

# 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  $p = \text{marginal cost}$

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- ▶ Suppose the firm can observe all characteristics of the consumer
- ▶ What should the firm do?

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- ▶ 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?

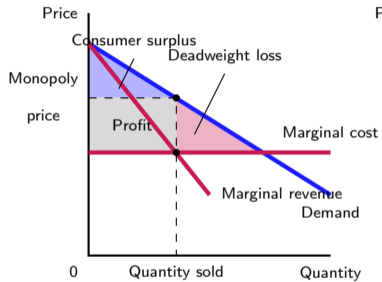
- ▶ Firm will price at  $p(q)$  for the  $q$ -th unit and continue to produce until  $p(q) = MC(q)$

- ▶ 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:

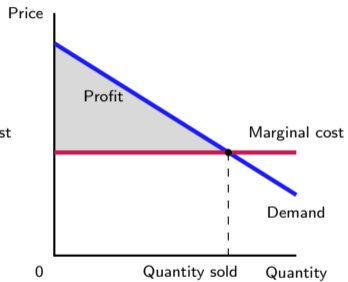
$$\Pi = \int_0^{q^*} (p(q) - c'(q))dq = \int_0^{q^*} p(q)dq - c(q^*),$$

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

(a) Monopolist with Single Price



(b) Monopolist with Perfect Price Discrimination



- ▶ Firm can do this is because it knows the exact demand curve of each consumer
- ▶ Such activity is prohibited in many countries

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- ▶ Such activity is prohibited in many countries
- ▶ 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

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

$$\max_{p_A} (24 - p_A)(p_A - 6) \implies p_A^* = 15$$

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

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:

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

- ▶ 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:

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

- ▶  $p = 10$

- ▶ 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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Double Marginalization Problem

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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:

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

- ▶ 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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$$C(q_b) = (p_a + c)q_b.$$

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- ▶ Demand equation for good  $b$  is linear:

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

- ▶ Firm  $B$ 's optimization problem becomes:

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

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- ▶ The first order condition tells us:

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

- ▶ 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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- ▶ 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:

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

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



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▶ Then the price is given by:

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

▶ To summarize, we have:

$$p_a^* = 50 - \frac{c}{2} \tag{1}$$

$$q_a^* = \frac{100 - c}{4} \tag{2}$$

$$p_b^* = 75 + \frac{c}{4} \tag{3}$$

$$q_b^* = \frac{100 - c}{4} \tag{4}$$

▶ **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:

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

- ▶ 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  $\alpha$  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  $\alpha$  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:

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

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

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- ▶ The first order condition gives:

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

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- ▶ The first order condition gives:

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

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

► Solving, we get:

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

- ▶ Solving, we get:

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

- ▶ This does solve the double marginalization problem slightly:

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