SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

SCHOOL OF
MANAGEMENT AND
ENTREPRENEURSHIP

Economics for Business - I

MEC1001 [L3]

Rahul Chakraborty

SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

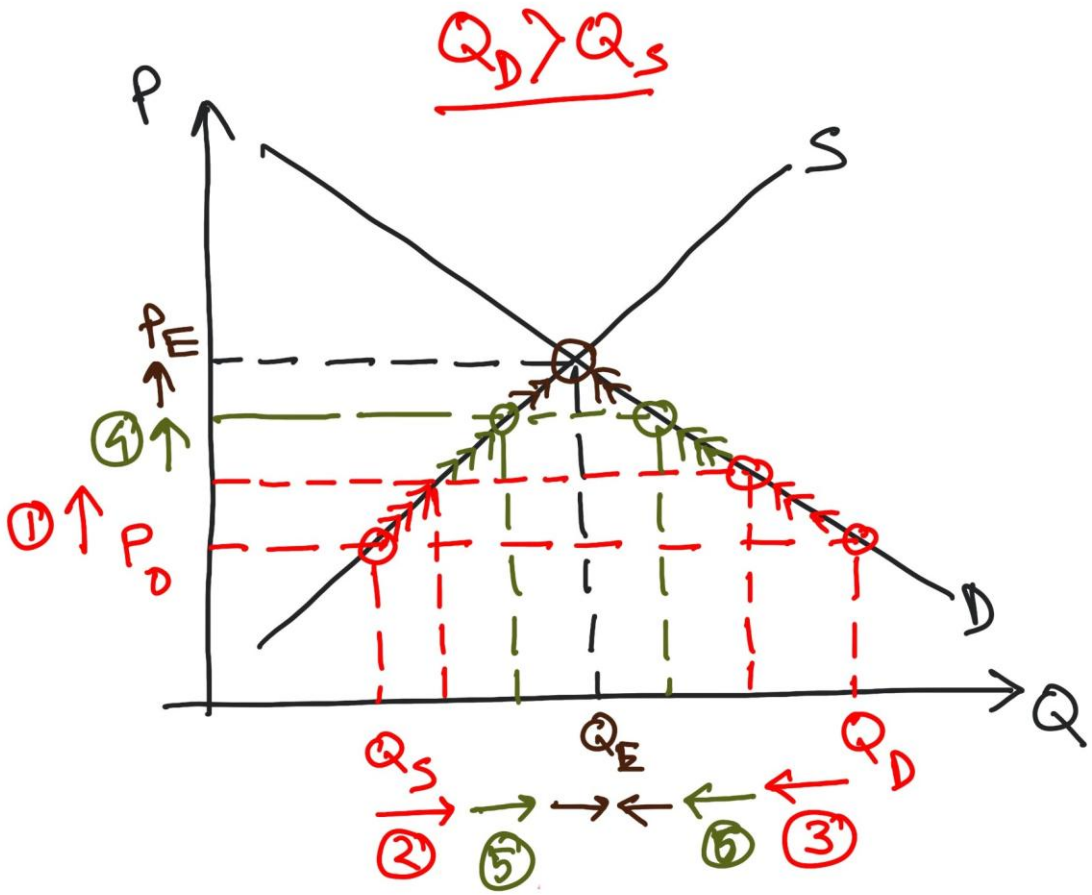
SCHOOL OF
MANAGEMENT AND
ENTREPRENEURSHIP

Economics for Business - I

Recap: Equilibrium in the Goods Market

Disequilibrium: Adjustments

Market forces ensure that equilibrium is reached---- How does it happen in a situation of Excess Demand?



At P_0 there is excess demand for the good → Producers have incentive to increase price → Higher price increases supply and reduces demand

Price adjustment followed by quantity adjustment → keeps occurring till $Q_D = Q_S$ or equilibrium is established

Price is the baton used by "invisible hand"

What will happen in the case of Excess Supply?– Price falls, which triggers quantity response, till market reaches equilibrium

SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

SCHOOL OF
MANAGEMENT AND
ENTREPRENEURSHIP

Economics for Business - I

Numerical Problems

Demand Function: Numerical Example

Individual demand to market demand

Suppose there are 3 persons in a market for chocolate- i1, i2, i3

The inverse demand functions are as follows:

i1: $\boldsymbol{P = 5 - 2.Q_{i1}}$
i2: $\boldsymbol{P = 5 - 3.Q_{i2}}$
i3: $\boldsymbol{P = 5 - 4.Q_{i3}}$

What is the market demand function? What is the maximum price of chocolate at which there will be positive demand?

