Lecture8-9

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Lecture8-9

Lecture 8-9: Price Discrimination

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Lecture 8-9: Price Discrimination

- Introduction
- First Degree Price Discrimination
- Third Degree Price Discrimination
- Monopsony
- Double Marginalization Problem
- Profit Sharing and Double Marginalization

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- In real life, firms often have different prices for different consumers/units
- We will explore some of these now
- In a competitive market such exotic pricing schemes could never arise since $p =$ marginal cost

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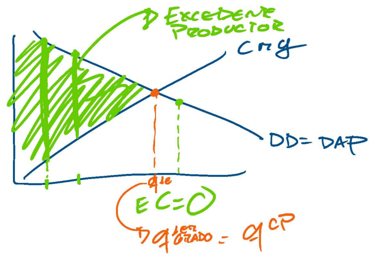
- Firm can extract all of the surplus of the consumer. How?



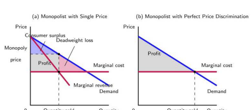
- Firm will price at $p(q)$ for the q-th unit and continue to produce until $p(q) = MC(q)$

- Firm will price at $p(q)$ for the q-th unit and continue to produce until $p(q) = MC(q)$

- Firm gets all of the consumer surplus as his profits:

$$\Pi = \int_0^{q^*} (p(q) - c'(q))dq = \int_0^{q^*} p(q)dq - c(q^*),$$

where q^* is the quantity at which $p(q^*) = c'(q^*)$.



- Firm can do this is because it knows the exact demand curve of each consumer
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- Amazon tries to estimate everyone's demand curve

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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

$\pi_A = (24 - P_A)P - (24 - P_A)6 = (24 - P_A)(P_A - 6)$

$\frac{\partial \pi_A}{\partial P_A} = (-1)(P_A - 6) + (24 - P_A)(1) = 6 - P_A + 24 - P_A = 30 - 2P_A = 0$

$\boxed{P_A^* = 15}$

$\pi_B = (24 - 2P_B)(P_B - 6)$

$\frac{\partial \pi_B}{\partial P_B} = (-2)(P_B - 6) + (24 - 2P_B)(1) = 12 - 2P_B + 24 - 2P_B = 0$

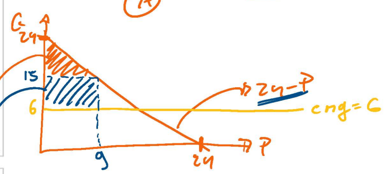
$36 - 4P_B = 0$

$\boxed{P_B = 9}$

A

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

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



$\pi^* = (15 - 6)(9) = 81$

$EC = \frac{9(24 - 15)}{2} = \frac{81}{2} = 40.5$

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

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

$Q_T(P) = Q_A(P) + Q_B(P)$

$Q_A(P) = 24 - P \rightarrow Q_A(P) = \begin{cases} 24 - P & P \le 24 \\ 0 & P > 24 \end{cases}$

$Q_B(P) = 24 - 2P \rightarrow Q_B(P) = \begin{cases} 24 - 2P & P \le 12 \\ 0 & P > 12 \end{cases}$

~~$Q_T(P) = 48 - 3P$~~

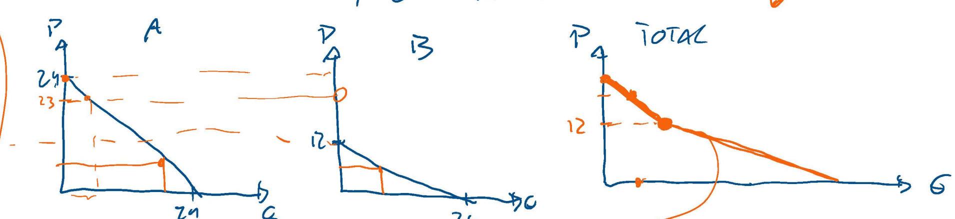
~~$Q_T(13) = 48 - 39 = 9$~~

$Q_T(P) = \begin{cases} 48 - 3P & P \le 12 \\ 24 - P & P \in (12, 24) \\ 0 & P \ge 24 \end{cases}$

