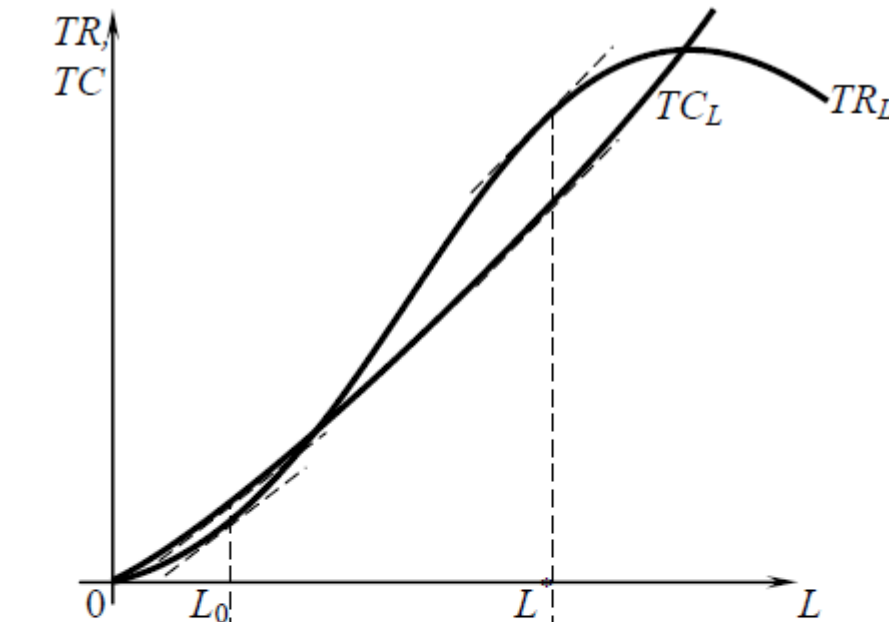
Labour input optimization rule: $MRP_L = MC_L = AC_L = w$.

A monopoly at a product market will hire less labour (L^M) as compared to a firm under perfect competition at a product market (L^C).

Example: APT 2005 (Form B)

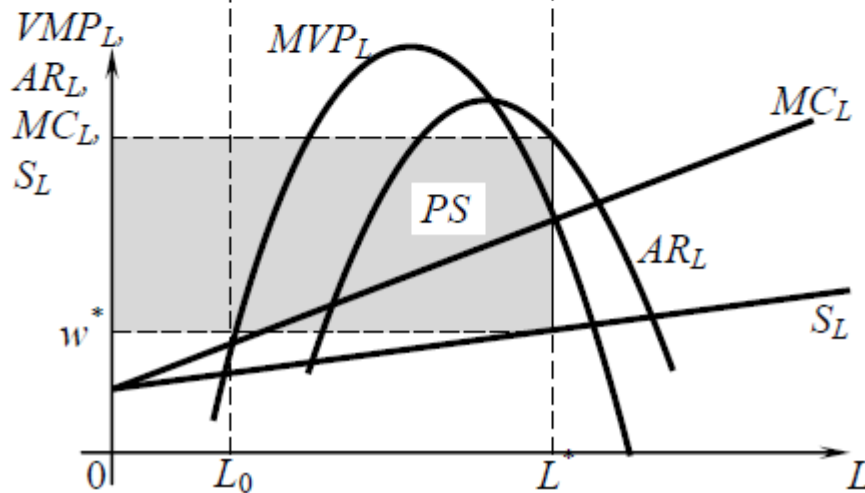
1. Petsall Corporation is a profit-maximizing monopolist. It sells a patented rabies vaccine for pets and earns economic profits.
 - (a) Draw a correctly labeled graph that shows each of the following for Petsall.
 - (i) Output and price of the vaccine
 - (ii) Area of economic profits
 - (b) Assume that Petsall hires its production workers in a perfectly competitive labor market at the wage rate of \$20 per hour.
 - (i) State the marginal conditions for hiring the profit-maximizing amount of labor.
 - (ii) Draw a correctly labeled graph that shows the labor supply and demand curves for Petsall and indicate the profit-maximizing quantity of labor.
 - (c) Suppose that the market wage rate now falls to \$15 per hour. Show on your diagram in (b) (ii) how each of the following would be affected.
 - (i) The supply of labor to Petsall
 - (ii) The amount of labor Petsall would hire
 - (d) Given the lower wage rate in (c), indicate how each of the following would change.
 - (i) Total fixed cost
 - (ii) Marginal cost
 - (iii) Price of the product

