Analysis of Market: Demand-Supply Framework

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Topics:

1. Concept of Demand.
2. Law of Demand.
3. Demand curve/schedule.
4. Violation of Law of Demand.
5. Demand function.
6. Inverse demand function.
7. Function versus correspondence.
8. Market demand

Demand

- The various amounts of a product that the consumers are **willing and able** to purchase at various prices during some specific period. It should be backed by **purchasing power**.

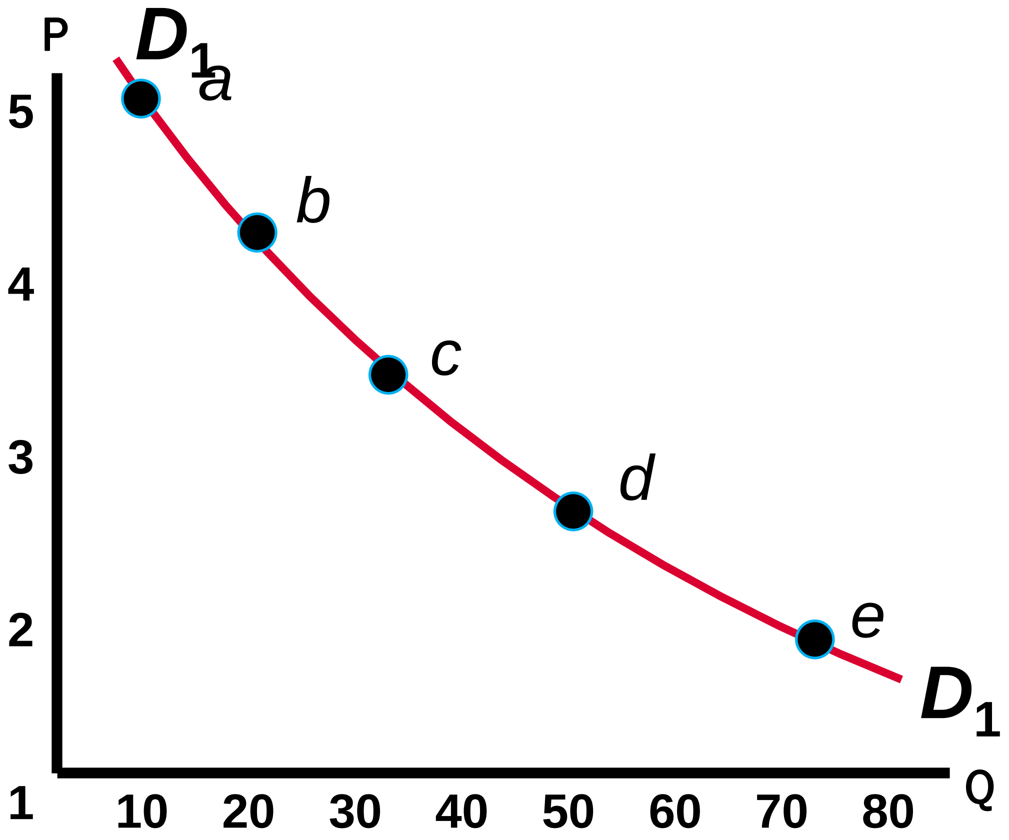
- Consider representative consumer.

Law of Demand

It is the inverse relationship between the price and the quantity demanded of a product.

	Price	Quantity demanded
a)	5	10
b)	4	20
c)	3	35
d)	2	55
e)	1	80

The Demand Schedule/Curve



The Demand Schedule/Curve

- **Demand curve** is the locus of different purchase plans & different prices.

- **Demand curve** Relationship between the quantity of a good that consumers are willing to buy and the price of the good.

Determinants of Demand

Potential consumers decide how much of a good or services to buy on the basis of its own **price** and many other factors, including:

- Tastes
- Prices of other goods
  - Complements or substitutes
- Income
- Weather
- Expectation

Demand Function

We can write this relationship between quantity demanded and price as an equation:

$Q_D = Q_D(P_Q\ ,\ \textit{Price of related goods, income, taste/preference, weather, expectation})$

