Lecture 9: Price Discrimination

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- Market is segmented (no re-selling across markets)
- Firm knows the characteristics of each market (demand curve)
- Consider the following example: Two kinds of consumers:

$$q_A(p_A) = 24 - p_A$$
$$q_B(p_B) = 24 - 2p_B.$$

- constant marginal cost of production of 6

If the firm were allowed to set different prices in the different markets, then he would choose:

$$\max_{p_A}(24 - p_A)(p_A - 6) \Longrightarrow p_A^* = 15$$
$$\max_{p_B}(24 - 2p_B)(p_B - 6) \Longrightarrow p_B^* = 9.$$

Total consumer surplus (CS) and profits of the firm in each market:

$$\pi_A^* = 81, \pi_B^* = 18, CS_A = 40.5, CS_B = 9.$$

Firm chose to set the same price in each market. Then he would maximize the following:

$$\max\left\{\max_{p\geq 12}(24-p)(p-6),\max_{p<12}(24-p)(p-6)+(24-2p)(p-6)\right\}$$
$$=\max\{81,75\}=81$$

- Price of $p^* = 15$ in both markets, which leads to only consumers in market A buying

- To summarize, the consumer surplus and profits in each market are:

$$\pi_A^* = 81, \pi_B^* = 0, CS_A = 40.5, CS_B = 0.$$

- Prohibiting third degree price discrimination can exclude a whole market altogether

- Highly inefficient compared to the social welfare outcome given third degree price discrimination

- Suppose that the constant marginal cost of production is now 4 instead of 6

- With third degree price discrimination, the firm sets the following prices:

$$\max_{p_A}(24 - p_A)(p_A - 4) \Longrightarrow p_A^* = 14,$$
$$\max_{p_B}(24 - 2p_B)(p_B - 4) \Longrightarrow p_B^* = 8.$$

- In this case, the profits and consumer surplus in each market is given by:

$$\pi_A^* = 100, \pi_B^* = 32, CS_A = 50, CS_B = 16, TS = 198.$$

- If the firm were prohibited from using third degree price discrimination, then:

$$\max\left\{\max_{p\geq 12}(24-p)(p-4), \max_{p<12}(48-3p)(p-4)\right\}$$
$$=\max\{100, 108\}=108.$$

- $p=10$

- profits in both markets and the consumer surplus in both markets:

$$\pi_A^*=84, \pi_B^*=24, CS_A=98, CS_B=4, TS=210.$$

- Consumers in region B are hurt but consumers in region A gain significantly leading to an increase in consumer surplus

- The firm's joint profits are hurt but the total surplus actually increases

- Total surplus decreases

- Third degree price discrimination is considered illegal in many countries and the European union

- It is possible to get around such allegations by claiming that the differential pricing comes from cost reasons

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- When someone or some firm is the sole buyer (monopoly is the sole seller)

- Often arises in the context of firms being the sole buyers of labor

- Let us study the profit maximization problem of a firm:

$$\max_{K,L} pf(K, L) - rK - w(L)L.$$

- w is now a function of the amount of labor demanded (reflecting the power of the firm in the labor market)

- The first order condition yields:

$$p\frac{\partial f}{\partial L}(K^*, L^*) = w'(L^*)L^* + w(L^*) \Longrightarrow pMPL = L^*w' + w.$$

- In a competitive market $w' = 0$ and so $pMPL = w$

- Wages and labor below the competitive level (an argument for minimum wages and union)

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- Demand equation for good b is linear:

$$q_b(p_b) = 100 - p_b.$$

- Firm B's optimization problem becomes:

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- The first order condition tells us:

$$100 - 2q_b = p_a + c \Longrightarrow p_a = 100 - 2q_b - c.$$

- Since firm b is the only demander of commodity a, we have:

$$p_a = 100 - 2q_b - c = 100 - 2q_a - c.$$

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- Thus firm B's maximization problem has given us an inverse demand function for commodity a

