Lecture8-9

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Lecture8-9

Lecture 8-9: Price Discrimination

Mauricio Romero

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 $\boxed{p = \text{marginal cost}}$

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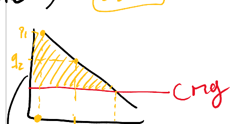
- Suppose the firm can observe all characteristics of the consumer (DISPONIBILIDAD A PAGAR)
- What should the firm do?

DD L



¿EFICIENTE? SI

"PARETO"

- Suppose the firm can observe all characteristics of the consumer

"PRECIO"

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- What should the firm do?
- Demand curve illustrates the willingness to pay for the q-th unit of the product

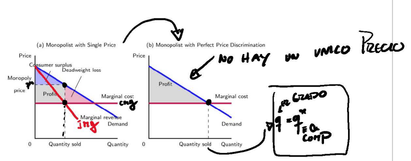
- Suppose the firm can observe all characteristics of the consumer
- What should the firm do?
- Demand curve illustrates the willingness to pay for the q-th unit of the product
- Firm can extract all of the surplus of the consumer. How?

- 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
- Such activity is prohibited in many countries

- Firm can do this is because it knows the exact demand curve of each consumer
- Such activity is prohibited in many countries
- Amazon tries to estimate everyone's demand curve

RAPPI

DATOS!

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A ≠ B

- 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:

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

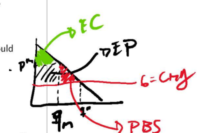
- constant marginal cost of production of 6

$\underbrace{(24-P_A)}_{q_A}\cdot P_A - 6\underbrace{(24-P_A)}_{q_A} = (24-P_A)(P_A-6)$

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

$\Pi_A = \boxed{\max_{p_A}(24-p_A)(p_A-6)} \Longrightarrow \boxed{p_A^* = 15} \to q_A^m = 9$

$\Pi_B = \boxed{\max_{p_B}(24-2p_B)(p_B-6)} \Longrightarrow \boxed{p_B^* = 9.} \to q_B^m = 6$



$EC_A = \frac{9\cdot(24-15)}{2} = \frac{81}{2}$ $EC_B = \frac{6(12-9)}{2} = \frac{18}{2} = 9$

$EP_A = 9\cdot(\underset{P_m}{15} - \underset{Cmg}{6}) = 9\cdot 9 = 81$ $EP_B = 6\cdot(\underset{P_m}{9} - \underset{Cmg}{6}) = 18$

$PBS_A = \frac{(18-9)(15-6)}{2} = \frac{81}{2}$ $PBS_B = \frac{(12-6)(9-6)}{2} = \frac{6\cdot 3}{2} = \frac{18}{2} = 9$

$q_A^c = 24-6 = 18$ $q_B^c = 24-6\cdot 2 = 12$

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:

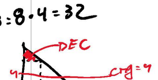
$$\boxed{\pi_A^* = 81}, \pi_B^* = 0, \boxed{CS_A = 40.5}, CS_B = 0.$$

- 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 $\boxed{4}$ instead of $\boxed{6}$
- With third degree price discrimination, the firm sets the following prices:

$\Pi_A = \max_{p_A}(24-p_A)(p_A-4) \Longrightarrow p_A^* = 14,$ $q_A = 10$ $\Pi_A = 10\cdot 10 = 100$

$\Pi_B = \max_{p_B}(24-2p_B)(p_B-4) \Longrightarrow p_B^* = 8.$ $q_B = 8 \to \Pi_B = 8\cdot 4 = 32$



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

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

$q_A = 24 - P_A$
$q_B = 24 - 2P_B$

$\to$ $q_A = 24 - P$
$q_B = 24 - 2P$

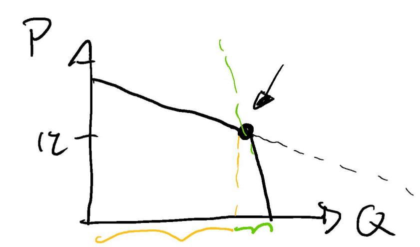
$\to$ $Q = q_A + q_B = (24-P) + (24-2P)$
$= 48 - 3P$

$\Downarrow$

$q_A = \max(0, 24-P)$
$q_B = \max(0, 24-2P)$

$q_A = 0$ si $P \geq 24$
$q_B = 0$ si $P \geq 12$

$$Q_T = \begin{cases} 48-3P & \text{si } P \leq 12 \\ 24-P & \text{si } 12 \leq P \leq 24 \\ 0 & \text{si } P \geq 24 \end{cases}$$