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

$(P - 6)(48 - 3P)$

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



$\Pi(Q) = Q\,P(Q) - 6 \cdot Q$

- 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:

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

Si $P \ge 12$

Solo A

$\Pi = (24 - P)(P - 6)$

$\frac{\partial \Pi}{\partial P} = 0 \Rightarrow P^* = 15$

$\boxed{Q^* = 9 = q_A}$

$\boxed{\Pi = 81}$

$\boxed{EC = 40.5}$

Si $P < 12$

A y B

$\Pi = (48 - 3P)(P - 6)$

$\frac{\partial \Pi}{\partial P} = (-3)(P - 6) + (48 - 3P)(1)$

$= 18 - 3P + 48 - 3P$

$= 66 - 6P = 0$

$P^* = 11$

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

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

- $p = 10$
- profits in both markets and the consumer surplus in both markets:

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

$EC = 40.5$

$= 66 - 6p = 0$

$\boxed{p^* = 11}$

$\Pi^* = (48-33)(11-6)$
$= 15\,(5) = 75$

- 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

$\boxed{P^M = 15}$

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

$\Rightarrow \frac{\partial \Pi}{\partial L} = p\frac{\partial f(K,L)}{\partial L} - w'(L)L - w(L) = 0$

sin poder monopsonio $w'(L) = 0 \Rightarrow \boxed{\frac{\partial f(K,L)}{\partial L} = \frac{w}{p}}$

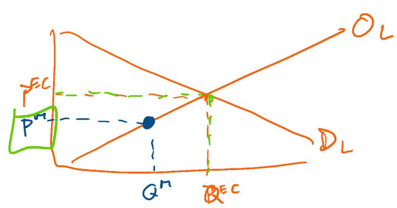
$w'(L) \neq 0$

$$\boxed{\frac{\partial f(K,L)}{\partial L} = \frac{w'(L)L + w(L)}{p}}$$

+

- 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)



W_{MIN}

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$$C(q_b) = (p_a + c)q_b.$$

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- Demand equation for good b is linear:

$$\boxed{q_b(p_b) = 100 - p_b.}$$

- Firm B's optimization problem becomes:

$$\max_{q_b} \underbrace{(100 - q_b)}_{P_B} q_b - \underbrace{p_a q_b - c q_b}_{\text{Costo total.}}$$

$$\pi = (100 - q_b) q_b - P_a q_b - C q_b$$

$$\frac{\partial \pi}{\partial q_b} = 100 - 2q_b - P_a - C = 0 \rightarrow \boxed{100 - 2q_b - C = P_a}$$

$$\boxed{q_b^* = \frac{100 - P_a - C}{2}}$$

DEMANDA

- Firm B's optimization problem becomes:

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$$\max_{q_b} (100 - q_b)q_b - p_a q_b - c q_b.$$

- The first order condition tells us:

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

→ DEMANDA A $\Rightarrow q_a = \frac{100 - P_a - c}{2}$

$\Pi_A = q_a P_a - \cancel{0} \rightarrow 0$

$\Pi_A = \left(\frac{100 - P_a - C}{2}\right) P_a$

- Firm B's optimization problem becomes:

$$\max_{q_b} (100 - q_b)q_b - p_a q_b - c q_b.$$

- 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:

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

$\frac{\partial \Pi_A}{\partial P_A} = \frac{100 - 2P_a - C}{2} = 0$

$\boxed{\frac{100 - C}{2} = P_A^*}$

$q_a = \frac{100 - \left(\frac{100 - C}{2}\right) - C}{2}$

- If the price is p_a then the q_a that solves the above equation would be the amount demanded of good a