Other things remaining unchanged, we can write this relationship between quantity demanded and price as an equation:

$$Q_d = Q_d\,(P)$$

Example of Demand Function

The demand function of *good-i* is:

$$x_d^i = D(p_i, p_j, M)$$

- p_i is own price of apple;
- p_j is the price of related goods;
- M is income

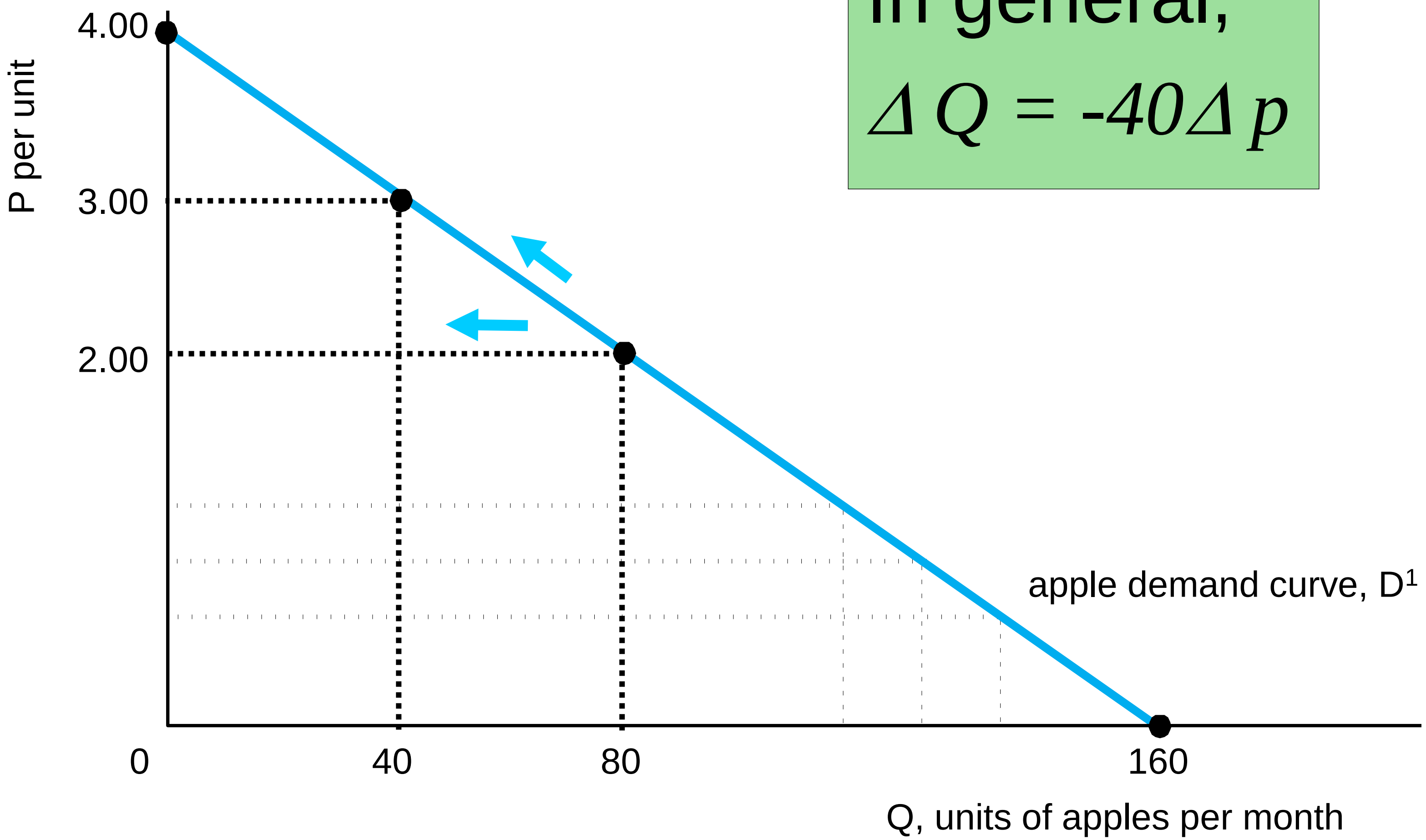
The demand function for apple is:

$$Q = 104 - 40p + 20p_j + 0.01M$$

Let $p_j = 0.80$ and $M = 4{,}000$, we have

$$Q = 160 - 40p$$

- which is the linear demand function for apples.



In general,

$$\Delta Q = -40\Delta p$$

Solved Problem 1

How much would the price have to fall for consumers to be willing to buy 1 more unit of apples per month?

1. Express the price that consumers are willing to pay as a function of quantity.

$$Q = 160 - 40p$$

$$40p = 160 - Q$$

$$p = 4 - 0.025Q$$

2. Use the inverse demand curve to determine how much the price must change for consumers to buy 1 more *unit of apples* per month.

$$\begin{aligned}\Delta p &= p_2 - p_1 \\ &= (40 - 0.025Q_2) - (40 - 0.025Q_1) \\ &= -0.025(Q_2 - Q_1) \\ &= -0.025\Delta Q.\end{aligned}$$

- The change in quantity is $\Delta Q = Q_2 - Q_1 = (Q_1 + 1) - Q_1 = 1$, so the change in price is $\Delta p = -0.025$.