$\max_P \ \Pi \quad Q_T(P)P - 6Q_T(P)$

Suponga $P < 12$

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

Supongamos $12 < P < 24$

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

$P = 12$

$\Pi = (12)(12-6)$
$\underbrace{}_{q}$ $(P-C)$

$\pi_A: \max_{p_A}(24-p_A)(p_A-4) \Longrightarrow p_A = 14,$

$\pi_B: \max_{p_B}(24-2p_B)(p_B-4) \Longrightarrow p_B^* = 8. \quad q_B = 8 \Rightarrow \pi_B = 8 \cdot 4 = 32$

DEC

$c_{mg} = 4$

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

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

$$\frac{10 \cdot (24-14)}{2} = \frac{10 \cdot 10}{2} = 50 \qquad \frac{8 \cdot (12-8)}{2} = \frac{32}{2} = 16$$

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

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

- $\boxed{p = 10}$
- profits in both markets and the consumer surplus in both markets:

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

- 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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Double Marginalization Problem

Profit Sharing and Double Marginalization

- 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:

$$\max_{K,L} pf(K,L) - \boxed{rK} - w(L)L = \pi$$

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

mcdo perfecto $\rightarrow w'(L) = 0 \Rightarrow \boxed{\frac{\partial f}{\partial L} = \frac{w}{P} = \text{salario real}}$

$\Rightarrow EC \Rightarrow$ "firma"

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

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

$$\frac{\partial \pi}{\partial P} = -3(P-6) + 1(48-3P) = 0$$

$-3P + 18 + 48 - 3P = 0$

$66 = 6P$

$P = 11$

$\pi^* = (48-33)(11-6)$

$= (15)(5) = 75$

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

$$\frac{\partial \pi}{\partial P} = -1(P-6) + 1(24-P)$$

$= -P + 6 + 24 - P = 0$

$30 = 2P$

$P = 15$

$\pi^* = (24-15)(15-6)$

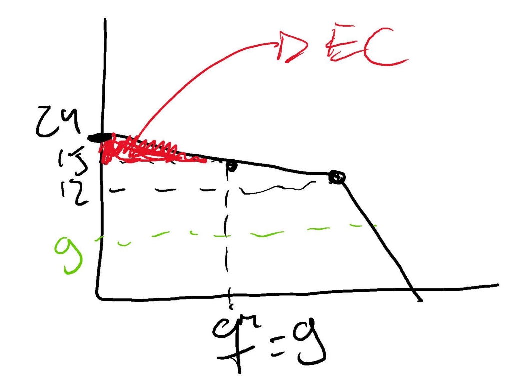
$= 9 \cdot 9 = 81$

$q\,(P-C)$

$\pi^C = 12 \cdot 6$

$\pi^C = 72$

$$\boxed{P^M = 15}$$



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

$EP = 81$

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si $P > 12$

$\pi = (24-P)(P-4)$

$$\frac{\partial \pi}{\partial P} = -1(P-4) + 1(24-P) = 0$$

$-P + 4 + 24 - P = 0$

$28 = 2P$

$P^* = 14$

si $\boxed{P < 12}$

$\pi = \boxed{(48-3P)}(P-4)$

$$\frac{\partial \pi}{\partial P} = -3(P-4) + 1(48-3P) = 0$$

$-3P + 12 + 48 - 3P = 0$

$60 = 6P$

$P^* = 10$

$28 = 2Y$

$P^* = 14$

$\Pi^* = 10 \cdot 10 = 100$

$60 \cdots$

$P^* = 10$

$\Pi^* = (18)(6) = 108$

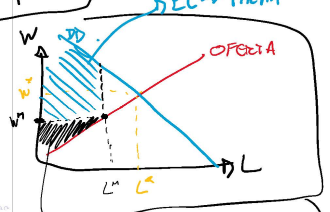
$\boxed{P^{UNICO} = 10}$

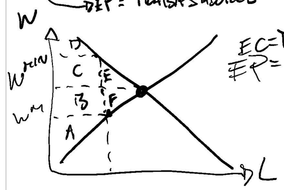
MERCADO PERFECTO $\rightarrow w'(L) = 0 \Rightarrow \boxed{\frac{\partial f}{\partial L} = \frac{w}{P} = \text{SALARIO REAL}}$

- The first order condition yields:

