Joanna Wolszczak-Derlacz
Faculty of Management and Economics
Gdańsk University of Technology
jwo@zie.pg.gda.pl

12. PRICE DIVERSIFICATION

Key words

price discrimination, monopoly power, deadweight loss.

Introduction

We fondly recollect our university times when we could buy the discount tickets while going to the cinema. Moreover we are not surprised if the same product has different price depending whether we bought it in supermarket or in the shop round the corner. The product sold in Warsaw has different price than the same one in London. Backpackers are aware of different air tariffs depending on the time of their travel. Many people hunt for last minute package holidays etc. These are countless examples of price diversification.

The price diversification is to set different prices (opposed to unique price) of the same product when sold to different customers without any cost justification. It is often called price discrimination but its connotation gives strong negative impression of its effects while its economic effects are ambiguous.

To set different prices to different customers is not a new phenomenon and in practice has been used since trade was introduced. The power of price discrimination was well understood in ancient times, even if the economic concept was not defined (Odlyzko, 2004, p. 6). Taylor in his classical economics textbook (Taylor, 2004) writes that the price discrimination is common and is likely to become even more popular in the future as firms become more sophisticated in their price settings.

This article focused on assessment of economic effects of price diversification but also legal aspects are presented.

The paper is organised in the following way
- section 2 is dedicated to the different types of price diversification according to the traditional and modern taxonomy
- section 3 presents the arguments for and against price discrimination together with EU legislation procedure in this matter.

Finally, the conclusion is drawn together with suggestions for future studies.

Types of price diversification

There are at least three basic condition required for price diversification to take place:
- company's power to set prices
- different elasticity of demand
- separation of the market

The price diversification is not possible under the perfect competition when all units of the same product are sold for the same price. In this theoretical scenario the price is the result of interaction between demand and supply. In this model prices are exogenous to producers (they are price takers). The competition drives prices towards marginal cost. In reality we

have markets characterized by an imperfect competition where firms can diversify the price of the same products. Prices are endogenous then producers are price givers. To set different prices the firm should have at least some price setting power. Of course it is guaranteed by monopoly market but it does not mean that the price discrimination occurs only for monopolies but it can be observed for all model of imperfect competition (especially oligopoly but also monopolistic competition). It is said that firms in all types of markets at least try to price discriminate. Of course, some markets are more prone to price discrimination for example service markets.

As far as demand side is considered the required condition is the existing the consumers with different price elasticity of demand. Difference between price elasticity is a key reason for price discrimination (Taylor, 2004 pp 261). The firm has to identify consumers or different consumer's groups with different willingness to pay. Setting the different prices to the separate sub markets requires the prevention of products' reselling. If the same good has different prices it would be profitable to buy it where it is cheaper and a to sell it on the more expensive market. In consequence, there would be a flow of products from cheaper markets to more expensive ones and the process will continue till the price is equalised on both markets and there is no more motivation for arbitrage transactions. Consequently if the product can move freely between different markets the firms action to keep market segmented will be thwarted.

According to the classical taxonomy (Pigou, 1929) there are three types of price discrimination:
- first degree price discrimination
- second degree
- third degree

First degree price discrimination (perfect differentiation) involves the situation in which the same product is sold to different consumers for different prices. Each consumer is charged what he is willing to pay - the maximum individual price. The provider exploits the difference in demand of the customers being the consequence of different client's taste, incomes etc. The situation is shown in picture 1. For simplicity, the functions are in linear form and marginal cost is constant and drawn with a straight line.

