Topic 8
Price Discrimination

Price discrimination occurs when the same product is sold at more than one price.

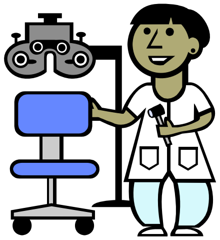
The purpose of price discrimination is to reduce **consumer surplus** by making the consumer pay more for each unit.

Example: An airline sells tickets on a particular flight at a higher price to business travellers than to seniors.

Even if the products are not precisely the same, price discrimination is said to occur if very similar products are sold at prices that are in different ratios to marginal costs.

It is not just the fact that differences in price exist among similar products that this is evidence of discrimination.

***Only if these differences do not reflect <u>cost differences</u> is there evidence of price discrimination*.**



<u>For a firm to be able to engage in price discrimination:</u>

1. The buyers of the firm's product must be easily **<u>segregated</u>** into classes.

2. Each class must possess considerable differences in each class's price elasticity of demand for the product.

3. The seller must be able to identify these classes.

4. Also, buyers must be unable to transfer the product easily from one class to another, otherwise a person could make money by buying the product from the low-price class and selling it to the high-price class.

The differences among classes of buyers in the price elasticity of demand may be due to differences among classes in income level, tastes, or availability of substitutes.

How much output should the firm allocate to each class of buyer?

What price should it charge each class of buyer?

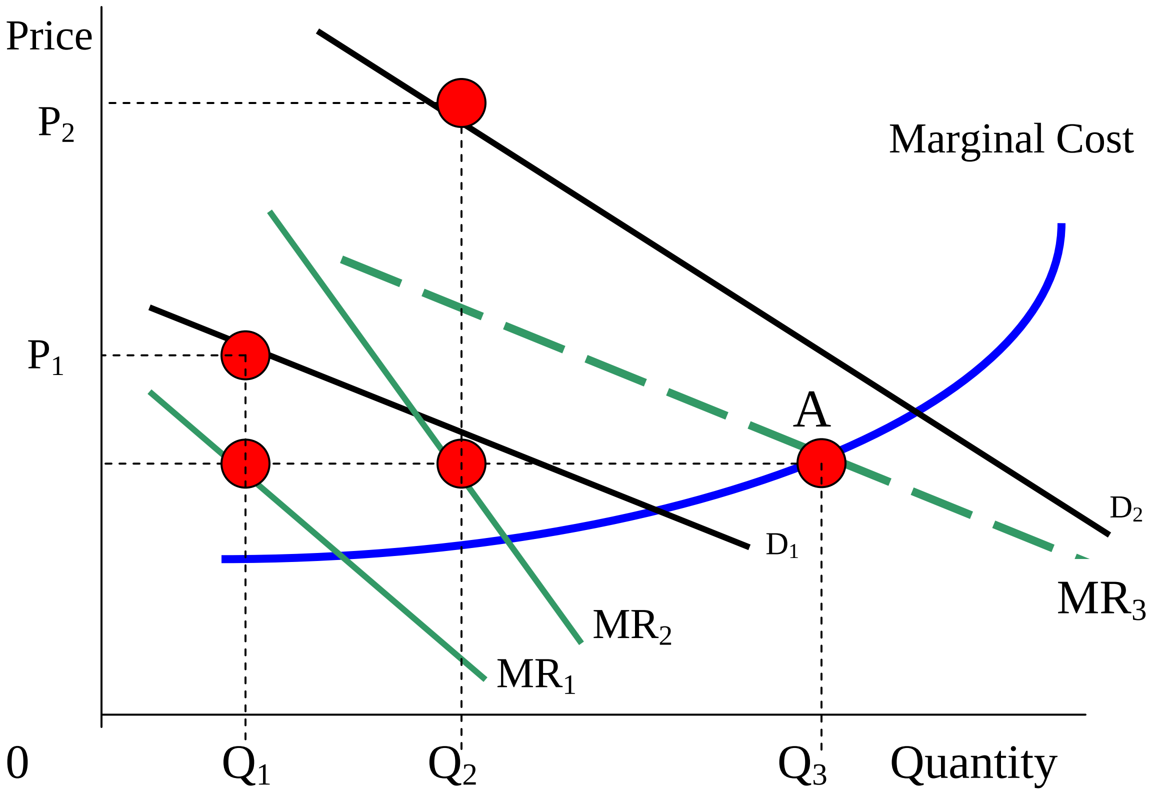
Suppose that the firm has decided on its total output and there are only two classes.

The firm will maximize its profits by allocating the total output between the two in such a way that marginal revenue in one class is equal to marginal revenue in the other class.

If discrimination does pay, the price will be higher in the class in which demand is **less elastic**.

- Now suppose, in the more realistic case, the firm must decide on its total output. The firm must consider its costs as well as demand in the two classes.

The firm will choose the output where the MC of its entire output is equal to the common value of the **marginal revenue** in the two classes.