Inverse demand cureve

Note that so far we have plotted the inverse demand function. Quantity demanded, which is the dependent variable, is on the horizontal and price, the independent variable, is on the vertical axis. This was due to Marshall, who viewed the entire analysis from the sellers' point of view. It is as if the seller is asking the buyer: for a particular amount what is the maximum price that the buyer is willing to pay (WTP).

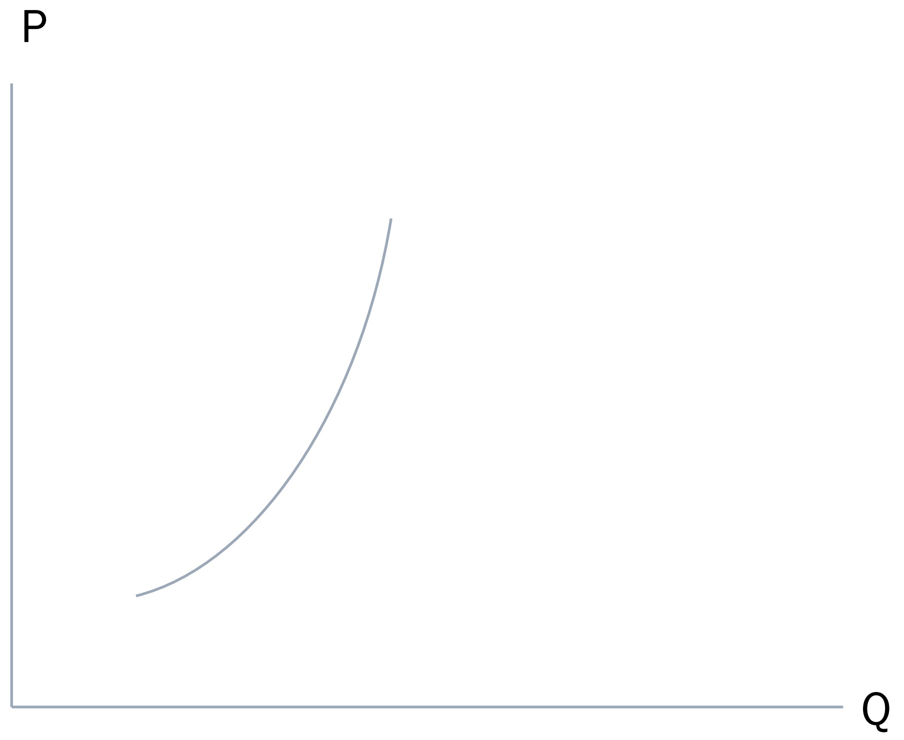
Marshallian definition (of inverse demand): it is the locus of the different maximum prices that a buyer is WTP at different purchase levels.

Inverse DD function

- Marshallian dd: How much the buyer wants to pay to buy a particular amount.
- Direct dd function: $x^d = f(p)$
- Inverse dd function: $P^d = g(x)$ where $g = f^{-1}$
- So inverse dd curve is from seller's point of view.

Violation of Law of Demand

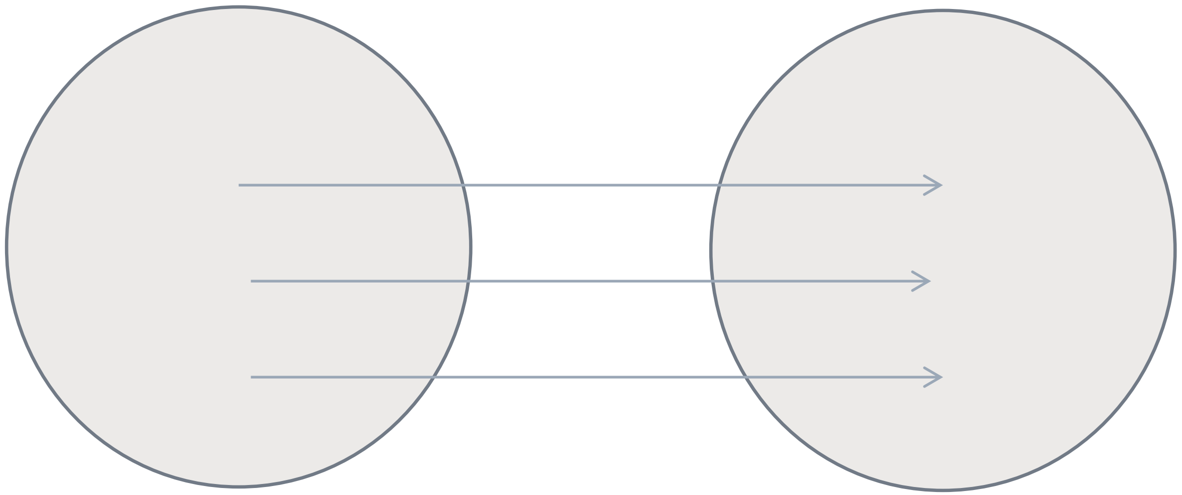
- Giffen good
- Uncertain product quality
- Goods with snob appeal



