

Session #8

Fundamentals of Microeconomics

Price Discrimination

November 25, 2019

- ▶ Principle of price discrimination
- ▶ First-degree price discrimination
- ▶ Second-degree price discrimination
- ▶ Third-degree price discrimination

PRICE DISCRIMINATION IS USED TO INCREASE THE COMPANY'S PROFIT

- ▶ Let's go back to the monopoly as an example of a company that sells at a price higher than its marginal cost.
- ▶ Such a company operates at an inefficient level of production - it produces a lower amount than the socially optimal quantity in the case of perfect competition.
- ▶ Lower production is compensated by higher price.
- ▶ It does not cover the demand of those customers not willing to pay higher price.
- ▶ If a monopolist could sell products at different prices, it would be possible to charge lower price to customers with lower willingness to pay and charge the original high price to the remaining ones.
- ▶ This could increase the level of production and cover remaining demand.

PRICE DISCRIMINATION IS ONLY FEASIBLE UNDER CERTAIN CONDITIONS

- ▶ The company must have market power.
- ▶ The company must be able to identify customers to whom it may charge higher prices.
- ▶ The company must be able to prevent the subsequent resale of goods between customers.
 - ▶ This is easier to avoid for services, goods sold with a warranty, or goods that the manufacturer can change so that it cannot be used by other customers.
 - ▶ The resale can also be banned in the manufacturer-consumer contract and is restricted where there are high transaction costs.

- ▶ Principle of price discrimination
- ▶ **First-degree price discrimination**
- ▶ Second-degree price discrimination
- ▶ Third-degree price discrimination

BASIC PRICE DISCRIMINATION (OF A FIRST DEGREE) IS PERFECT DISCRIMINATION

- ▶ There are several ways in which companies can price discriminate.
- ▶ The basic and theoretically the easiest way is so-called first degree price discrimination or perfect discrimination.
- ▶ This discrimination can be done in markets where each customer buys one unit of good and where each customer has a different reservation price that he or she is willing to pay.
- ▶ In addition, this discrimination may be carried out by companies in markets where customers purchase a variety of goods, and their reservation price is reduced for each additional unit.

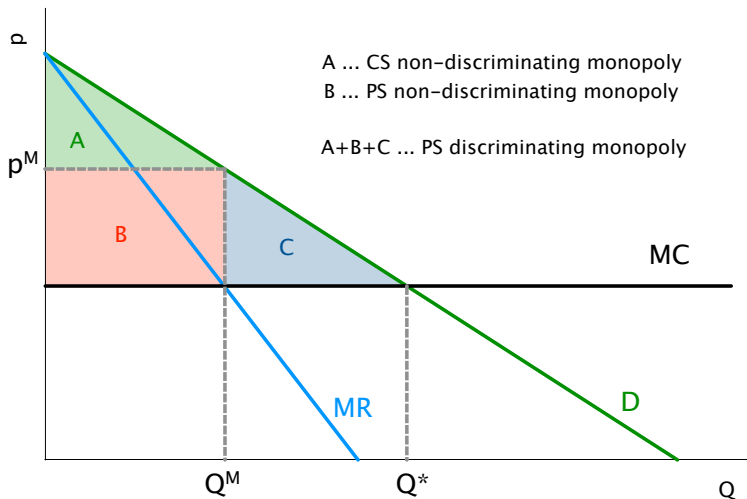
IN FIRST DEGREE PRICE DISCRIMINATION, EVERY CONSUMER PAYS DIFFERENT PRICE

- ▶ In the first case, first-degree price discrimination means that the company sells its products at different prices, varying from person to person.
- ▶ Each customer pays the maximum price they are willing to pay - the price coincides with the overall demand curve.
- ▶ In the second case, first-degree price discrimination means that the company sells to each customer each unit at a different price.
- ▶ For each unit, the customer pays the maximum price he/she is willing to pay - the price coincides with the individual demand curve.

AT FIRST DEGREE PRICE DISCRIMINATION, OVERALL WELL-BEING IS MAXIMIZED

- ▶ There is no consumer surplus on the market at first degree price discrimination.
- ▶ All surplus falls on the producer.
- ▶ The level of production is at the optimum level - the company sells all units of goods for which customers are willing to pay the price at least at the marginal cost of the company.
- ▶ Total well-being is maximized, so it is as efficient as the perfect competition.
- ▶ However, the welfare distribution is very uneven.