Demand Function: Numerical Example

Individual demand to market demand

Rearranging the inverse demand functions we get:

$$Q_{i1} = \frac{5}{2} - \frac{1}{2}.P$$
$$Q_{i2} = \frac{5}{3} - \frac{1}{3}.P$$
$$Q_{i3} = \frac{5}{4} - \frac{1}{4}.P$$

Market Demand for chocolate (**Q**) = $(Q_{i1} + Q_{i2} + Q_{i3})$

$$Q = \left(\frac{5}{2} - \frac{1}{2}P\right) + \left(\frac{5}{3} - \frac{1}{3}P\right) + \left(\frac{5}{4} - \frac{1}{4}P\right) = \left(\frac{65}{12} - \frac{13}{12}P\right)$$

Demand Function: Numerical Example

Maximum price that can be charged for positive demand

$$Q = \left(\frac{65}{12} - \frac{13}{12}P\right) \geq 0$$

$$\rightarrow \frac{13}{12}P \leq \frac{65}{12}$$

$$\rightarrow P \leq 5$$

Any price below 5 will ensure there is a positive demand.

Supply Function: Numerical Example

Individual seller's supply to market supply

Suppose there are 3 sellers (s1, s2, s3) selling ice-cream and the following are their supply functions:

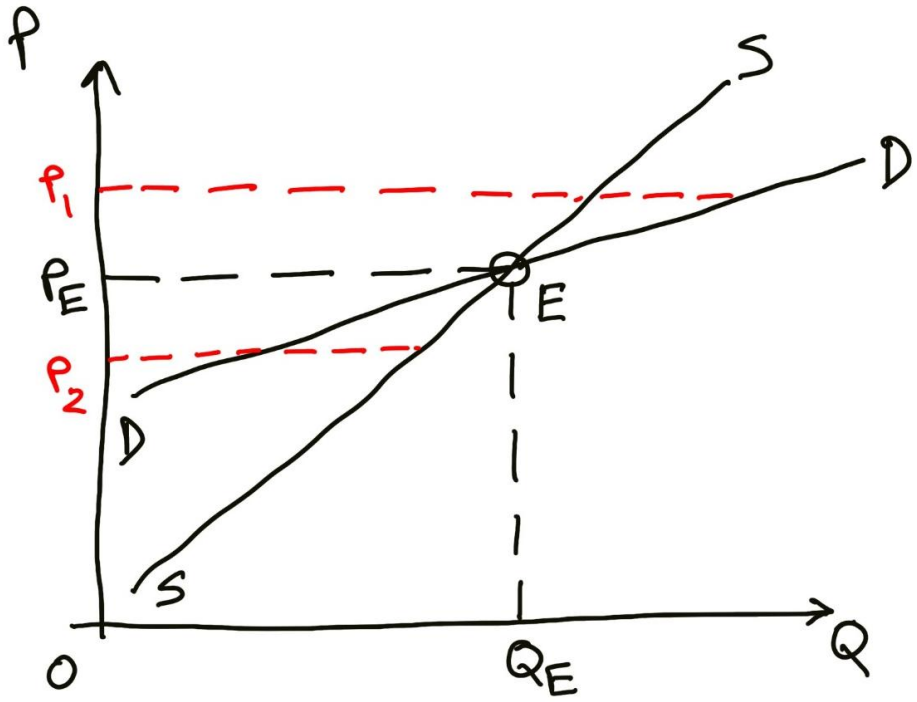
$$\boldsymbol{Q_{s1} = 200 + P}$$
$$\boldsymbol{Q_{s2} = 150 + 2.P}$$
$$\boldsymbol{Q_{s3} = 200 + 3.P}$$