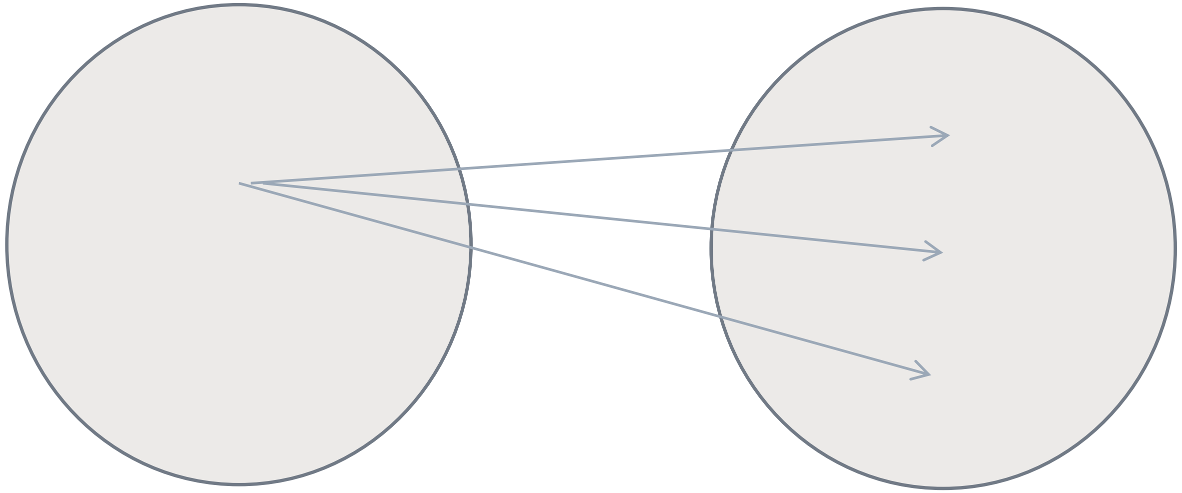
Function vs Correspondence

- A function $f : S \longrightarrow T$ is a map which associates each element in S with one and only one element in T.
- A Correspondence φ is a map which associates each element θ in S with a non-empty subset $\varphi(\theta)$ of T.
- A function is a single-valued correspondence.

Function



Correspondence



Example :

- Function: $y = x^3$
- Correspondence: $y = x^2$

Restrictions on range/domain can convert correspondence into function.

$y = x^2, x > 0$ is a function

Restrictions on demand function

- Must be a single-valued correspondence
- Continuity
- Inverse should exists.
- $iii.\, p \in [0,\infty), x \in [0,\infty)$
- Monotonic
- Must be differentiable.

Examples:

1. $$x_d = \begin{cases} 4 \forall p < 2 \\ \dfrac{8}{p} \forall p \geq 2 \end{cases}$$