Picture 1. The perfect price discrimination
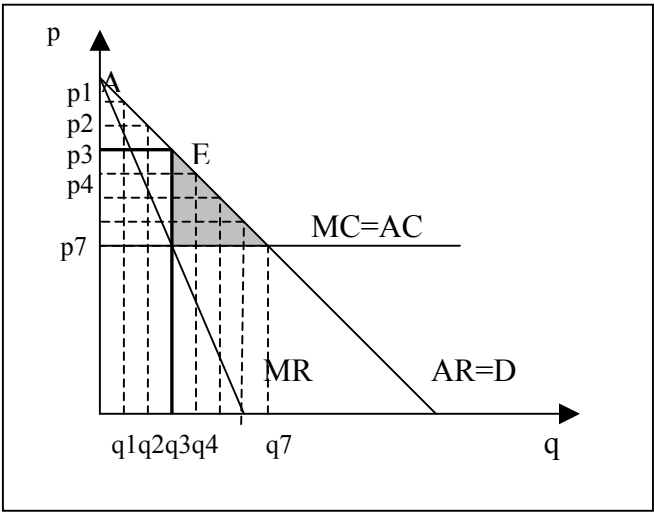
Source: own compilation based on Begg D., Fischer S., Dornbush R., (1995), McGraw Hill Higher Education; 8New Ed edition.

Without price discrimination, a single price *p3* is available to all customers. The profit is maximized when marginal costs equals marginal revenue according to the standard profit maximizing condition.

$$MR = MC \tag{1}$$

The output is *q3* and the total revenue equals the rectangle *p3Eq3* according to the formula:

$$TR_1 = p_3 \times q_3 \tag{2}$$

When the perfect discrimination takes place, first unit is sold for *p1* the second for *p2*, the third for *p3* and finally the last unit is sold for the price which equals to the marginal cost, in our case for *p7*. Now the total revenue is the sum of individual revenues as follows:

$$TR_2 = p_1 \times 1 + p_2 \times 1 + p_3 \times 1 + ... + p_7 \times 1 \tag{3}$$

The difference between total revenue with perfect price discrimination and without is positive:

$$TR_2 - TR_1 > 0 \tag{4}$$

The extra revenue consists of consumer surplus (triangle *AEp3*) absorbed by the seller plus the additional revenue from higher production. The production rises from *q3* to *q7*.

Let's compare the profit that gets company under perfect discrimination in relation to nondiscriminatory scenario. Picture 2 shows the situation of perfect discrimination in more details. Again for simplicity the functions are in linear forms and marginal cost is constant. The demand function and total cost function are respectively: D: $q = a - bp$ and $TC = kq$ where *k* is an unit variable cost. We assume that there are no fixed cost.

Picture 2. The higher profit in case of perfect discrimination
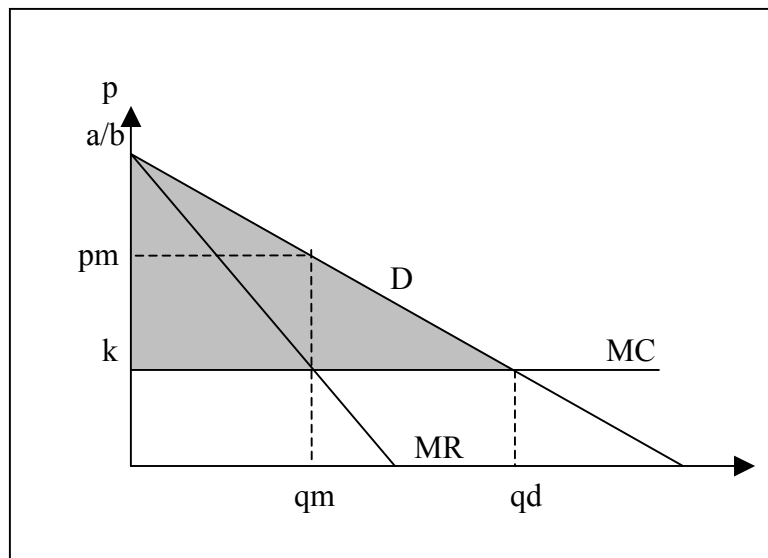
Source: own compilation

First we calculate the profit of the company without price discrimination. The total revenue is:

$TR_m = \dfrac{a - q_m}{b} q_m$ and the marginal revenue: $MR_m = \dfrac{dTR_m}{dq_m} = \dfrac{a - 2q_m}{b}$. Marginal costs equals

to the unit variable cost as: $MC = \dfrac{dTC}{dq_m} = k$ We use the optimizing formula (1) to get the mo-

nopoly output q_m and price p_m.