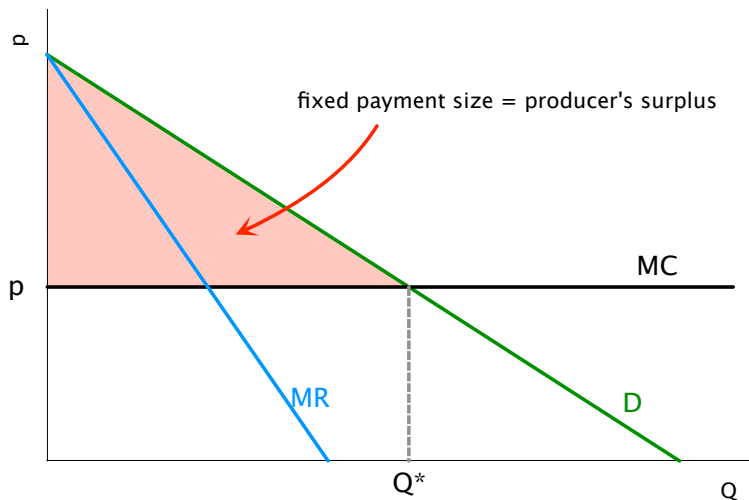
AT FIRST DEGREE PRICE DISCRIMINATION, OVERALL WELL-BEING IS MAXIMIZED



FIRST-DEGREE PRICE DISCRIMINATION CAN ALSO BE DERIVED FROM AN INDIVIDUAL DEMAND CURVE

- ▶ If price discrimination is applied to customers purchasing multiple units of good, the price is derived from an individual demand curve.
- ▶ The customer purchases the maximum quantity of good, the price of the last unit he buys is equal to the marginal costs of the company.
- ▶ Alternatively, price discrimination can be performed using so-called two-component pricing - the company requires a fixed payment for the option to purchase, and then charges a price for each unit at its marginal cost.
- ▶ It is optimal to set the fixed payment as the surplus that the customer would have incurred if he had the option of paying only the price at the marginal cost.
- ▶ This surplus thus becomes again a surplus of the producer.

AT FIRST-DEGREE PRICE DISCRIMINATION, OVERALL WELL-BEING IS MAXIMIZED



FIRMS ARE USUALLY NOT ABLE TO DO FIRST DEGREE PRICE DISCRIMINATION

- ▶ First degree price discrimination requires that a discriminating firm accurately knows market demand or individual demand.
- ▶ Such situation usually does not occur in the real world.
- ▶ Perfect price discrimination can occur when there is an individual interaction between the buyer and the customer and the contract price.
- ▶ In this situation, discrimination is possible if the vendor has the opportunity to estimate the income situation of his customers.
- ▶ In general, however, companies have the opportunity for imperfect discrimination, which is described as third-degree price discrimination.

- ▶ Principle of price discrimination
- ▶ First-degree price discrimination
- ▶ Second-degree price discrimination
- ▶ Third-degree price discrimination

ANOTHER FORM OF PRICE DISCRIMINATION IS NON-LINEAR PRICING

- ▶ The methods of price discrimination discussed so far are appropriate where the manufacturer is able to distinguish different groups of consumers.
- ▶ If a manufacturer is unable to distinguish customers with different demand elasticities, they may use non-linear pricing methods.
- ▶ The non-linear pricing strategy means that the amount customer pays does not grow linearly with the quantity purchased.
- ▶ By choosing a quantity, the customers themselves indicate which group they belong to and how much they are willing to pay.
- ▶ Nonlinear pricing methods are also called second-degree price discrimination.

THE NONLINEAR PRICE STRATEGY IS BASED ON THE PRINCIPLE OF A TWO-COMPONENT PAYMENT

- ▶ In the case of first-degree price discrimination, we mentioned the two-part price strategy - the firm requires a fixed payment for the purchase option and then charges for each unit the price at the marginal cost.
- ▶ If the company knows the shape of the consumer's demand, it is optimal to set the fixed payment in the amount of the surplus that the customer would have incurred if he had the option of paying only the price at the marginal cost.
- ▶ Such price discrimination is naturally possible only if customers cannot resell the goods.