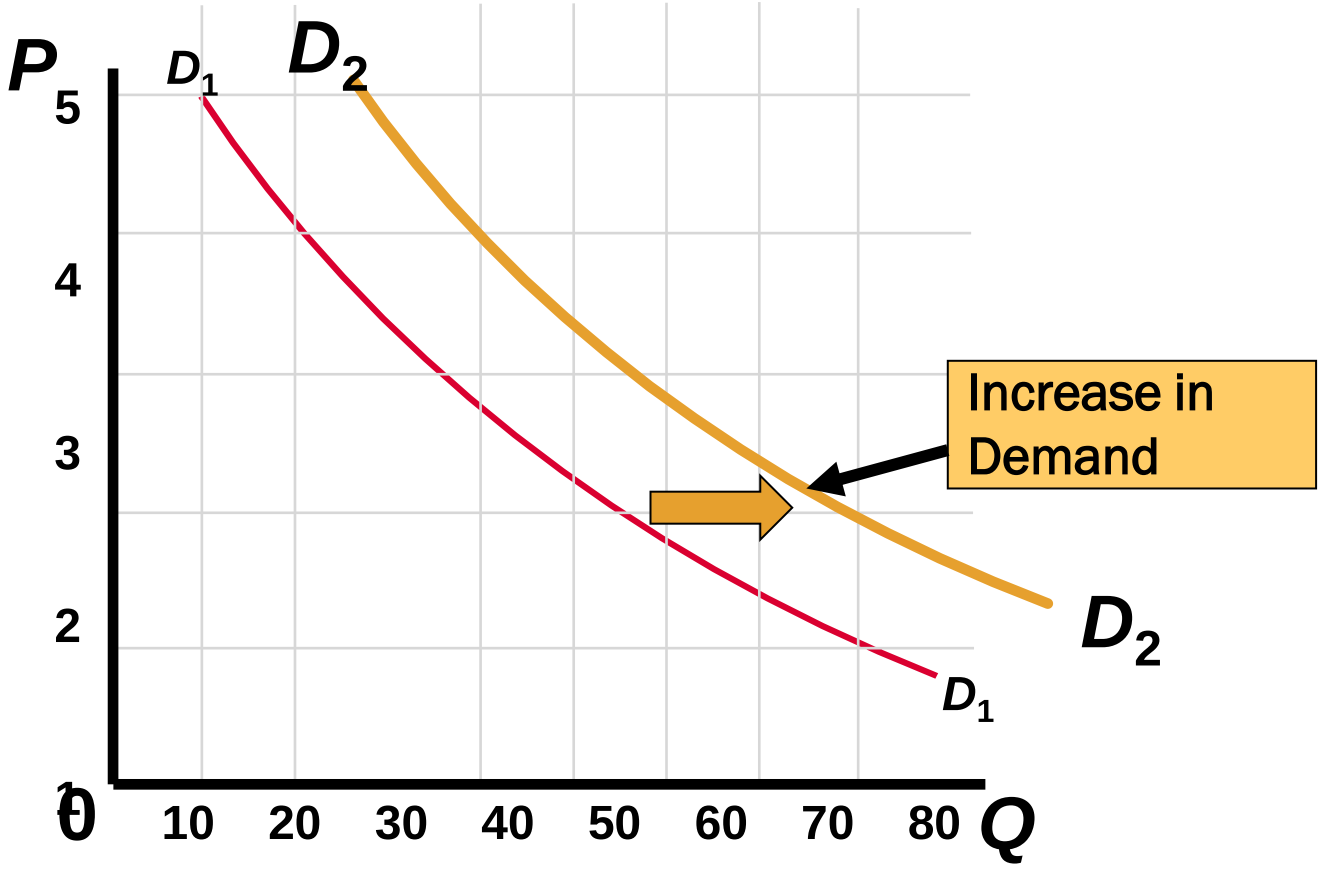
2. $$x_d = \begin{cases} 20 - p \forall p \leq 5 \\ 8 \forall p > 5 \end{cases}$$