$$q_m = \frac{1}{2}[a - kb] \tag{5}$$

$$p_m = \frac{1}{2}\left[\frac{a}{b} + k\right] \tag{6}$$

The profit of the monopoly is the difference between its total revenue and total cost and can be written as:

$$\Pi_m = TR - TC = q_m \times p_m - k \times q_m$$

Putting (5) for q_m and (6) for p_m and after rearranging we get the final formula for the monopoly profit:

$$\Pi_m = \frac{1}{4}\left[\frac{a^2}{b} - 2ka + k^2b\right] \tag{7}$$

In case of perfect discrimination the profit equals to the area of the grey triangle depicted in picture 2. We calculate its area according to the standard formula for surface of triangle:

$$\Pi_d = \frac{1}{2}q_d\left[\frac{a}{b} - k\right] \tag{8}$$

We know that the last unit is sold for the price which equals to the marginal cost: $MC = p$. Marginal cost as before equals to unit variable cost k. The equilibrium equation is:

$$k = \frac{a - q_d}{b} \tag{9}$$

Putting $q_d = a - bk$ and after rearranging we get the final formula for the profit under perfect discrimination:

$$\Pi_d = \frac{1}{2}\left[\frac{a^2}{b} - 2ka + k^2b\right] \tag{10}$$

The ratio of profit with and without discrimination is:

$$\frac{\Pi_d}{\Pi_m} = \frac{\frac{1}{2}\left[\frac{a^2}{b} - 2ka + k^2b\right]}{\frac{1}{4}\left[\frac{a^2}{b} - 2ka + k^2b\right]} = 2 \tag{11}$$

We proved that in case of perfect price discrimination the profit of the company is doubled.

The example of first degree discrimination are:
- tender for a building plot, real estate, retail outlet etc.
- Dutch auction
- haggling in market transaction

Second degree price discrimination (also called price-quantity discrimination or non-linear price discrimination) takes place when the unit price depends on the quantity sold. Sellers offers the discounts for those who buy larger quantities. Additionally second degree price discrimination is commonly used by public utilities with introducing two-part tariffs. Two-part tariff is the pricing scheme in which price has two components: the constant subscription or attachment fee to connect to the network and additional part depending on the quantity consumed expressed in the price per unit.

The example of two-part tariffs:

$$P = S + p \times q_i \qquad (12)$$

where:

P - total price

S - constant periodic subscription or attachment fee

p - price per unit

q_i - quantity of units consumed

Note that if the consumer does not use the service at all he has to pay the subscription and the average cost of one unit will be infinite. If he/she consumes only one unit, its average cost will be $S + p$ and the average cost of one unit moves closer to the price of additional unit when the quantity goes to infinity.

Average cost of one unit cab be written with the formula:

$$\frac{P}{q_i} = \frac{S}{q_i} + p \qquad (13)$$

In practice this kind of discrimination is used by :

- wholesalers
- electricity suppliers
- telecommunication

Third degree price discrimination takes place when different prices are charged for the same product in different segments of the market. The market can be segmented by location, time or customers. The situation is shown in picture 3. Again for simplicity the functions are linear. The firm determines the optimum price (by profit maximization condition) in each of sub markets. In segment A where price elasticity is lower and demand is insensitive to price, higher price *pa* is set, while in segment B where price elasticity is higher and demand is sensitive to price, a lower price is established. Without price discrimination the price *pm* is established with the level between sub market's prices: *pb<pm<pa.*