3rd case: Perfect competition in product market and monopsony in labour market

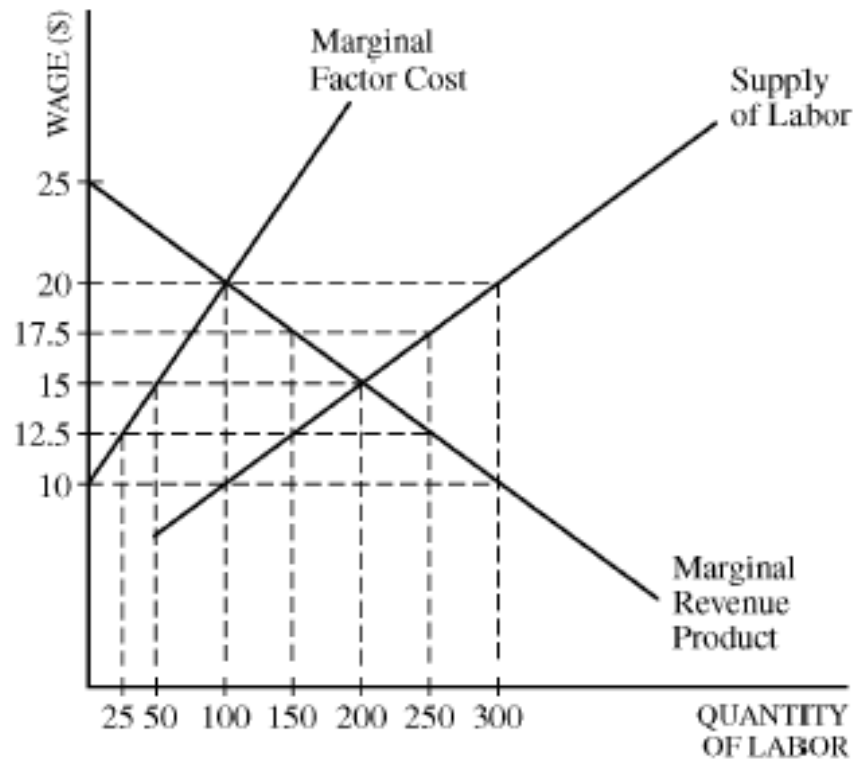


Profit maximization rule:

$$MVP_L = MC_L$$



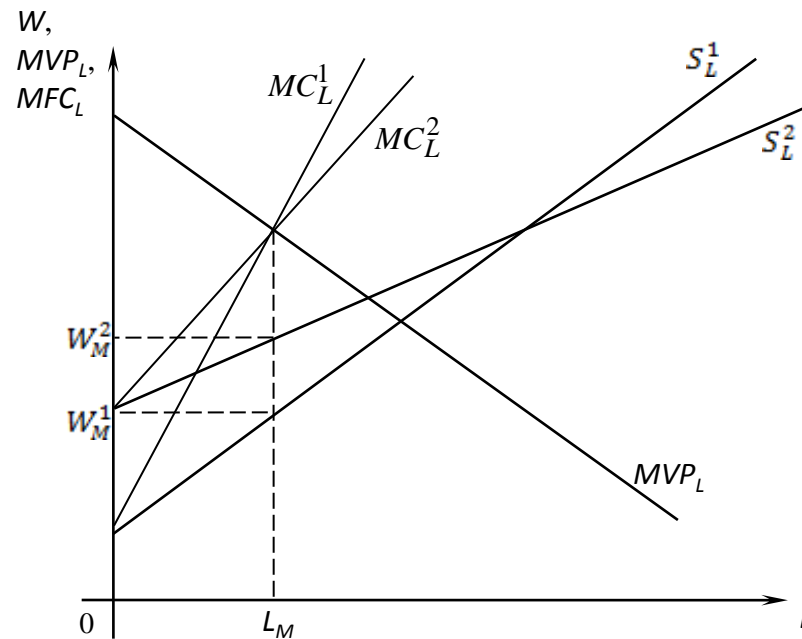
Example: APT 2011 (Form B)