Change in demand vs Change in quantity demanded

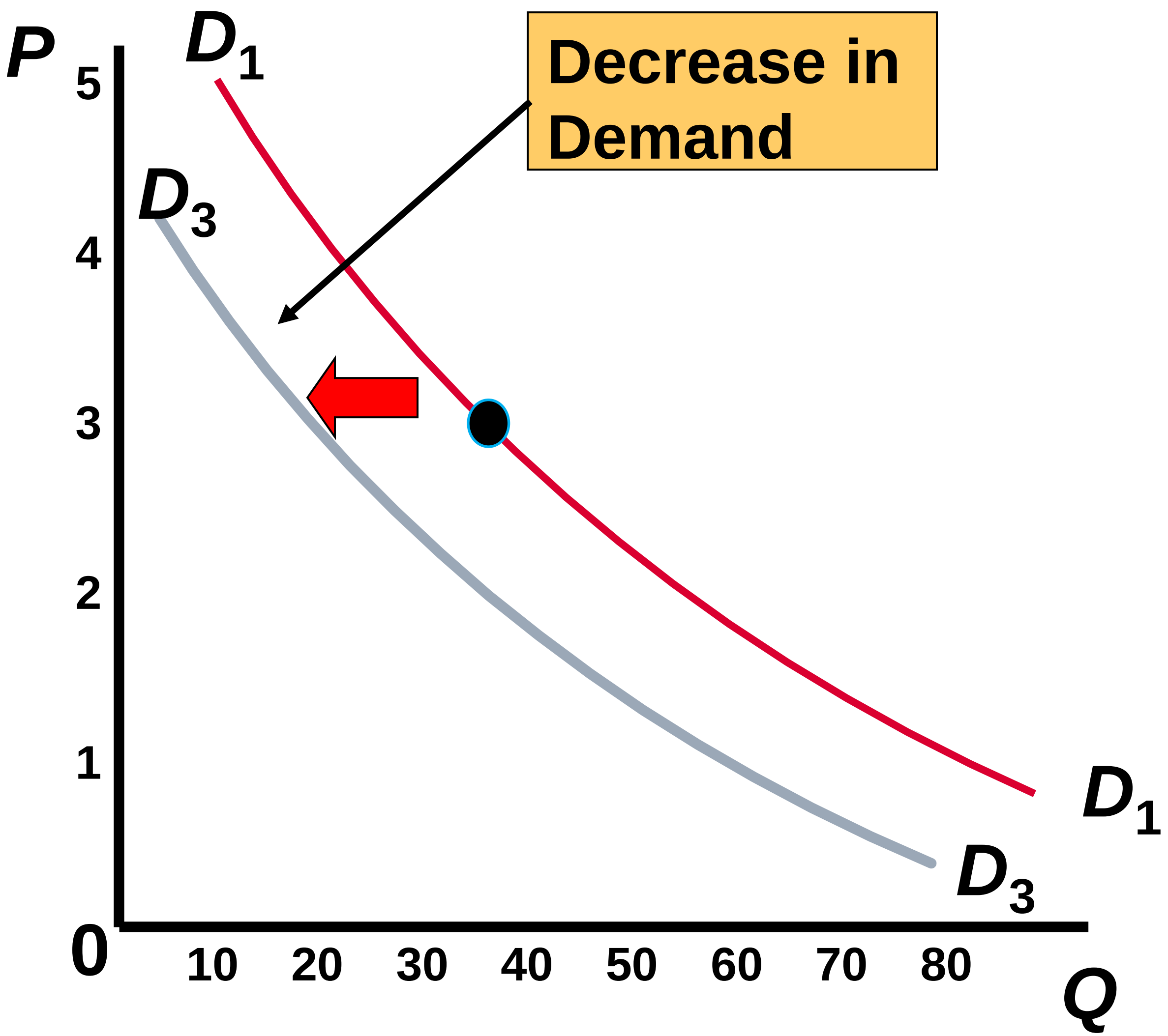
- Change in demand: **shift of the dd curve** (violation of *CP*) if something (income, taste, preference., price of related goods) other than price changes.

- Change in quantity demanded: **movement along dd curve** (under *CP*) due to change in own price.