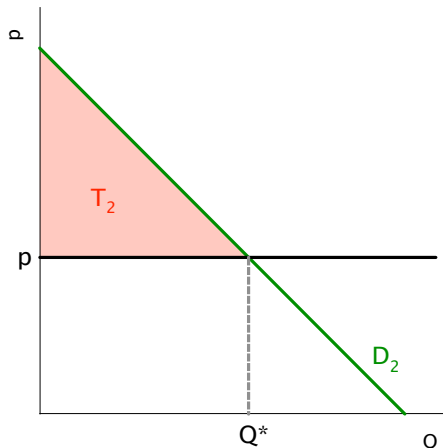
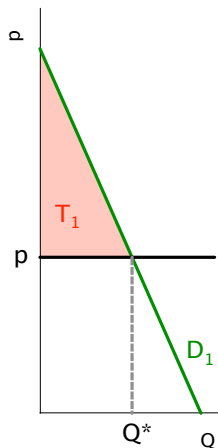
TO SET OPTIMALLY THE TWO PART TARIFF, THE FIRM MUST KNOW AT LEAST THE DIVISION OF DEMAND

- ▶ It is usually not possible to set the fixed payment as optimally as possible, but it is possible to use the principle of two-component prices and to charge a fixed charge (tariff) and a unit price.
- ▶ The question is how high the tariff and how high the unit price should be set by the company to maximize its profit.
- ▶ Finding the optimal tariff and the price is complicated especially because the demand of individual customers may not be the same.
- ▶ We will assume that the company does not know individual customer demand but knows the general distribution of demand in the population (for example, it knows that 50% of customers have high demand and 50% have low demand).

TO SET OPTIMALLY THE TWO PART TARIFF, THE FIRM MUST KNOW AT LEAST THE DIVISION OF DEMAND

- ▶ Suppose there are two groups of customers in the market.
- ▶ The second group of customers is willing to buy more at every price p .
- ▶ The second group has a larger surplus at each price.
- ▶ If we denote the surplus of the first group T_1 and the surplus of the second group T_2 , it holds that $T_2 > T_1$.
- ▶ If the company is able to separate both groups of customers, each group would be charged the corresponding tariff T_i and the unit price would equal the marginal cost.

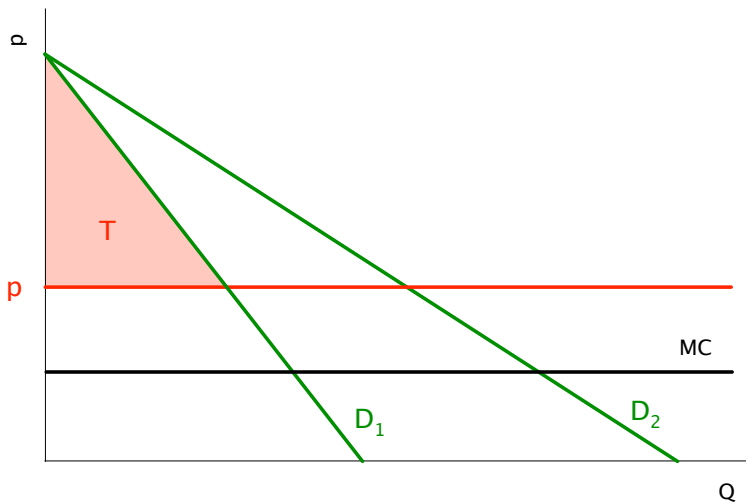
TO SET OPTIMALLY THE TWO PART TARIFF, THE FIRM MUST KNOW AT LEAST THE DIVISION OF DEMAND



OPTIMAL TARIFF AND PRICE COME FROM PROFIT MAXIMIZATION - THE TARIFF IS FUNCTION OF PRICE

- ▶ If the company is not able to separate both groups and have to charge both the same tariff, the situation is more complicated.
- ▶ The tariff cannot be too high - if, for example, the company charged tariff T_2 to everybody, customers from the first group would not buy the goods.
- ▶ The tariff is therefore set as a surplus of customers from the first group at some given price.
- ▶ The price should be higher than the average cost.
- ▶ The higher the price, the more is charged per unit sold.
- ▶ On the other hand, the lower the price, the higher the tariff can be charged.

OPTIMAL TARIFF AND PRICE COME FROM PROFIT MAXIMIZATION - THE TARIFF IS FUNCTION OF PRICE



OPTIMAL TARIFF AND PRICE COME FROM PROFIT MAXIMIZATION - THE TARIFF IS FUNCTION OF PRICE

- ▶ The company has to optimize its profit with respect to the price, which also determines the amount of the tariff.
- ▶ The company maximizes profit in the form

$$\max_p \pi = \max_p 2 \cdot T(p) + p \cdot q_1(p) + p \cdot q_2(p) - C(q_1(p) + q_2(p)) \quad ,$$