3. Woodland is a small town in which everyone works for TreeMart, the local lumber company. TreeMart is a monopsonist in the labor market and a perfect competitor in the lumber market. In the short run, labor is the only variable input. The labor market for TreeMart is given in the graph above.
- Identify the profit-maximizing quantity of labor for TreeMart.
 - Identify the wage rate TreeMart pays to hire the profit-maximizing quantity of labor.
 - Identify the quantity of labor hired in each of the following situations.
 - TreeMart operates in a competitive labor market.
 - The government imposes a minimum wage of \$12.5. Explain.

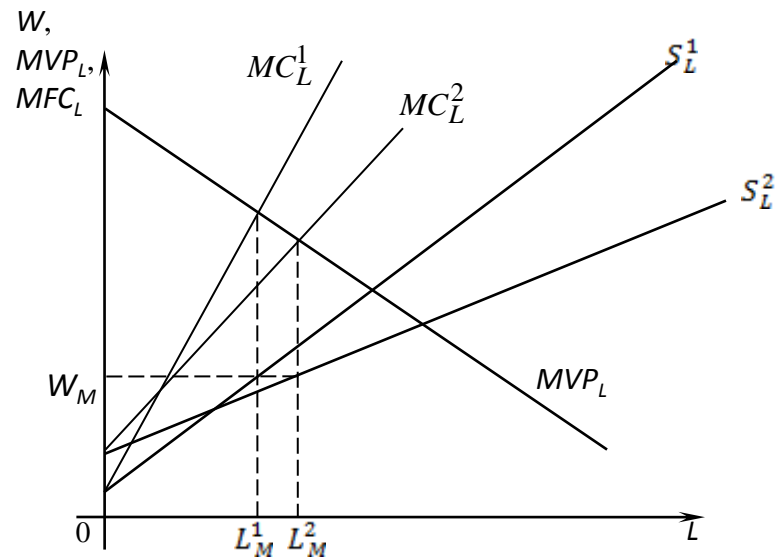
3rd case: Perfect competition in product market and monopsony in labour market

There is no demand for labour curve with monopsony



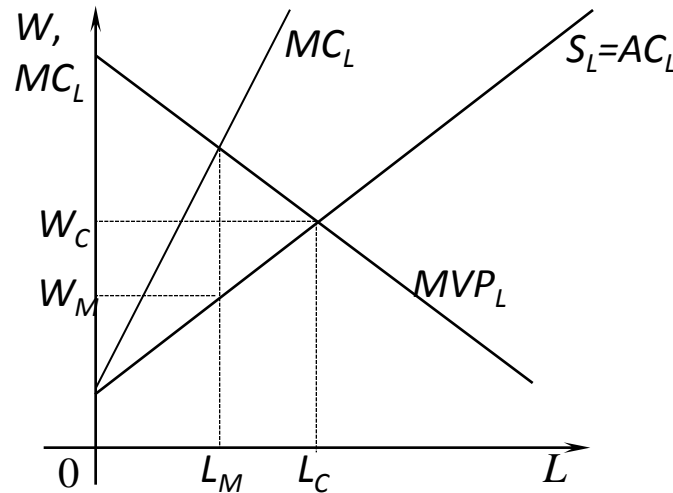
3rd case: Perfect competition in product market and monopsony in labour market