Picture 3 Third degree price discrimination
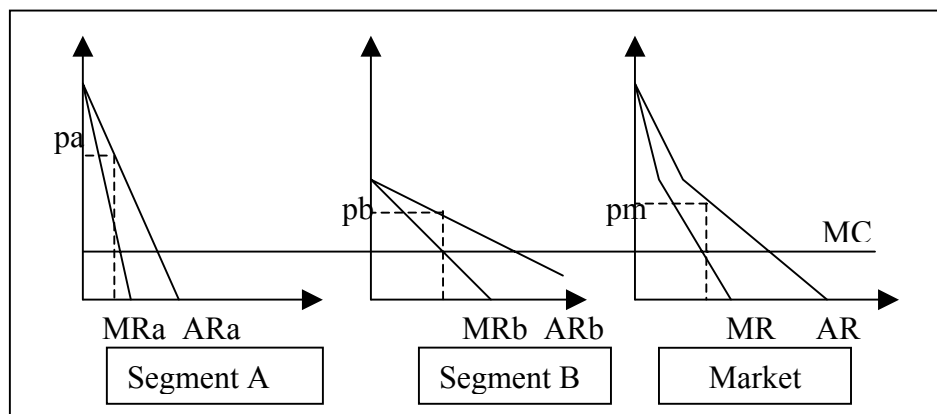
Source: own compilation based on Varian H. R., (1993**)** Microeconomic Analysis**,** W. W. Norton & Company; 3RD edition

The total revenue of the firm which operates in two segments is the sum of the revenues from each of the segments and it can be proved that it higher than would be without price segmentation, although it is not as high as in perfect discrimination. As the number of

prices increases to infinity we converge to perfect price discrimination and thus maximal social welfare (Varian, 1985 p. 871).

Note that if we put the general form of the total revenue $TR = p(q)q$ into equation of marginal revenue we get he following

$$MR = \frac{dTR}{dq} = \frac{d[p(q)q]}{dq} = \frac{dp(q)}{dq}q + p(q) = p(q)\left[1 + \frac{dp(q)}{dq}\frac{q}{p(q)}\right]$$ while the latter expression is the inverse of price elasticity of demand which in fact has negative sign so the formula can be rewritten as:

$$MR = p(q)\left[1 - \frac{1}{e_p}\right] \tag{14}$$

At the point of optimization we have:

$$MC = p(q)\left[1 - \frac{1}{e_p}\right] \tag{15}$$

and for the two segments we have respectively: $MC = p_A\left[1 - \frac{1}{e_{pA}}\right]$ and $MC = p_B\left[1 - \frac{1}{e_{pB}}\right]$.

We get the assumption that the market less price sensitive should be charged the higher prices and vice versa.

In real word companies use very specific and sophisticated forms of price diversification and they not always can be explicitly assigned to the one of the above described price discrimination category. For example telecommunication suppliers often set different two-part tariffs for private and business customers. This action involves both second and third degree discrimination. The alternative types of price discrimination can be presented (Png, 2001):
- complete discrimination
- direct segmentation
- indirect segmentation

The division is made according to the profitability exploited by a seller and required information. The picture 4 shows the relation between these three types of discrimination.

Picture 4 Different types of price discrimination and their relation to needed information and profitability
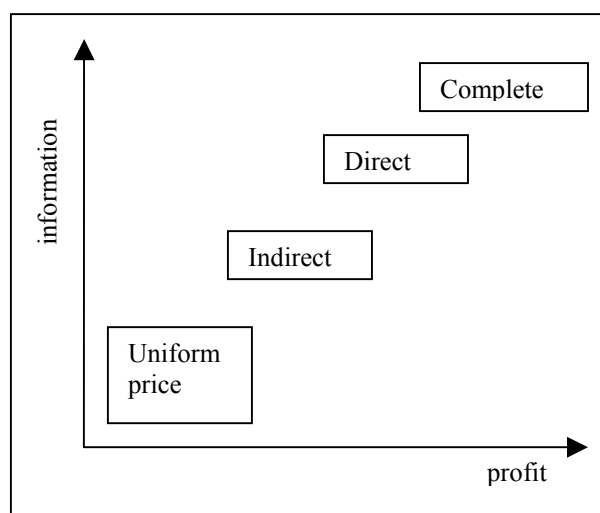
Source: own compilation

As far as complete discrimination is considered, a seller must have the most information, must know each buyer's individual willingness to pay, individual function of demand but it is most profitable pricing policy as the whole consumer surplus is absorbed by a seller. The direct segment discrimination is the next most profitable policy but it requires to settle the conditions which would define the various segments and preventing the resale between the segments. Next, indirect segment discrimination in which sellers provide buyers with set of choice in relation to some variables to which the various segments are differentially sensitive and the consumers self-select themselves eg different price-quantity package. Finally uniform pricing is considered to require the least information about buyers but it is least profitable either.