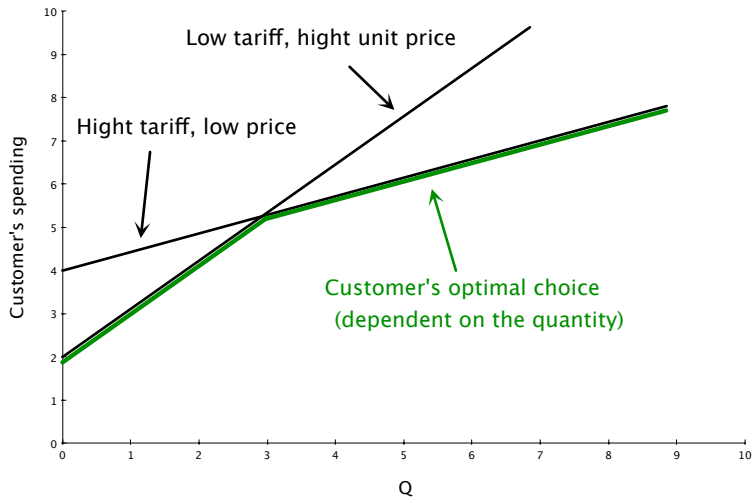
where $T(p)$ is the tariff selected from each customer group and $q_1(p)$ and $q_2(p)$ are the demand of the first and the second group respectively.

- ▶ $T(p)$ is determined as a consumer surplus for a lower demand group.
- ▶ In general, the company may face multiple groups of customers, and general optimization may be challenging in this case.

FIRM CAN OFFER DIFFERENT TARIFFS TO DIFFERENT CUSTOMER GROUPS

- ▶ Firms often do not use one single tariff (and the corresponding price).
- ▶ Customers usually have a choice between several tariffs and unit prices are set so that the higher the tariff, the lower the unit price.
- ▶ This strategy allows customers to indicate to which group they belong.
- ▶ A customer with lower demand chooses a tariff with a higher unit price and a lower base tariff, the customer with higher demand chooses an inverted option.

FIRMS CAN OFFER DIFFERENT TARIFFS TO DIFFERENT CUSTOMER GROUPS



OPTIMAL TARIFFS AND PRICES ARE BASED ON PROFIT MAXIMIZATION - TARIFFS ARE PRICE FUNCTIONS

- ▶ Once again, the company maximizes its profits.
- ▶ Each group of customers is offered a different price and a different tariff, tariff is function of corresponding price.
- ▶ At the same time, the company must take into account that the tariffs must not be higher than the surpluses of the two groups.
- ▶ It also has to ensure that the higher demand group chooses a higher tariff, and the lower demand group chooses a lower tariff - this is when customer has a greatest benefit for a given combination of tariff and unit price .
 - ▶ Customer surplus can be expressed as the difference between initial customer surplus and tariff.

OPTIMAL TARIFFS AND PRICES ARE BASED ON PROFIT MAXIMIZATION - TARIFFS ARE PRICE FUNCTIONS

- ▶ Firm thus maximizes profit in the form

$$\max_{p_1, p_2} \pi = \max_{p_1, p_2} T_1(p_1) + T_2(p_2) + p_1 \cdot q_1(p_1) + p_2 \cdot q_2(p_2) - C(q_1(p_1) + q_2(p_2))$$

with conditions

$$CS_1(p_1) - T_1 \geq CS_1(p_2) - T_2$$

$$CS_2(p_1) - T_1 \leq CS_2(p_2) - T_2$$

$$CS_1(p_1) - T_1 \geq 0$$

$$CS_2(p_2) - T_2 \geq 0$$

where p_i is price for first or second group, T_i is the tariff for first or second group, $q_i(p_i)$ is the demand of each group and $CS_i(p_j)$ are consumer surpluses of each group.

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- ▶ **Third-degree price discrimination**

IN THIRD-DEGREE PRICE DISCRIMINATION, DIFFERENT GROUPS FACE DIFFERENT PRICES

- ▶ Third-degree price discrimination is an arrangement where the monopoly identifies several different consumer groups and sells its product to each group at a different price.
- ▶ Student discounts or retirement discounts can be an example.
- ▶ The monopolist decides what quantity to sell to which group and at what price.
- ▶ Monopoly gain is the sum of the revenues from sales to all groups and its costs are the costs of producing the total quantity sold.