There is no demand for labour curve with monopsony



3rd case: Perfect competition in product market and monopsony in labour market

Inefficiency of a monopsony



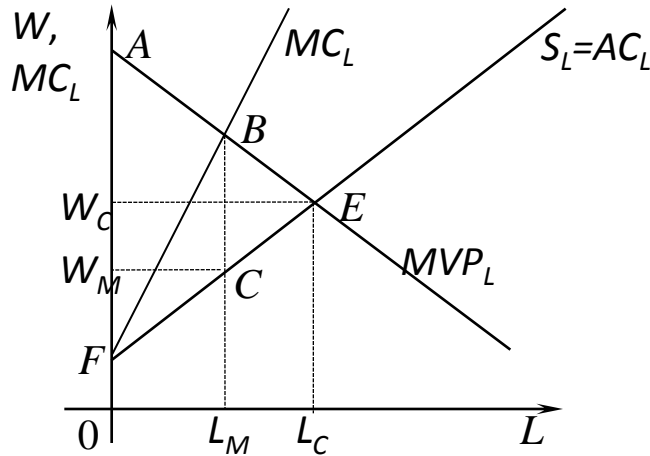
A monopsony hires less labour (L_M) as compared to labour market under perfect competition (L_C) and pays lower wages (W_M) than a competitive firm (W_C).

Welfare Analysis of Labour Market

- The transfer earnings of a factor of production - minimum payments required to induce that factor to work in that job.
- Economic rent is the extra payment a factor receives over and above the transfer earnings.

3rd case: Perfect competition in product market and monopsony in labour market

Welfare loss under monopsony



Perfect competition

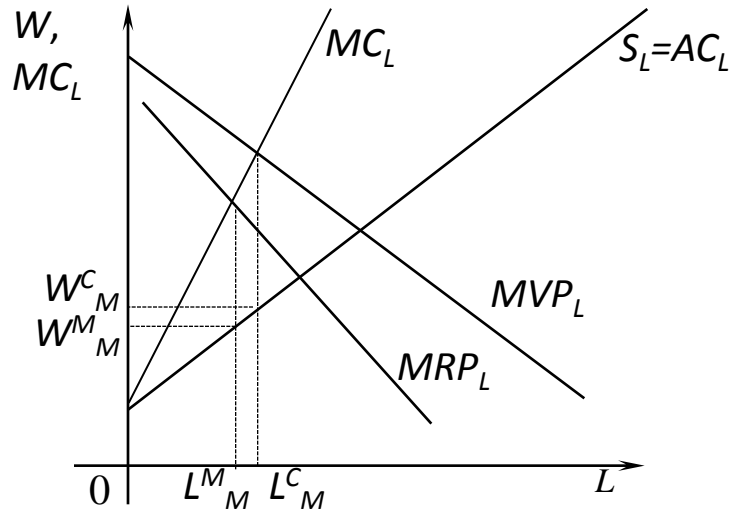
- S_{0AEL_C} – total revenue
- $S_{0W_CEL_C}$ – variable cost of production
- S_{W_CAE} – producers' surplus
- $S_{0W_CEL_C}$ – wages earned by workers
- S_{0FEL_C} – transfer earnings
- S_{FW_CE} – workers' rent
- S_{FAE} – social welfare

Monopsony

- S_{0ABL_M} – total revenue
- $S_{0W_MCL_M}$ – variable cost of production
- S_{W_MABC} – producer's surplus
- $S_{0W_MCL_M}$ – wages earned by workers
- S_{0FCL_M} – transfer earnings
- $S_{FW_M\bar{C}}$ – workers' rent
- S_{FABC} – social welfare

S_{BCE} – welfare loss under monopsony

4th case: Monopoly in product market and monopsony in labour market



Labour input optimization rule:

$$MRP_L = MC_L.$$

A monopsony at a labour market which is the sole producer of the good will hire less labour (L^M_M) as compared to monopsony under perfect competition at a product market (L^C_M) and will pay lower wages (W^M_M) in comparison with a perfect competitor at the product market (W^C_M).