Arguments for and against price diversification

In this part e would like to find out whether price diversification is generally a good or bad phenomenon? To assess price discrimination we have to take into account effects it exerts on both supply and demand side.

As far as supply side is considered the answer for the given question is very simple. It has already been shown that price diversification is used by companies as a mechanism to higher their profits (picture 2).

It has to be remembered that the success of price discrimination depends on the requirements that has to be fulfilled: price setting power, different price elasticity and separation of segments. Companies developed a bulk of strategic responses to certain market condition to strengthen their price setting power or aimed at limiting the extend of competition. They are listed in table 1

Table 1 Companie's strategic responses to certain market conditions, aimed at limiting the extend of competition

Market condition	Company's response is to:
Many firms are too small to have an individual impact on prices	increase scale size
Entry and exit into industry is costless	Creative/raise barriers to entry
Products are homogenous	Aim to product differentiation, branding
There is perfect knowledge among buyers and sellers of prices and costs	Control/limit information
All firms have the same technology and production economics	Emphasize technological innovation, market share and the control of supply sources
Buyers have equal access to output of all suppliers	Control distribution

Source: Impact on competition and scale effects – price competition and price convergence, (1997), The Single Market Review, Subseries V, Volume 1, European Commission, pp. 110.

Moreover, the success of price discrimination depends on the ability to avoid the reselling of products. To keep markets separate the company again take many strategic actions from keeping the different price groups separated, complicating price schemes to make price comparison difficult, not issuing complete information, imposing impediments to free arbitrage by for example restricting warranty to the given location.

But we have to be aware that all of these actions aimed at strengthening companies'

price setting power or at prevention reselling, higher the cost of segmentation. From the company view the price discrimination is justified as far as additional cost of market segmentation are lower that additional revenues. To discriminate prices firms should not only find it profitable but also it should be feasible to set different prices (Goldberg, Verboven 2004 p. 5)

As far as consumers are considered the situation is more complicated. As it has been already said the price discrimination has negative connotation suggesting that at least part of the consumers are now worse off because they have to pay higher prices. Recollect that a monopoly is not efficient because its optimal output is lower and the price higher in comparison with perfect competition. The monopoly inefficiency is called the deadweight or social (economic) loss. This loss is connected with the fact that part of the quantity demanded is not satisfied and can be evaluate as the lost production expressed in the price consumers are willing to pay. In picture 1 the deadweight loss is marked as a grey triangle. In the case of perfect discrimination when the last unit is sold for the price equaling the marginal cost, the social loss is reduced to zero. That is why it is said that perfect discrimination is efficient. Picture 5 shows the reduction of social loss in case of third degree discrimination.

Picture 5 The reduction of deadweight loss in case of third degree discrimination
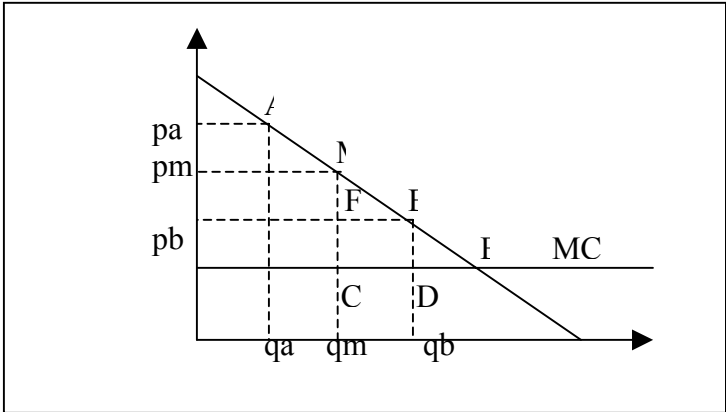
Source: own compilation