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

- In a competitive market $w' = 0$ and so $pMPL = w$
- Wages and labor below the competitive level (an argument for minimum wages and union)





EC = D + C + E (FIRMA)

EP = A + B + F (TRABAJADORES)

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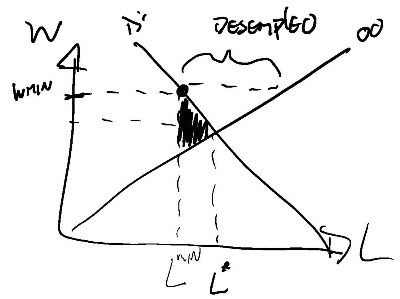

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$$C(q_b) = (p_a + c)q_b.$$

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- Firm A produces factor a at no cost
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- Firm B produces according to a cost function:

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

COSTO MARGINAL.

(FIRMA A y FIRMA B SON MONOPOLISTAS)

- Demand equation for good b is linear:

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

- Firm B's optimization problem becomes:

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

- Firm B's optimization problem becomes:

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

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

- The first order condition tells us:

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

$q_b = q_a$

$$\underbrace{p_a = 100 - 2q_a - c}_{DDa.}$$

- 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:

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

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

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- 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

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

$$\max_{q_a} q_a \underbrace{(100 - 2q_a - c)}_{DDa = Pa} - c\,? \to 0$$

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

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

- As a result, we get:

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

$$\boxed{q_a = q_B}$$

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

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

- 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:

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

- 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:** $c = 0$
-

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

- 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:

$$\boxed{\max_q q(100 - q).}$$

- The first order condition states that:

$$100 - 2q^* = 0 \Longrightarrow \boxed{q^* = 50}, p^* = 50. \quad \boxed{P_b = 50}$$

- 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!

$$\Pi = \boxed{\Pi_a} + \Pi_b$$

$$q_a P_a + q_b P_b - (P_a + c) q_b$$

$$q_a P_a + q_b P_b - \frac{P_a q_b}{P_a q_a} - c q_b$$

$$q_b P_b - c q_b$$

$$\boxed{q_b(100 - q_b) - \cancel{c} q_b \to 0}$$

- **Case ~~1~~ 2:** $c = 10$
-

$$p_a^* = 45, q_a^* = 22.5, p_b^* = 77.5, q_b^* = 22.5.$$

- 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:

$$\boxed{\max_q q(100 - q) - 10q}$$

- The first order condition states that:

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

used freely by that firm.

- The monopolists problem becomes:

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

- The first order condition states that:

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

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

↑Π, ↑EC.

- 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 $\boxed{\alpha}$ 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
- $\boxed{\text{Firm } A\text{'s decision is trivial. He simply produces } q_a = q_b}$
- Firm B chooses to maximize:

$$\max_q (1-\alpha)\,((\underbrace{100-q}_{P})q - cq) = (1-\alpha)\left(\overbrace{\max_q (100-q)q - cq}^{\Pi^M \text{(FIRMAS FUSIONADAS)}}\right).$$

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

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

$q^* = q^{M \text{ FUSIONADO}}$

- 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

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

- Profits are usually difficult to verify. However, revenues are much easier to check.

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- Profits are usually difficult to verify. However, revenues are much easier to check.
- Firms enter into an arrangement where the revenues are shared according to α (firm A) and $(1-\alpha)$ (firm B) split
- 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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- Suppose that $\alpha = 1/2$ and $c = 10$. Then firm 2 maximizes:

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

- The first order condition gives:

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

$\mathrm{Img}^n = \mathrm{CMg}^n$

- Profits are usually difficult to verify. However, revenues are much easier to check.
- Firms enter into an arrangement where the revenues are shared according to α (firm A) and $(1-\alpha)$ (firm B) split
- Suppose that $\alpha = 1/2$ and $c = 10$. Then firm 2 maximizes:

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

- The first order condition gives:

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

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

$\alpha^{min} \to 1.6$ $\quad \alpha I_b^m = \Pi_a^c$

OPERARA POR APARTE

- Solving, we get:

Pb

$$100 - 2q = 20 \Longrightarrow \boxed{p^* = 60} > \boxed{p^m = 55}, q^* = 40 < q^m = 45.$$

- Solving, we get:

$$100 - 2q = 20 \Longrightarrow p^* = 60 > p^m = 55, q^* = 40 < q^m = 45.$$

- This does solve the double marginalization problem slightly:

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