Capital markets: Interest Rates

Interest rate is determined at financial markets, where supply of loanable funds is provided by households (savers) and demand for loanable funds is required by investors (borrowers)

Nominal interest rate: i

Inflation rate: π

Real interest rate: $r = i - \pi$

Present value

Value next year = $(1+r)$ *Present value

$$\text{Present value} = \frac{\text{Value next year}}{1 + r}$$

FV – future value t years from now:

$FV = PV(1+r)^t$, where PV – present value

$$PV = \frac{FV}{(1 + r)^t}$$

Net present value

R_t – rental in year t ,

C_t – costs in year t (investment and maintenance)

$$\text{NPV} = R_0 - C_0 + \frac{R_1 - C_1}{1+r} + \frac{R_2 - C_2}{(1+r)^2} + \dots + \frac{R_T - C_T}{(1+r)^T}$$

or

$$\text{NPV} = \sum_{t=0}^T \frac{R_t - C_t}{(1+r)^t}$$

Invest money in an asset if the asset price is greater than the present discounted value of its net income stream

Value of a perpetuity

Suppose $R_t = R = \text{const}$ - annual rental, $C_t = 0$, $T = \infty$

$$\begin{aligned} \text{NPV} &= \frac{R}{1+r} + \frac{R}{(1+r)^2} + \dots + \frac{R}{(1+r)^t} + \dots = \\ &= \frac{R}{(1+r) \left(1 - \frac{1}{1+r} \right)} = \frac{R}{r} \end{aligned}$$

Asset Price, Rental Payments and Interest Rate (continued)

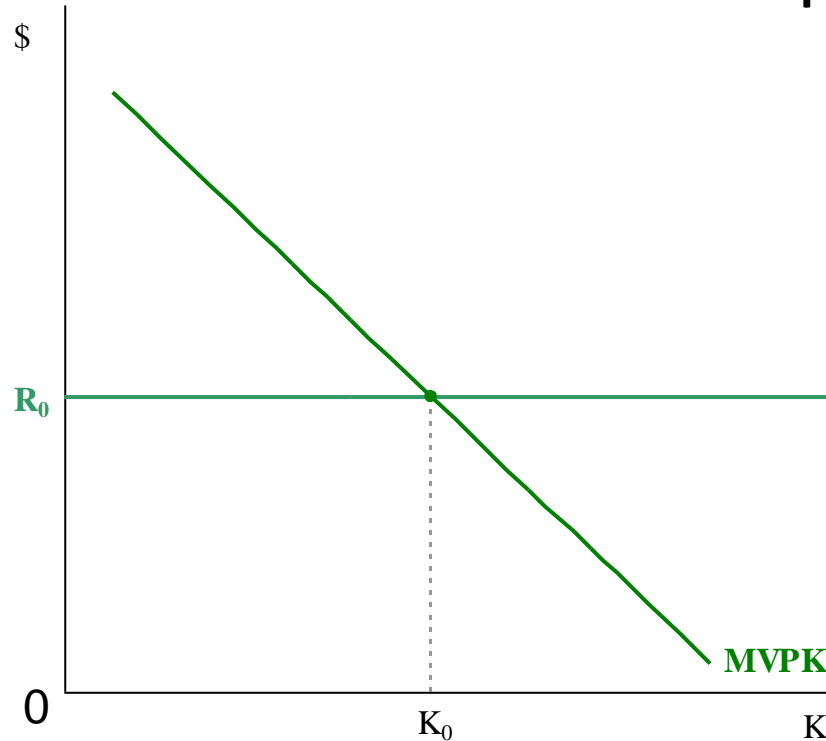
P_A – price of an asset, R – annual rental, C – annual maintenance costs, r – real interest rate, δ – depreciation rate
Required rental on capital – rental payment that would just cover the costs.

Borrow to invest in projects that would yield return in future.
Interest rate – the price of borrowing for investors.