$\boxed{q_a^* = \frac{100 - C}{4}}$

$\boxed{q_b^* = \frac{100 - C}{4}}$

- If the price is p_a then the q_a that solves the above equation would be the amount demanded of good a

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

$P_b = 100 - q_b = 100 - \frac{100}{4} + \frac{C}{4}$

$\boxed{P_b^* = \frac{300 + C}{4}}$

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

$$\max_{q_a} q_a (100 - 2q_a - c).$$

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- As a result, we get:

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

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$$\max_{q_a} q_a (100 - 2q_a - c).$$

- As a result, we get:

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

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

- Firm B will produce $q_b^* = q_a^* = \frac{100-c}{4}$

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- Then the price is given by:

$$p_b^* = 100 - \frac{100-c}{4} = 75 + \frac{c}{4}.$$

- Firm B will produce $q_b^* = q_a^* = \frac{100-c}{4}$
- Then the price is given by:

$$p_b^* = 100 - \frac{100-c}{4} = 75 + \frac{c}{4}.$$

- 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:** $c = 0$
- $$\boxed{p_a^* = 50, q_a^* = 25, p_b^* = 75, q_b^* = 25.}$$
- 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:

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

- 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!

$\Pi_T = \Pi_A + \Pi_B$

$\Pi_T = (100-q_b)q_b - (P_a+c)q_b + q_a P_a.$

$\boxed{q_a = q_b}$

$\Pi_T = (100-q_b)q_b - P_a q_b - c q_b + q_b P_a$

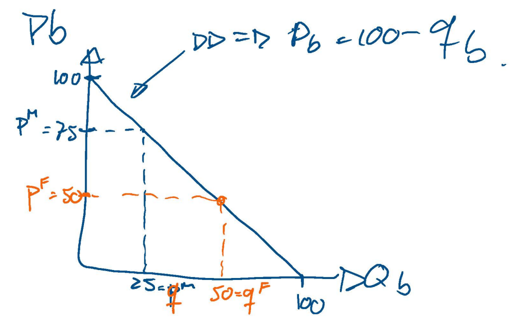
$\Pi_T = (100-q_b)q_b - c q_b$

$\frac{\partial \Pi_T}{\partial q_b} = 100 - 2q_b - c = 0$

$\frac{100-c}{2} = q_b$

$\boxed{c=0}$

$q_b = 50$
$P_b = 50$
$q_a = 50$



- **Case 1:** $c = 10$
- $$\boxed{p_a^* = 45, q_a^* = 22.5, p_b^* = 77.5, q_b^* = 22.5.}$$
- 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:

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

- 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

- 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
- 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:

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

$$(1-\alpha)\left(P_b q_b - (\cancel{P_a}^{\,0} + c)q_b\right)$$

$$(1-\alpha)\left((100-q_b)q_b - cq_b\right)$$

$$\frac{\partial \Pi}{\partial q_b} = (1-\alpha)\left[100 - 2q_b - c\right] = 0$$

$$\boxed{\frac{100-c}{2} = q_b}$$

- The firms will produce at the monopoly quantities which we were found were strictly greater than if the two firms produced completely separately without any such agreement

- The firms will produce at the monopoly quantities which we were found were strictly greater than if the two firms produced completely separately without any such agreement
- The price will be the monopoly price

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$$\alpha \Pi_B^{Fusion} \geq \Pi_A^{DM}$$

$$(1-\alpha)\Pi_B^{Fusion} \geq \Pi_B^{DM}$$

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Ingreso

$\frac{\partial \pi}{\partial q}$ $\frac{1}{2}(100-2q) - c = 0$

$50 - q - c = 0$

$\boxed{50 - c = q}$

$\boxed{c = 10}$

$\boxed{40 = q}$

$\boxed{P^{CG} = 60} = 100 - 40$

$\Pi_B^{CG} = \frac{1}{2}(40)(60) - 10(40)$

$\Pi_A^{CG} = \frac{1}{2}(40)(60)$

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Fusion

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