IN THIRD-DEGREE PRICE DISCRIMINATION, DIFFERENT GROUPS FACE DIFFERENT PRICES

- ▶ An example of the monopoly optimization problem for two groups is

$$\max_{Q_1, Q_2} p_1(Q_1)Q_1 + p_2(Q_2)Q_2 - C(Q_1 + Q_2)$$

- ▶ That leads to condition

$$MR_1(Q_1) = MC(Q_1 + Q_2)$$

$$MR_2(Q_2) = MC(Q_1 + Q_2)$$

- ▶ That can be rewritten using elasticities as

$$p_1 \left(1 + \frac{1}{\varepsilon_1} \right) = MC(Q_1 + Q_2)$$

$$p_2 \left(1 + \frac{1}{\varepsilon_2} \right) = MC(Q_1 + Q_2)$$

IN THIRD DEGREE PRICE DISCRIMINATION, A HIGHER ELASTICITY GROUP PAYS HIGHER PRICE

- ▶ We can derive from the previous condition that if $p_1 > p_2$, it has to hold that $|\varepsilon_1| < |\varepsilon_2|$.
- ▶ At the same time, we can write:

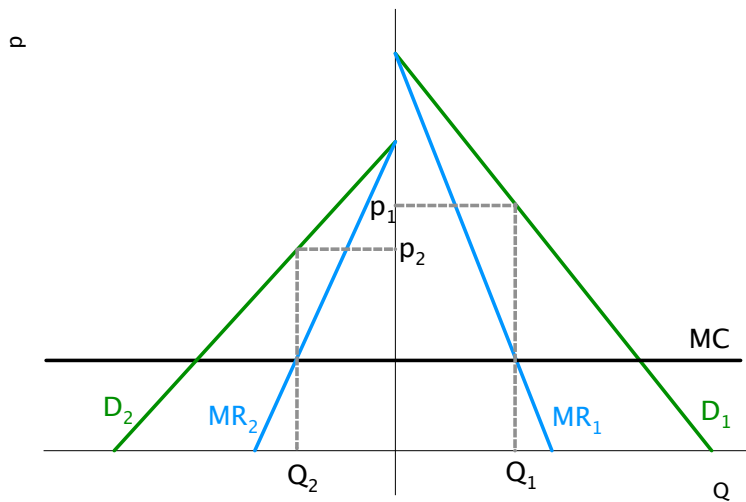
$$\frac{p_1 - MC(Q_1 + Q_2)}{p_1} = -\frac{1}{\varepsilon_1}$$
$$\frac{p_2 - MC(Q_1 + Q_2)}{p_2} = -\frac{1}{\varepsilon_2} .$$

- ▶ The price margin for each group is thus inversely proportional to the elasticity of the given demand.

IN THIRD DEGREE PRICE DISCRIMINATION, A HIGHER ELASTICITY GROUP PAYS HIGHER PRICE

- ▶ With third degree price discrimination, the monopoly charges higher prices to consumer groups with less elastic demand.
- ▶ In this case of price discrimination lower prices are charged to more price-sensitive consumers.
- ▶ Price discrimination generates an increase in total production as monopoly sells in a part of the market that would otherwise not accept the higher price and therefore would not have access to the goods.

IN THIRD DEGREE PRICE DISCRIMINATION, A HIGHER ELASTICITY GROUP PAYS HIGHER PRICE



DISCRIMINATION OF THE THIRD DEGREE CAN BE ACCOMPLISHED THROUGH DIFFERENT APPROACHES

- ▶ It is not always possible to separate both groups of customers directly, but it can be done indirectly.
- ▶ One option is to take advantage of situations where a part of customers is better informed about price options and to offer discounts to those customers.
- ▶ Another option is to use the fact that richer customers usually value more their time and increase the price for these customers with less elastic demand by means of different surcharges for express processing.
- ▶ It is also possible to take advantage of consumers that want to have the good among first - in that case it is possible to charge high launch price and lower prices after some time.

THIRD-DEGREE PRICE DISCRIMINATION DOES NOT LEAD TO AN EFFICIENT EQUILIBRIUM

- ▶ The effects of price discrimination on well-being are straightforward in the case of first-degree price discrimination - social well-being is maximized.
- ▶ In the case of third-degree price discrimination, the impact on well-being is not so clear.
- ▶ In this case, the price exceeds the marginal cost, which means that the equilibrium is not fully efficient.
- ▶ In fact, price discrimination can be more or less efficient than the equilibrium of a monopoly that does not discriminate.
- ▶ The final impact depends on the shape of cost curves and demand.
- ▶ The closer the third-degree price discrimination is to perfect discrimination, the more likely it will be more efficient than non discriminating monopoly.

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