Investment in real and financial assets should yield at least the same return: $R - C + (1 - \delta)P_A \geq P_A(1 + r)$

Equilibrium price of an asset:
$$P_A = \frac{R - C}{\delta + r}$$

Demand for Capital Services



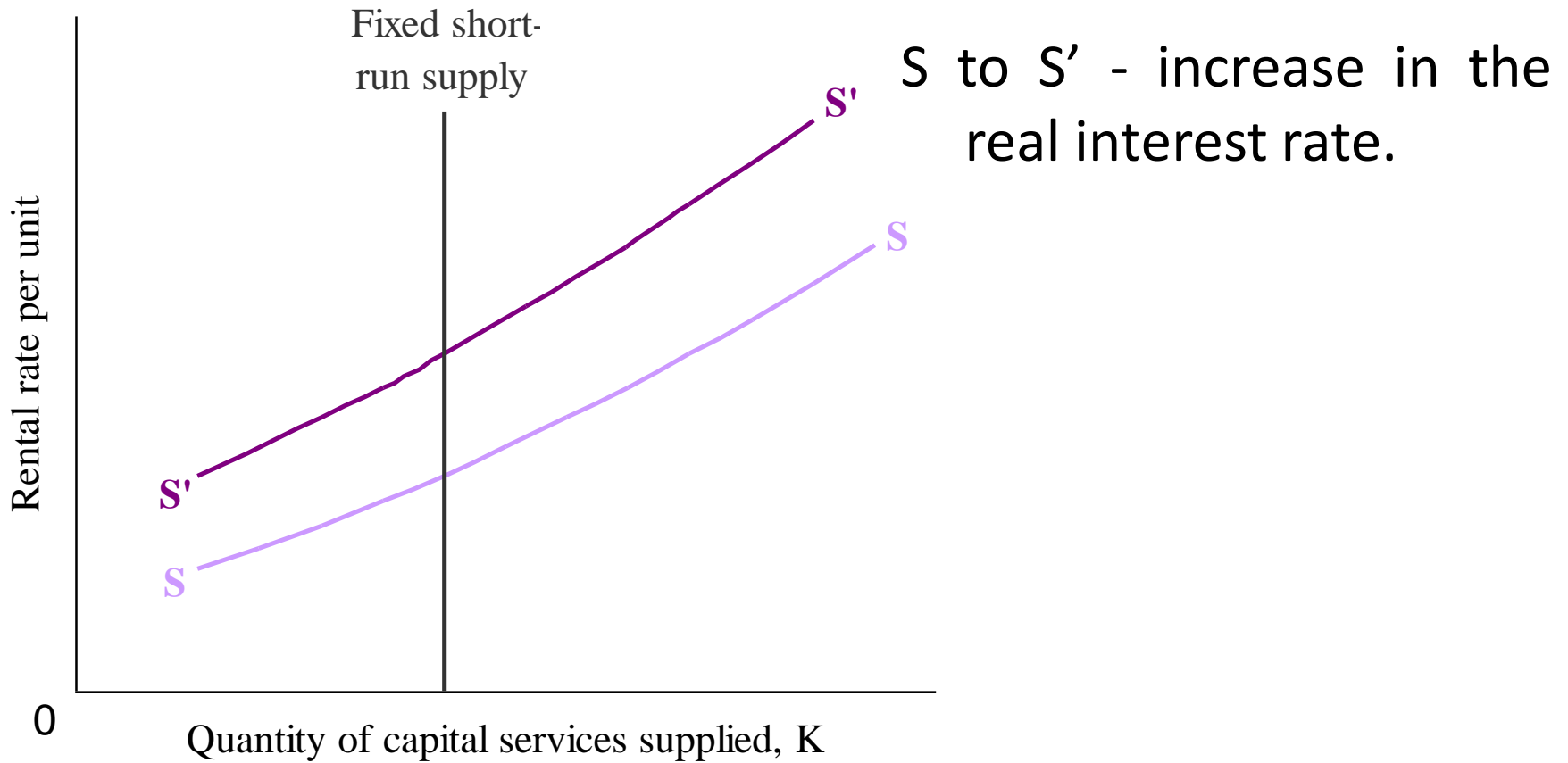
Competitive output market
and competitive capital
market

Marginal value product of
capital ($MVP_K = MP_K * P$)

Capital input optimization
rule: $MVP_K = R$.