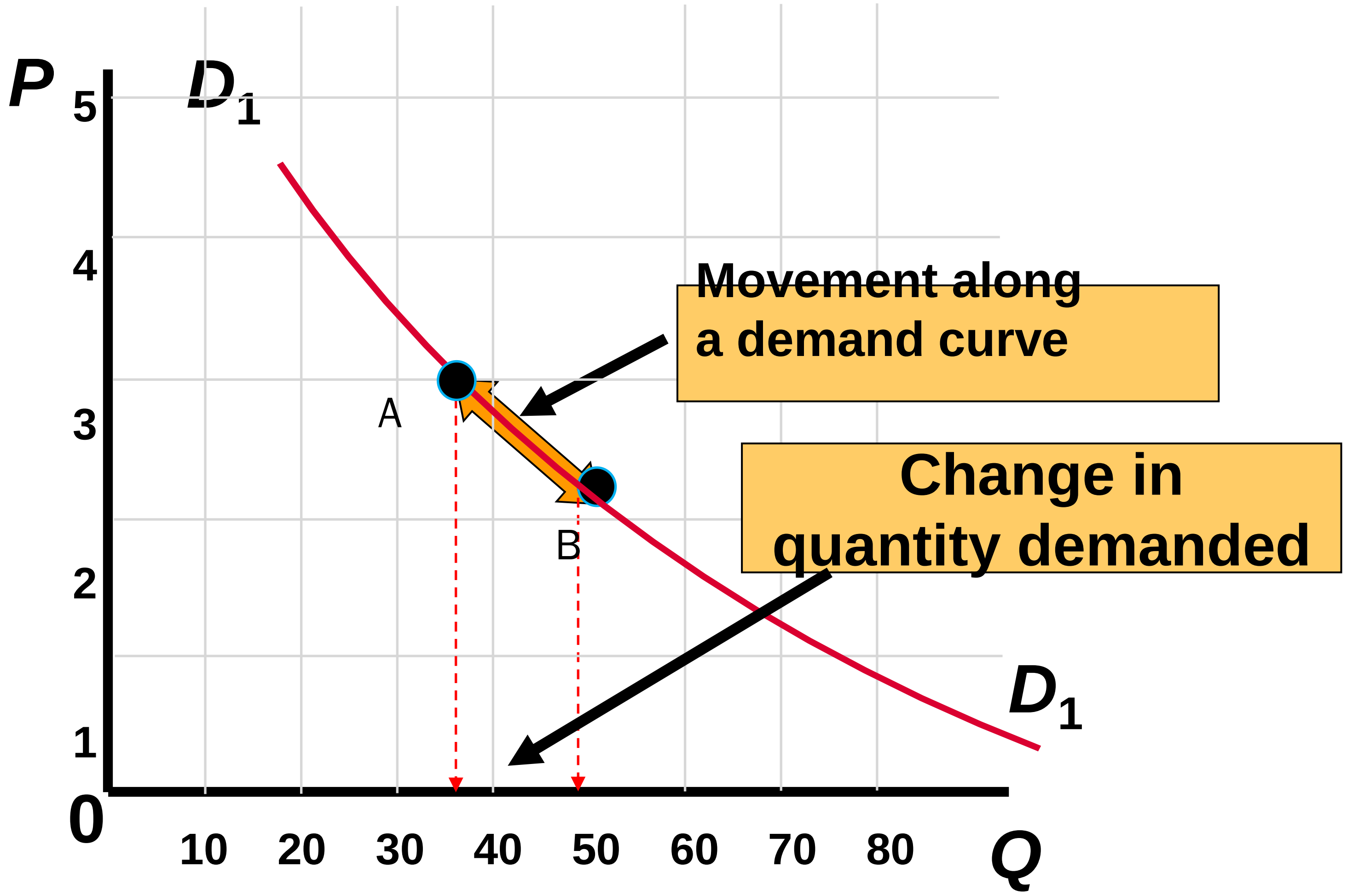
Increase in Demand



Decrease in Demand



Movement along a Curve



Individual and Market Demand

Market demand is derived by horizontally summing individual demand curves.

That is, by adding all the quantities demanded in a demand schedule which correspond to their prices.

$$X_d(p) = \sum_{h=1}^{n} x_d^h(p)$$

Summing Demand Curves

The total demand shows the total quantity demanded at each price.

The total quantity demanded *at a given price* is the sum of the quantity each consumer demands at that price.

$$Q = Q_1 + Q_2 = D^1(p) + D^2(p)$$

Homogeneous consumers

Market Demand : Lateral summation of Individual Demand

Let h = 1 ,2 … n and $x_d^h(p)$ is the quantity demanded by buyer h at price p Є [0, ∞)