- Since firm A is also a monopolist in producing good a, we can solve firm A's maximization problem in the following way:

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$$100 - 4q_a - c = 0 \Rightarrow q_a^* = \frac{100 - c}{4}, p_a^* = 50 - \frac{c}{2}.$$

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- Firm a decides to supply the above units of a at a price $50 - c/2$

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- To summarize, we have:

$$p_a^* = 50 - \frac{c}{2} \quad (1)$$

$$q_a^* = \frac{100-c}{4} \quad (2)$$

$$p_b^* = 75 + \frac{c}{4} \quad (3)$$

$$q_b^* = \frac{100-c}{4} \quad (4)$$

- **Case 1:** $c = 0$
-

$$p_a^* = 50, q_a^* = 25, p_b^* = 75, q_b^* = 25.$$

- If the firms were to merge so that whatever is produced by one of the firms can be used freely by that firm?
- The monopolists problem becomes:

$$\max_q q(100 - q).$$

- The first order condition states that:

$$100 - 2q^* = 0 \implies q^* = 50, p^* = 50.$$

- Price of good b comes down from 75 to 50
- Production of good b goes up from 25 to 50
- This increases both the profits of the firm *and* the consumer surplus!

- **Case 1:** $c = 10$
- $$p_a^* = 45, q_a^* = 22.5, p_b^* = 77.5, q_b^* = 22.5.$$
- If the firms were to merge so that whatever is produced by one of the firms can be used freely by that firm?
- The monopolists problem becomes:

$$\max_q q(100 - q) - 10q$$

- The first order condition states that:

$$100 - 2q = 10 \Longrightarrow p^* = 55, q^* = 45.$$

- This increases both the profits of the firm *and* the consumer surplus!

- What is going on in the above examples?
- because the first firm is a monopolist, it charges a mark up above marginal cost for its intermediate good
- This then distorts the marginal cost of firm B up additionally
- This then leads an even larger mark up on top of this additional marginal cost that affects the price of good b
- Essentially a markup on product a indirectly leads to an even larger markup on the final product b
- This is called the **double marginalization problem**

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- Double marginalization can lead to inefficiently high prices and inefficiently low levels of production
- By merging, both profits of the firm and consumer surplus may simultaneously go up
- Difficult to tell if two firms are merging to solve a double marginalization problem or if they are simply merging to create a monopoly
- What are some potential ways to solve this problem without mergers?
- One possible way might be to engage in profit sharing

- Firms agree to share profits according to the following rule
- Prices charged for good a are zero
- In exchange, the profits of firm B are shared via a split of α going to firm A and $(1-\alpha)$ going to firm B

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- Prices charged for good a are zero
- In exchange, the profits of firm B are shared via a split of α going to firm A and $(1-\alpha)$ going to firm B
- Firm A's decision is trivial. He simply produces $q_a = q_b$
- Firm B chooses to maximize:

$$\max_q (1-\alpha)\left((100-q)q - cq\right) = (1-\alpha)\left(\max_q (100-q)q - cq\right).$$

- Term inside the parentheses is just the monopoly profits if the two firms merged:

$$(1-\alpha)\max_q \Pi^m(q).$$

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- For any $\alpha \in (0, 1)$, we get an increase in consumer surplus and total profits
- Really, for any α?
- Such arrangements can break down easily. Profits are hard to verify.

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- Suppose that $\alpha = 1/2$ and $c = 10$. Then firm 2 maximizes:

$$\max_q \frac{1}{2} q(100 - q) - 10q.$$

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$$\frac{1}{2} MR(q) = MC = 10 \Longrightarrow MR(q) = 2MC = 20.$$

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- Firm will produce below monopoly profits since it will produce at a point where $MR = 2MC$ instead of $MR = MC$

- Solving, we get:

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- This does solve the double marginalization problem slightly:

$$p_b^* = 77.5 > p^* = 60, q_b^* = 22.5 < q^* = 40.$$