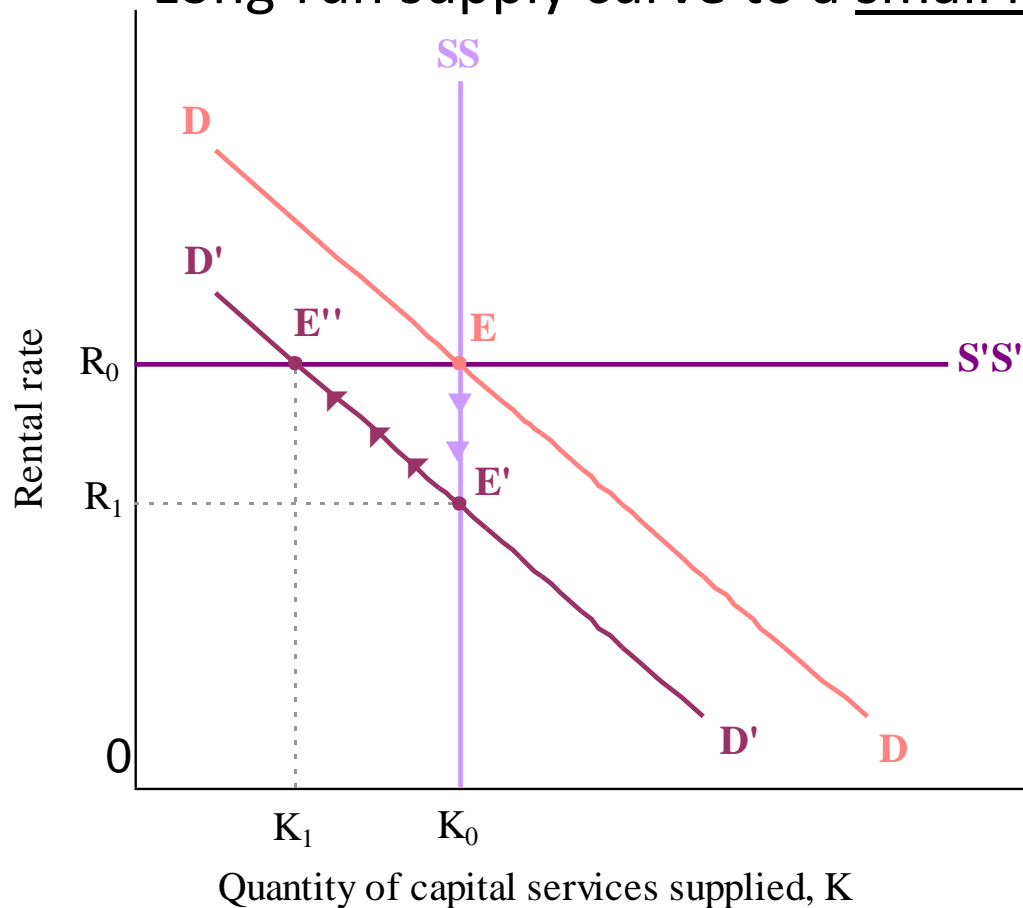
- MVPK – demand for capital services by individual firm.
- As with demand for labour, elasticity of demand for capital services depends on the elasticity of demand for industry's output (derived demand).
- The industry demand for capital services can be derived from demands of individual firms as we derived the market demand for labour.

Supply of Capital Services to the Economy



Short-run and Long-run Equilibrium in the Market for Capital Services: small industry

The slope of the supply curve depends on size of the industry:
Long-run supply curve to a small industry is horizontal.