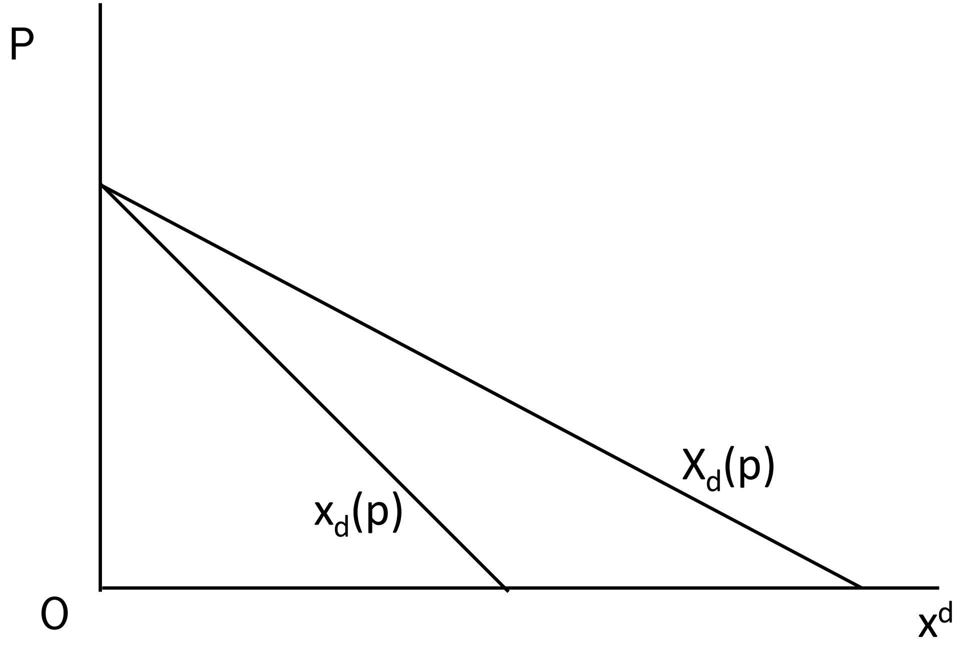
$$X_d(p) = \sum_{h=1}^{n} x_d^h(p)$$

Case 1 : All consumers are alike

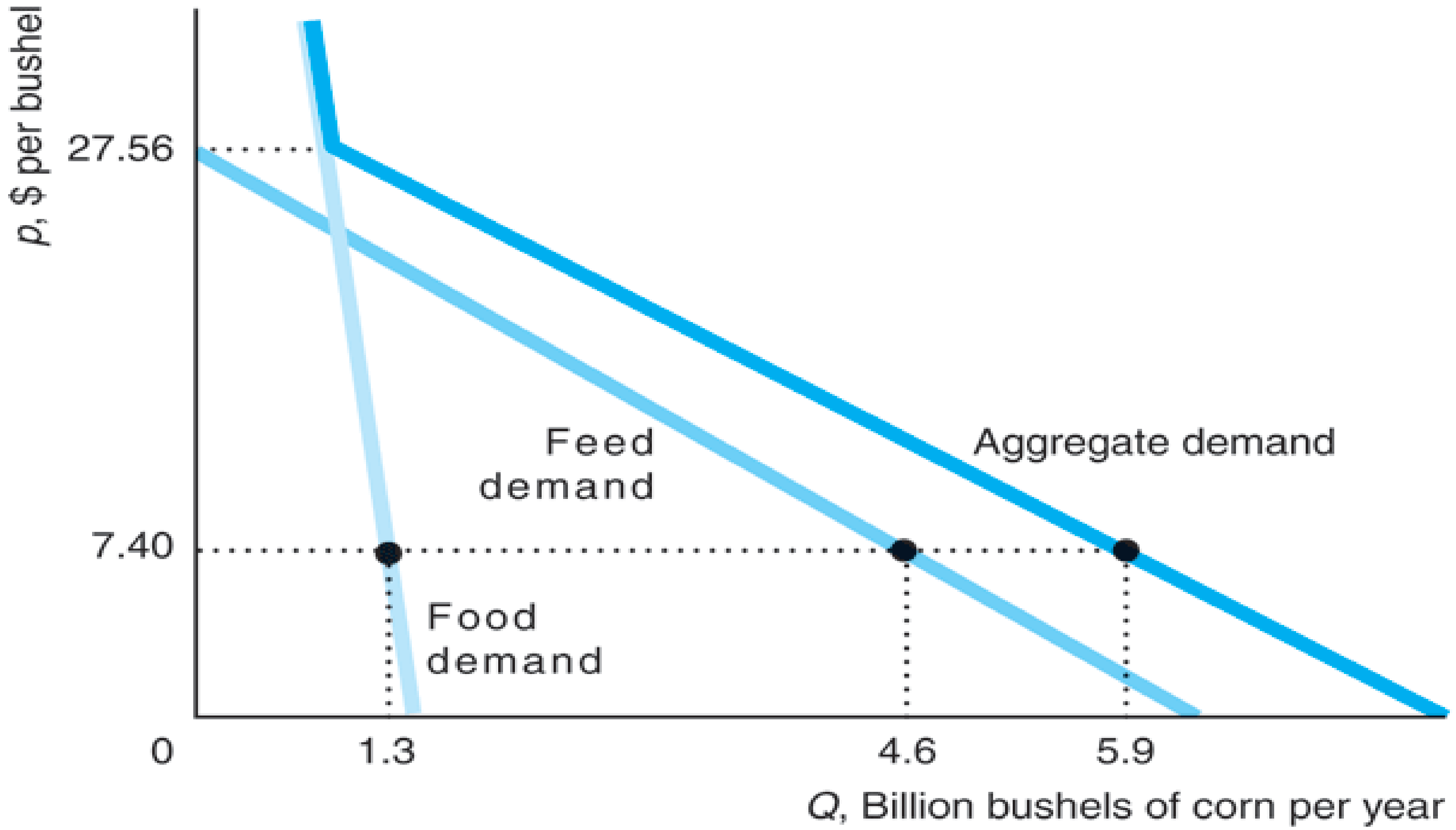
$$x_d^h(p) = x_d^k(p) \ldots\ldots \forall h \neq k$$

$$\Rightarrow X_d(p) = n x_d(p)$$

e.g.: x_d=20-p ∀ p Є [0, 20]
Let n = 2
X_d = 40-2p



Heterogenous consumers: Aggregating Corn Demand Curves



Reference

1. Maddala & Miller
2. Pindyck & Rubinfeld