As it was presented earlier in picture 3, two optimal prices *pa* and *pb* are set in two different segments. The price that would be established without price discrimination *pm* is in their range. With single monopoly price the deadweight loss equals the area of the triangle MCE. In case of two segments the deadweight loss is reduced to the triangle BED. Of course, although the deadweight loss is reduced, the distribution of benefits between consumers and producers is unequal. The area that shows the reduction of social loss consists of two parts: the triangle MBF - the consumer surplus and the rectangle FBDC - producer additional revenue. The area of FBCD which is the producer profit is determined by the additional expenses of those consumers who without price discrimination had not purchased because the price was higher that their willingness to pay. As the result the part of the consumers lose their surplus because now they have to pay more, while others (qb-qm) will get access to the products that so far have been out of their reach. That is why it is said that price discrimination makes it possible to serve niche markets. If differential pricing is not allowed, groups with small willingness to pay may not be served at all (Varian 1996 p. 11). The distribution goes from the clients that pay more to the clients that pay less. The benefits is moved from consumers to producers (loss of consumer surplus). Additionally with price discrimination the consumer surplus is distributed from the clients with higher willingness to pay (usually rich) to those with lower willingness to pay (usually poor).

Nevertheless it should be taken in consideration if additional producers' profit resulting from the price diversification are lost for good for the social welfare. Higher profits should mean higher employees income etc. so finally at least in some scope the higher producers' benefits should be felt by the whole society.

Furthermore price discrimination is common in industries with large fixed costs and small marginal costs. Without differential pricing the price of the service/product would be equal to the very high unit cost. In case of nonlinear pricing the fixed costs are recovered through subscription or access fee while the unit cost can be settled at marginal costs.

The most common argument against the price discrimination comes from the moral background. This is unfair to sell the same product for different price to different people. The price discrimination as well as other kinds of discrimination is felt as negative phenomenon. It privileges some customers without any cost justification. The argument can be less powerful if this privilege goes to poverty stricken or ill (e.g refunding of prescription). Without going to deep into the philosophy aspects of fairness and equality one could ask: what is fairer equal price, equal market access or equal distribution of surplus? In fact only the first term means uniform pricing the latter imply differential pricing.

The next argument in favour of single price is its simplicity and clearness as opposed to complex price systems which understanding can be difficult. The complicated price schemes results that customers finally do not know how much they really pay. People prefer simply rules and in consequence simply – uniform prices. On the other hand multiply prices higher the flexibility of pricing, they involve more information about customers and then prices are better fit and can better map the interaction between production and consumer needs.

The overall assessment of price discrimination should be conditional on its effect on output. A necessary condition for price discrimination to increase social welfare is that output increase (Varian 1985 pp. 2).

There is also the legal aspect of the matter. The legal practice concerning price discrimination is under EU competition law. Price discrimination is not prohibited by EU law *per se*, but the procedures are against the abuse of the dominant position. According to the Article 82 of EU Treaty *"Any abuse by one or more undertakings of a dominant position within the common market or in a substantial part of it shall be prohibited as incompatible with the common market insofar as it may affect trade between Member States."* Next the list of unlawful acts is presented. The article 82 (c) is related to the price discrimination, as it states that, for one or several firms holding a dominant position, "*applying dissimilar conditions to equivalent transactions with other trading parties, thereby placing them at a competitive disadvantage*" is an abuse of a dominant position. "Dissimilar condition" are here understood as different prices. It has to be pointed out that not all kinds of price discrimination by a dominant firm are prohibited. The abuse takes place when a dominant firm charges different prices without any objective reasons such as: different transportation cost, quantity rebates. On the other hand the "fidelity rebates" which are offered on the bases of commitment to place all or most of its orders to the given firm are generally prohibited. And so was the judgment of the European Court of Justice in cases of *Michelin* and *Hoffman-La Roche*[1]. The

