

Prof. Marek Weretka's  
Econ 301 Intermediate Microeconomics  
**Problem set 11**

**Problem 1 (Monopoly and Labor Market)**

- a) Find a secret of happiness of a monopoly (on a good market) that determines the optimal demand for labor (in terms of elasticity of the demand). Hint: what is a derivative of  $TR(y(L))$  with respect to  $L$ ?
- b) Explain intuitively the condition from a)
- c) Argue that the less elastic the demand (i.e., smaller  $|\varepsilon|$ ) the smaller the demand for labor.
- d) Explain how the equilibrium wage rate and the level of labor is affected by market power in good markets, if labor supply is inelastic.

**Problem 2 (Monopsony and Labor Market)**

Consider a firm with the (short run) production function  $y(L) = 2L - L^2$  and assume  $p = 1$ .

- a) Find labor demand of a firm that is competitive on both labor and commodity market. Plot the demand for labor in the graph.
- b) Suppose the (inverse) labor supply is  $w(L) = L$ . Find a competitive equilibrium employment and wage rate. Mark the equilibrium in the graph.

Monopsony:

- c) Find a total labor cost of a monopsony that recognizes its impact on wage rate  $C_L(L) = w(L)L$  and calculate marginal labor cost  $MC_L(L)$ .
- d) Explain why marginal cost of labor  $MC_L(L)$  is above wage  $w(L)$  for any  $L$ . Plot the two curves in in the graph.
- e) Write down a profit function of a monopsony and derive a secret of happiness ( $MPL = MC_L$ ). Explain intuitively why monopsony does not hire one more or one less worker than the one determined by condition  $MPL = MC_L$ .
- f) Find optimal level of labor  $L$  and wage  $w$ . Mark them in a graph and compare with the competitive outcome from b). Is the level of labor efficient?

Minimal wage rate:

- g) Suppose minimal wage rate is  $w^{min}$  and hence the profit of the firm is given by  $\pi = y(L) - w^{min}L$ . Find optimal labor demand of a firm as a function of  $w^{min}$ .
- h) Suggest minimal wage rate  $w^{min}$  that results in a competitive (and hence Pareto efficient) level of labor.

**Problem 3 (Oligopolistic Industry)**

Below you can find market shares of major beer producers in the USA in 2000.

Bud Light	36.8%
Coors Light	19.1%
Miller Lite	18.5%
Natural Light	9.2%
Busch Light	6.1%
Michelob Light	3.3%
Keystone Light	2.6%
Millwaukee's Best Light	2.3%
Old Milwaukee Light	0.8%
Miller Genuine Draft Light	0.7%

The total light beer sales in 2000 amounted to 87 million barrels.

- a) Find the concentration ratio (a "big four" index) for the beer industry in the USA.
- b) Using Excel find HHI index for this industry.
- c) Is such industry concentrated, moderately concentrated or perfectly competitive? (argue using HHI index)
- d) What in your opinion would be a reaction of the Trade Commission to a merger proposal by Bud Light and Coors Light? Why?

#### Problem 4 (Aircraft industry)

The jet aircraft industry is dominated by two major competitors: Airbus ( $A$  - based in Europe) and Boeing ( $B$  - based in the USA). Both companies have similar technology allowing each firm to produce a jet at a cost of \$20 (in mln). Accordingly, their costs functions are given by

$$\begin{aligned}TC(y_A) &= 20y_A \\TC(y_B) &= 20y_B\end{aligned}$$

In order to simplify our analysis, we assume no fixed costs. The inverse demand for jets by major airlines is estimated to be

$$p(y) = 200 - y$$

a) Find analytically profit function  $\pi_B(y_B)$  for Boeing, given that the production of Airbus amounts to  $y_A = 100$  jets. In a graph with  $y_B$  on the horizontal axis and  $\pi$  on the vertical one, plot the profit function.

b) Is the production  $y_B = 100$  jets Boeing's best response to  $y_A = 100$ ? Why or why not? Find the optimal level of production, given Airbus produces  $y^A = 100$ ,  $y_A = 50$ , and  $y_A = 0$ ? Mark the three points in space  $(y_A, y_B)$ .

c) Find analytically the best response function for Boeing  $R_B(y_A)$  and plot it in the graph from point b) .

d) Find analytically the best response function for Airbus,  $R_A(y_B)$  and add it to your graph from point b)

e) Find analytically the market price of an aircraft, the level of individual and aggregate production in a Cournot-Nash equilibrium. Also find the level of profit of each individual firm. Show the equilibrium in your graph from b.

f) What is the deadweight loss (DWL) associated with oligopolistic trading by the two firms?

g) Suppose the two firms A and B form a cartel. What is the aggregate level of production, and profit per firm given collusion? Does collusion benefit the two producers?

h) Find a deadweight loss (DWL) given collusion, and compare it to the one from f) . Which loss is greater, why?

i) Is the considered cartel sustainable if the interactions, as described above, are only in the short run? Why? How about if the market interactions are repeated? Why?

#### Problem 5 (Accounting & Audit services in the USA)

There are  $N > 2$  auditing firms in the USA ( $N$  is a parameter). "Production"  $y^i$  of a firm  $i$  is measured in auditors' hours and a cost function is given by

$$TC(y^i) = 10y^i$$

You can think of \$10 as an hourly wage paid to an auditor. Again we assume no fixed cost. The inverse demand for auditing in the USA is

$$p(y) = 1000 - y$$

where  $y$  is an aggregate supply.

a) Find the level of aggregate production and market price in two extreme cases: monopoly ( $N = 1$ ) and perfect competition (Hint: recall that in the case of perfect competition the secret of happiness is  $p = MC$ .)

b) Plot the inverse demand function and mark the two points located on it - one for competitive interactions and one for monopoly.

c) Find analytically the level of production  $y^i$  supplied by each auditing firm and aggregate  $y$  number of hours, market price for one hour,  $p$ , the level of profit and the deadweight loss in the industry, all in the Cournot - Nash equilibrium. Find all variables as functions of  $N$ .

d) Find the values of aggregate production  $y$  and  $p$  for  $N = 2, 5$  and  $10$ . Mark the corresponding values on the graph from b)

e) In the graph with  $N$  on the horizontal axis and  $p$  on the vertical one, plot the equilibrium price. What can you say about the price limit, as  $N$  goes to infinity?

f) In the graph with  $N$  on the horizontal axis and  $y$  on the vertical one plot the equilibrium aggregate production. What can you say about the limit of aggregate production, as  $N$  goes to infinity?

g) In the graph with  $N$  on horizontal and  $DWL$  on vertical one plot the equilibrium DWL. What can you say about the limit of aggregate production, as  $N$  goes to infinity?