The diagram shows the demand curve for the first and second classes, D_1 and D_2, the two marginal revenue curves for each class, MR_1 and MR_2 and the firm's marginal cost curve, MC. The firm determines its total output by summing **horizontally** over the two marginal revenue curves.

The curve representing the summation of these two curves is labelled MR_3.

This curve shows, for each level of marginal revenue, the total output that is needed if marginal revenue in each class is to be maintained at this level.

The **<u>optimal output</u>** is at the point where MR_3 intersects the MC curve, since marginal cost must be equal to the common value of marginal revenue in each class.

The firm will produce a total output of Q_3 units.

The firm will produce Q_1 units at price P_1 in the first class market and Q_2 units at a price P_2 in the second class market.

This will result in higher **<u>profits</u>** than if the firm quoted the same price in both markets.

Example: A Pharmaceutical Example

Suppose a drug manufacturer sells a major drug in Europe and the United States. Because of legal restrictions, the drug cannot be bought in one country and sold in another.

The demand curve for the drug in Europe is:

$$\mathbf{P_E=10-Q_E}$$

where P_E is the price (in dollars per kilogram) in Europe, and Q_E is the amount (in millions of kilograms) sold there.

The demand curve for the drug in the United States is

$$\mathbf{P_U=20-1.5Q_U}$$

where P_U is the price (in dollars per kilogram) in the United States, and Q_U is the amount (in millions of kilograms) sold there.

The total cost (in millions of dollars) of producing the drug for sale worldwide is

$$\mathbf{TC=4+2(Q_E + Q_U).}$$

The firm's total profit for both Europe and the United States is:

$$\pi = P_E Q_E + P_U Q_U - TC$$

$$\pi = (10 - Q_E)Q_E + (20 - 1.5Q_U)Q_U - \left[4 + 2(Q_E + Q_U)\right]$$

$$\pi = -4 + 8Q_E - Q_E^2 + 18Q_U - 1.5Q_U^2$$

To maximize profit with respect to Q_E and Q_U, we find the first derivatives of this equation with respect to Q_E and Q_U and set them equal to zero.

$$\boxed{\begin{array}{l} \dfrac{\partial \pi}{\partial Q_E} = 8 - 2Q_E = 0. \\ 8 = 2Q_E \\ \dfrac{8}{2} = Q_E = 4 \end{array}}$$

$$\boxed{\begin{aligned} &\frac{\partial \pi}{\partial Q_U} = 18 - 3Q_U = 0 \\ &18 = 3Q_U \\ &\frac{18}{3} = Q_U = 6 \end{aligned}}$$

Solving for these equations for Q_E and Q_U, we find that 4 million kilograms of the drug should be sold in Europe and 6 million kilograms should be sold in the United States.

To find the optimal prices in Europe and the United States, we substitute 4 for Q_E and 6 for Q_U into the relevant demand equations for each country.

The result being the price in Europe should be \$6 per kilogram, and the price in the United States should be \$11 per kilogram.

Substituting these values of P_E and P_U, and Q_E and Q_U into the firm's total profit function we find that the firm's total profit equals:

$$\Pi = -4 + 8(4) - 4^2 + 18(6) - 1.5(6^2) = 66$$

or \$66 million.

It is interesting and useful to determine how much additional profit the firm makes because it engages in price discrimination.

If price discrimination were not possible, P_E and P_U would have to be equal.

If we denote this common price P, and rearrange the demand equations in terms of quantity:

$$Q_E = 10 - P$$

$$Q_U = \left(\frac{1}{1.5}\right)(20 - P)$$

The firm’s total amount sold in Europe and the United States combined is:

$$
\boxed{
\begin{aligned}
&Q = Q_E + Q_U \\
&\quad = 10 - P + \left[\tfrac{1}{1.5}\right](20 - P) \\
&Q = 23.33 - 1.6P \\
&\textit{rearranging}: \\
&P = 14.58125 - 0.625Q
\end{aligned}
}
$$

The firm's profit would be:

$$\pi = PQ - TC$$

$$\pi = (14.58125 - 0.625Q)Q - (4 + 2Q)$$

$$\pi = -4 + 12.58125Q - 0.625Q^2$$

To find the value of Q that maximizes profit, we differentiate the profit equation with respect to Q and set the derivative equal to zero:

$$\boxed{\begin{aligned} &\frac{\partial \pi}{\partial Q} = 12.58125 - 1.25Q = 0 \\ &12.58125 = 1.25Q \\ &\frac{12}{1.2} = Q = 10.065 \end{aligned}}$$

Solving for Q, we find that the firm should produce a total of 10 million kilograms of the drug when it cannot engage in price discrimination.

Substituting 10 for Q in the price and profit functions:

$$P = 14.58125 - 0.625(10.065) = 8.291$$

$$\pi = -4 + 12.58125(10.065) - 0.625(10.065^2) = 59.315$$

The firm's profit would be **$59 million** rather than $66 million.