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[1] The Michelin group was accused by the Commission of abusing its dominant position for tyres by imposing on dealers unfair business conditions based on a complex system of fidelity rebates aimed at tying those dealers closely to it, more see: Judgment of the Court of 9 November 1983. - NV Nederlandsche Banden Industrie Michelin v Commission of the European Communities. - Abuse of a dominant position - Discounts on tyre purchases. - Case 322/81. Hoffman-La Roche was found to have dominant position on markets for certain vitamins, and to have abused that position by entering into exclusive agreements or agreements containing exclusionary fidelity rebates with purchasers of vitamins. see more: Hoffmann-La Roche & Co. AG v Commission of the European Communities Court of Justice of the European Communities, Case 85/76.

most citied case on price discrimination is *United Brands*. The company was accused of geographical price discrimination through charging different prices of the same product (bananas) in different member states.

Recently the understanding of the Article 82 has been under discussion. It is expressed for example in the Report by the Economic Advisory Group for Competition Policy (EAGCP) "An economic approach to Article 82". As the title of the report indicates the assessment of price discrimination should be due its economic effects not its form.

Conclusion

The price diversification is a complex phenomenon. It is so popular among producers and sellers because it causes rise of their profits. We proved that companies obtain higher profit under price discrimination than under a single price policy. We perform very simple mathematical exercises which limits are mainly connected with our basic assumption e.g. constant marginal cost. However the results we derived can be extended e.g to the case of increasing marginal cost and the general conclusion concerning the difference in profit under price discrimination versus a single price policy will not be changed.

The price discrimination has negative connotation suggesting that at least part of the consumers are now worse off because they have to pay higher prices. In case of price discrimination the benefits is moved from consumers to producers (loss of consumer surplus) and additionally the consumer surplus is distributed from the clients with higher willingness to pay (usually rich) to those with lower willingness to pay (usually poor). Because of that, price discrimination does not benefit only sellers. Moreover, sellers' higher profit due to the process of price discrimination does not have to be bad for the consumers. If the output increases it may actually benefit collective of consumers or at least part of the consumers.

We showed that price discrimination can have both positive and negative effects. The final effect of price discrimination depends whether it makes competition more intense. If so it is positive. Otherwise when it hinder competition by exclusion competitors, increasing the concentration and own monopoly power is negative.

As far as legal procedure is concerned it is recommended to focus on the effects of company actions rather than on the form that these actions may take. There is need to understand and distinguish between price discrimination as the element of natural competition mechanism and price discrimination as the prohibited procedure which hinder competition. The border between these terms is very vague that is why each case should be treated *de casu ad causa*. Report by the Economic Advisory Group for Competition Policy (2005) says that "*In so doing, avoids confusing the protection of competition with the protection of competitors and it stresses that the ultimate yardstick of competition policy is in the satisfaction of consumer needs*".

Comprehension check

1. What is price diversification and why it is often called price discrimination?
2. What are the types of classical price discrimination?
3. Give some examples of each type of price discrimination?

Exercise – Price discrimination case study:

1. Search the internet for the air ticket from Warsaw to London. You should find quiet many

offers. Log on to one of cheap airline web side for example Centralwings: (http://centralwings.com) and use it to buy airline tickets for the same route.
Discuss the findings focusing on the following questions

- How the prices depends on the date of the journey (eg prices for the flight on Friday versus on Wednesday or Thursday, price for the flight on 23rd December)
- Have you fond any discounted fares? if yes what sort of and for whom ?
- How airlines separate people willing to pay a lot from those willing to pay a little?.
- What are the condition cheap airlines imposes and why are they imposed?
- Why businessmen are unlikely to buy from cheap airlines?
- What do you think if airlines was not allowed to charge different prices for the same route what would happen to the average ticket price?

2. Find the case *United Brands v Commission of the European Communities* ,Court of Justice of the European Communities, Case 27/76 [1978] ECR 207. It is available online from Eur-Lex.(http://eur-lex.europa.eu/).

- What was the subject of the case and who were the parties?
- What are the main arguments of United Brands?
- What are the main arguments of the Commission?
- What are the main points of judgment and what are their effects on understanding geographical price discrimination?
- Why location is commonly used basis for price diversification?

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