4.2 Price Discrimination

Price discrimination is the practice of charging different prices to different customers. There are three forms of price discrimination, defined and explained in what follows.

**Price Discrimination** = charging different prices to different customers.

### 4.2.1 First Degree Price Discrimination

First degree price discrimination is the extreme form of charging different prices to different consumers, and makes use of the concept of “reservation price.” A consumer’s maximum willingness to pay is defined to be their reservation price.

**Reservation Price** = the maximum price that a consumer is willing to pay for a good.

**First Degree Price Discrimination** = Charging each consumer her reservation price.

First degree price discrimination is shown in Figure 4.2, where the initial levels of consumer surplus ($CS_0$) and producer surplus ($PS_0$) are defined for the competitive equilibrium. The competitive quantity is $Q_C$, and the competitive price is $PC$. A monopoly could charge a price $P_M$ at quantity $Q_M$ to maximize profits with a single price.

Each individual’s willingness to pay is given by a point on the demand curve. If the firm knows each consumer’s maximum willingness to pay, or reservation price, it can transfer all consumer surplus to producer surplus. The firm extracts every dollar of surplus available in the market by charging each consumer the maximum price that they are willing to pay. First degree price discrimination results in levels of producer surplus and consumer surplus $PS_1$ and $CS_1$, as shown in equation 4.1.

\begin{equation}
PS_1 = PS_0 + CS_0; \quad CS_1 = 0.
\end{equation}

Every dollar of consumer surplus has been transferred to the firm. First degree price discrimination is also called, “Perfect Price Discrimination.”
In most circumstances, it is difficult for the firm to practice first degree price discrimination. First, it is difficult to charge different prices to different consumers. In many cases, it is illegal to charge different prices to different people. Second, it is difficult and costly to elicit reservation prices from every consumer. Therefore, first degree price discrimination is an extreme, idealized case of charging different prices to different consumers. It is rare in the real world.

“Imperfect Price Discrimination” is a term used to describe markets that approach perfect price discrimination. Examples of imperfect price discrimination include car sales and college tuition rates for students in college. Car dealerships often post a “sticker price” and then lower the actual price depending on how much the consumer is willing to pay. Successful car sales persons are often those who have exceptional abilities to discern exactly how much each consumer is willing to pay, or their reservation price. Colleges and universities use imperfect price discrimination by offering scholarships and financial aid packages to students based on their willingness to enroll and attend an institution.

Imperfect price discrimination is shown in Figure 4.3, where different groups of consumers are charged different prices based on their willingness to pay. Price $P_1$ is a high price to capture consumers with high willingness to pay, price $P_2$ is the monopoly
price, and price $P_3$ is the competitive price. If a firm can distinguish different consumer groups’ willingness to pay, it can enhance profits through this form of price discrimination.

![Figure 4.3 Imperfect Price Discrimination](image)

**4.2.2 Second Degree Price Discrimination**

Second Degree Price Discrimination is a quantity discount.

**Second Degree Price Discrimination** = charging different per-unit prices for different quantities of the same good.

Second degree price discrimination is a common form of pricing and packaging. Consider an example of two different sized packages of salsa with different prices per unit. Suppose that consumers have different preferences for different sized salsa packages, and different demand curves reflect this.

For simplicity, assume that there are two consumers and two choices of package size (A and B).
A: 8 oz jar, price = 2 USD, price per unit = 0.25 USD/oz
B: 32 oz jar, price = 4.80 USD, price per unit = 0.15 USD/oz

Figure 4.4 shows consumer demand for each of the two consumers.

Figure 4.4 Second Degree Price Discrimination

Consumer 1 has a preference for smaller quantities. This consumer could be a single person who desires to purchase a small jar of salsa. Consumer 1’s demand curve demonstrates that she is willing to pay for the 8 ounce jar of salsa (A), but not the 32 ounce jar (B). This is because A lies below demand curve $D_1$, but not B. On the other hand, consumer 2 desires the large jar of salsa, perhaps this is a family of four persons. Consumer 2 is willing to purchase the 32 ounce jar (B), but not the 8 ounce jar (A). This is because B lies below the demand curve $D_2$, but not A.

It can be shown that the salsa firm can enhance profits by offering both sizes A and B. Assume that the costs of producing salsa are equal to ten cents per ounce:

$MC = 0.10 \text{ USD/oz}$
**Situation One.** Firm sells 8-ounce jar only.

