

ECON 267 Homework 7

Problems 1 and 2 Due in class on April 19, 2006

1. There are 4 firms in a market and they are producing an identical product. The inverse demand for this product is $P = 100 - Q$, where P is the price and Q is aggregate output. The marginal cost for firm 1, 2, and 3 are \$20. The marginal cost for firm 4 is \$30. Note $Q = q_1 + q_2 + q_3 + q_4$. Assume that there is no fixed cost. Assume also that the firms each choose their outputs to maximize profits given that they each act as Cournot competitors.

- (a) Identify the Cournot equilibrium output for each firm, the output price, and the profits of the four firms.
(b) Now assume that firms 1 and 4 merge. Is this merger profitable? What has happened to the profits of firm 2 as a result of this merger?

(a) For firm 1, firm 2 and firm 3, the best response functions are

$$q_1 = 40 - \frac{1}{2}(q_2 + q_3 + q_4)$$

$$q_2 = 40 - \frac{1}{2}(q_1 + q_3 + q_4)$$

$$q_3 = 40 - \frac{1}{2}(q_1 + q_2 + q_4)$$

For firm 4, the best response function is

$$q_4 = 35 - \frac{1}{2}(q_2 + q_3 + q_4)$$

$$Q = 62$$

Thus, we have

$$Q = 62; \quad P = 38.$$

$$q_1 = q_2 = q_3 = 18$$

$$q_4 = 8$$

$$\pi_1 = \pi_2 = \pi_3 = (38 - 20) \times 18 = (18)^2 = 324$$

$$q_4 = (38 - 30) \times 8 = 64$$

- (c) We assume that firms 2 and 3 are still independent. Since firm 4 has higher costs than firm 1, all production at the merged firm will take place using the facilities of firm 1.

Thus we have a three-firm Cournot game where the firms are symmetric. We can proceed as in (a), essentially ignoring firm 4. Price=40 and the output of each firm is 20.

The profits for each firm are given by

$$\begin{aligned}\pi_i &= Pq_i - 20q_i \\ &= (40)(20) - (20)(20) \\ &= 800 - 400 \\ &= 400\end{aligned}$$

So firms 2 and 3 each have profits of 400. In (a), the profits of firm 2 were $\pi_2 = 324$.

We now need to compare this to the profits that occurred in (a) to see how firms 1 and 4 do. The combined profits of firm 1 and firm 4 in part (a) are

$$324+64=388$$

Since this is smaller than profits after the merger (400), here is an incentive to merge.

2. Norman International has a monopoly in the manufacture of whatsits. Each whatsit requires exactly one richet as an input and incurs other variable costs of \$5 per unit. Richets are made by RepRich Inc., which is also a monopoly. The variable costs of manufacturing richets are \$5 per unit. Assume that the inverse demand for whatsits is $p_w = 50 - q_w$, where p_w is the price of whatsits in dollars per unit and q_w is the quantity of whatsits offered for sale by Norman International.

- What is the equilibrium whatsit price to consumer p_w , the equilibrium Richet price to Norman International p_r , and the equilibrium quantity of whatsits q_w ? What is the profit earned by each firm at these equilibrium prices and quantity?
- Now assume that these two firms merge to form NPR international. What is the equilibrium whatsit price to consumer p_w , ~~the equilibrium Richet price to Norman International p_r~~ , and the equilibrium quantity of whatsits q_w ? What is the profit earned ~~by each firm~~ by the merged firm at these equilibrium prices and quantity?
- Compare the consumer surplus in Part (a) and Part (b). By how much has consumer surplus been increased by the merger in the market for whatsits.

(a) The price of whatsits is 40 and the price of richets is 25. The sales of whatsits and richets are both 10. (See the in-class practice problem for hints.)

Profits of Norman International are given by revenue minus the cost of the richets minus the other variable costs or

$$\begin{aligned}\pi_{NI} &= (p_w)(10) - (p_r)(10) - (5)(10) \\ &= (40)(10) - (25)(10) - (5)(10) \\ &= 400 - 250 - 50 \\ &= 100\end{aligned}$$

Profits of PepRich are given by

$$\begin{aligned}\pi_{PR} &= (p_r)(10) - (5)(10) \\ &= (25)(10) - (5)(10) \\ &= 250 - 50 \\ &= 200\end{aligned}$$

(b) Now assume that these two firms merge to form NPR International. The sales of whatsits is 20. The price of whatsits is then

$$p_w = 50 - q_w = 50 - 20 = 30$$

Profits for the combined firm are given by

$$\begin{aligned}\pi_{NPR} &= p_w q_w - 5q_w - 5q_w \\ &= 30q_w - 5q_w - 5q_w \\ &= 20q_w \\ &= (20)(20) \\ &= 400\end{aligned}$$

The joint profits are 400. The profits of NI alone were 100 and the profits of PepRich alone were 200 for a total of 300. Thus, the profits as a merged firm are larger.

(c) By how much has consumer surplus been increased by the merger in the market for whatsits?

The price to consumers of 30 is lower than in the case of separate firms when the price of whatsits was 40.

Consumer surplus before the merger $(50 - 40) \times 10 / 2 = 50$

Consumer surplus after the merger $(50 - 30) \times 20 / 2 = 200$

Thus consumers are better off with the merger.