Market for Capital Services determines rental rate for capital services and hours rented.

Supply: Owners of capital

Demand: Firms renting capital

Long-run supply curve to a large industry is upward-sloping.

Investment in human capital:

- education;
- training and on-the-job training;
- experience.

Human capital – the stock of knowledge and skills accumulated by a worker to enhance future productivity.

Benefits versus costs of getting more education

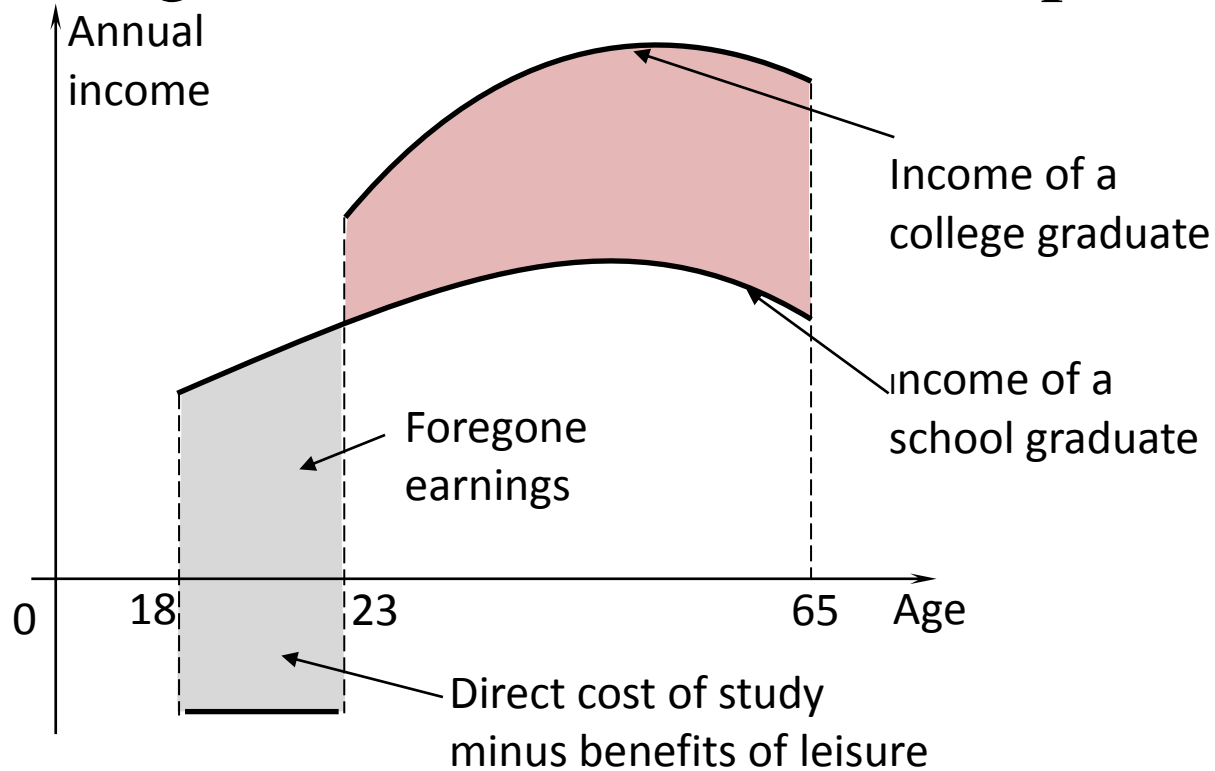
Benefits:

- higher future earnings (discounted for present value),
- fun going to school.

Costs:

- direct: tuition, books,... (minus grants and subsidies)
- opportunity costs: forgone income

Wage differentials: human capital



Compensating wage differentials - difference in the wage rate that reflects attractiveness of a job's working conditions.

Discrimination - different treatment of people whose relevant characteristics are identical.

Wage differentials: discriminating monopsony