Consumer 1 buys, Consumer 2 does not buy.

\[ Q = 8 \text{ oz}; \quad P = 0.25 \text{ USD/oz}; \quad MC = 0.10 \text{ USD/oz} \]

\[ \pi_1 = (P - MC)Q = (0.25 - 0.10)8 = (0.15)8 = 1.20 \text{ USD} \]

**Situation Two.** Firm sells 32-ounce jar only.

Consumer 2 buys, Consumer 1 does not buy.

\[ Q = 32 \text{ oz}; \quad P = 0.15 \text{ USD/oz}; \quad MC = 0.10 \text{ USD/oz} \]

\[ \pi_2 = (P - MC)Q = (0.15 - 0.10)32 = (0.05)32 = 1.60 \text{ USD} \]

**Situation Three.** Firm sells both 8-oz and 32-ounce jars.

Consumer 1 buys 8 ounce jar, Consumer 2 buys 32 ounce jar.

\[ \pi_3 = (0.25 - 0.10)8 + (0.15 - 0.10)32 = (0.15)8 + (0.05)32 = 2.80 \text{ USD} \]

Profits are larger if different sized packages are sold at the same time. Second degree price discrimination takes advantage of differences between consumers, and is usually more profitable than offering a good in only one package size. This explains the huge diversity of package sizes available for a large number of consumer goods.

### 4.2.3 Third Degree Price Discrimination

Third degree price discrimination is a practice of charging different prices to different consumer groups.

**Third Degree Price Discrimination** = charging different prices to different consumer groups.

A firm that faces more than one group of consumers can increase profits by offering a good at different prices to groups of consumers with different willingness to pay. The firm will maximize profits by setting the marginal revenue for each consumer group.
equal to the marginal cost of production. This solution is shown in equation 4.2 for two consumer groups:

(4.2) \[ MR_1 = MR_2 = MC. \]

Two things are interesting about this result. First, the firm practicing third degree price discrimination is simply following the profit-maximizing strategy of continuing any activity as long as the benefits outweigh the costs. The firm will stop when marginal benefits from selling the good to both groups are equal to the marginal costs of producing the good. Second, this solution is similar to the solution for the multiplant monopoly: \( MC_1 = MC_2 = MR \). Profit-maximizing firms use the same strategy for multiple plants and multiple consumers groups: set MR equal to MC in all circumstances.

Movie theaters often offer a student discount to students, as well as discounts for children, senior citizens, and military personnel. It may seem as if the theaters and other firms that offer these discounts are being nice to these groups. In reality, however, the firms are practicing third degree price discrimination in order to maximize profits! These groups of consumers have more elastic demands for movies, and would purchase a smaller number of movie tickets if the price was not discounted for them. A numerical example will demonstrate how third degree price discrimination works. Suppose that movie tickets are in thousands.

Movie ticket price = 12 USD/ticket
Student ticket price = 7 USD/ticket
Inverse Demand for movies: \( P_1 = 20 - 4Q_1 \)
Inverse Demand for students: \( P_2 = 10 - Q_2 \)
MC = 4 USD/ticket

\[
\max \pi = TR - TC
\]

\[
= TR_1 - TC_1 + TR_2 - TC_2
\]

\[
= P_1Q_1 - 4Q_1 + P_2Q_2 - 4Q_2
\]

\[
= (20 - 4Q_1)Q_1 - 4Q_1 + (10 - Q_2)Q_2 - 4Q_2
\]
= 20Q_1 - 4Q_1^2 - 4Q_2 + 10Q_2 - Q_2^2 - 4Q_2

\[ \frac{\partial \pi}{\partial Q_1} = 20 - 8Q_1 - 4 = 0 \]

8Q_1 = 16

Q_1^* = 2 thousand movie tickets

P_1^* = 20 - 4(2) = 12 USD/ticket

\[ \frac{\partial \pi}{\partial Q_2} = 10 - 2Q_2 - 4 = 0 \]

2Q_2 = 6

Q_2^* = 3 thousand movie tickets

P_2^* = 10 - (3) = 7 USD/ticket

The third degree price discrimination strategy is graphed in Figure 4.5.

Figure 4.5 Third Degree Price Discrimination

A pricing rule for third degree price discrimination can be derived. Recall the pricing rule that was derived for a monopoly in Chapter 3:

(4.3) \[ MR = P[1 + (1/E^d)] \]

This pricing rule can be extended to include two groups of consumers, as follows.

MR_1 = MR_2 = MC
P_1[1 + (1/E_1)] = P_2[1 + (1/E_2)]

P_1/P_2 = [1 + (1/E_2)] / [1 + (1/E_1)]

The pricing rule for the third degree price discriminating firm shows that the highest price is charged to the consumer group with the smallest (most inelastic) price elasticity of demand (E^d). This follows what we have learned about the elasticity of demand: consumers with an elastic demand will switch to a substitute good if the price increases, whereas consumers with an inelastic demand are more likely to pay the price increase.

The next section will present intertemporal price discrimination, or charging different prices at different times.