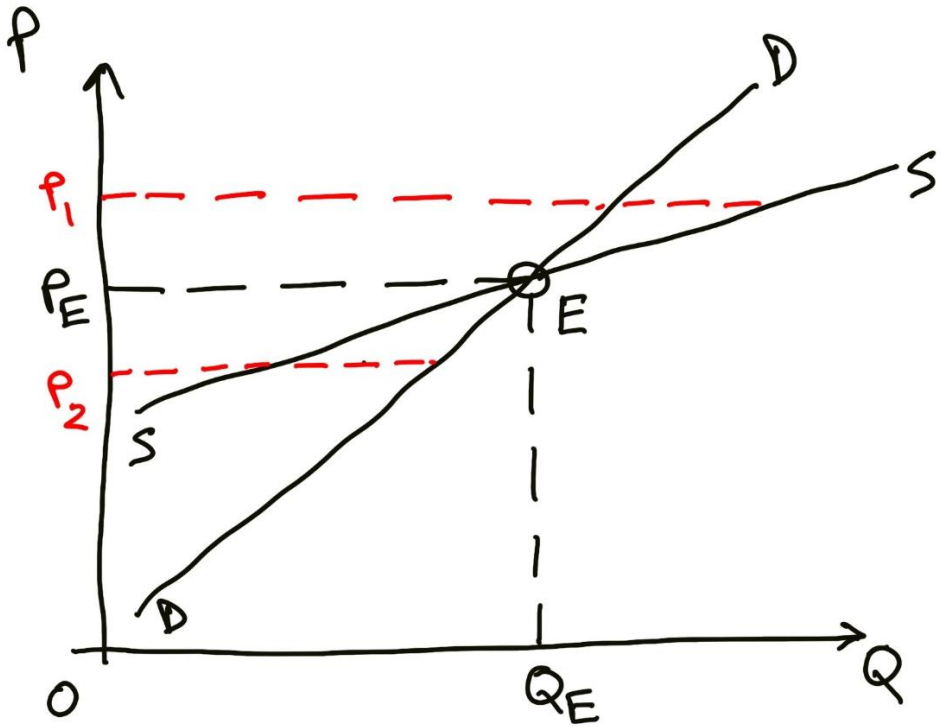
Market supply for ice-cream (**Q**) = $\boldsymbol{(Q_{s1} + Q_{s2} + Q_{s3})}$

$$\boldsymbol{Q = (200 + P) + (150 + 2.P) + (200 + 3.P) = 550 + 6.P}$$

Stability: Violation of Law of Demand

Giffen/Veblen Goods- What happens at a price that is not an equilibrium price?





Ans- Left panel shows “unstable equilibrium”; Right panel shows “stable equilibrium”

Stability condition- Demand curve should be steeper than the supply curve

SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

SCHOOL OF
MANAGEMENT AND
ENTREPRENEURSHIP

Economics for Business - I

Elasticities of Demand and Supply Curves

Elasticity

- **Price of the good, price of related goods, income/wealth affect demand**
- **Price of the good, input prices affect supply**
- **Can we say more than just the direction of quantity changes?**

Suppose Y = f(X): Variable **Y** depends on variable **X**

Elasticity depicts the % change in Y in response to a % change in X

Elasticity- It measures the responsiveness of quantity demanded/supplied to a change in one of its determinants

In market analysis, assessing demand responsiveness is important

Elasticity: Demand

3 types of elasticities of demand

- **Own-price**
- **Cross-price**
- **Income**

Own-price elasticity

The % change in quantity demanded of a good resulting from a 1% change in its price

$$E_P = \frac{\%\ change\ in\ Q_D}{\%\ change\ in\ P} = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{(\frac{\Delta Q_D}{Q_D})}{(\frac{\Delta P}{P})}$$

Example-

Suppose **the price of THALI increases** from INR 100 to INR 110- So a **10% increase in Price**

Because of the price hike, say, **demand for THALI falls** from 100 to 80 plates- So **a 20% fall in quantity** demanded. So, $E_P = \frac{\%\Delta Q_D}{\%\Delta P} = (-20\%)/(10\%) = -2$. **So, the price elasticity of THALI is –2**.

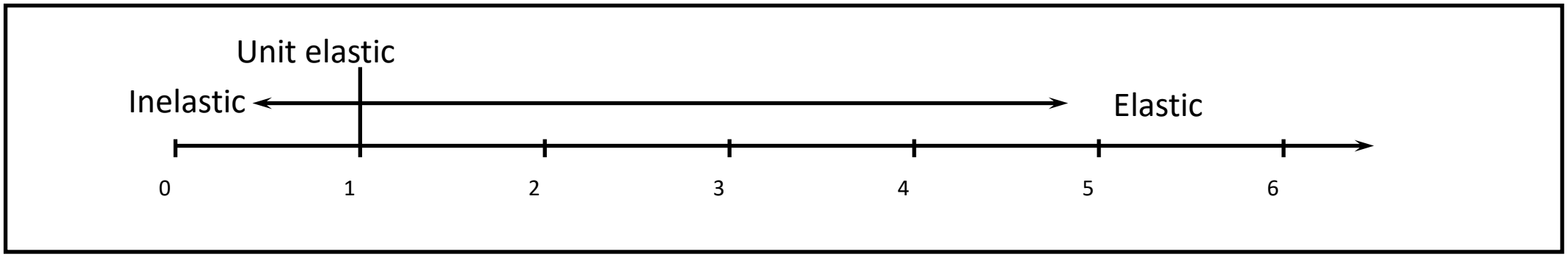
As a convention we often use the **absolute value** of the elasticity, and **say own-price demand elasticity of THALI is 2** (negative relationship between price and demand is obvious)

Elasticity: Demand

What happens with different magnitudes of E_P?

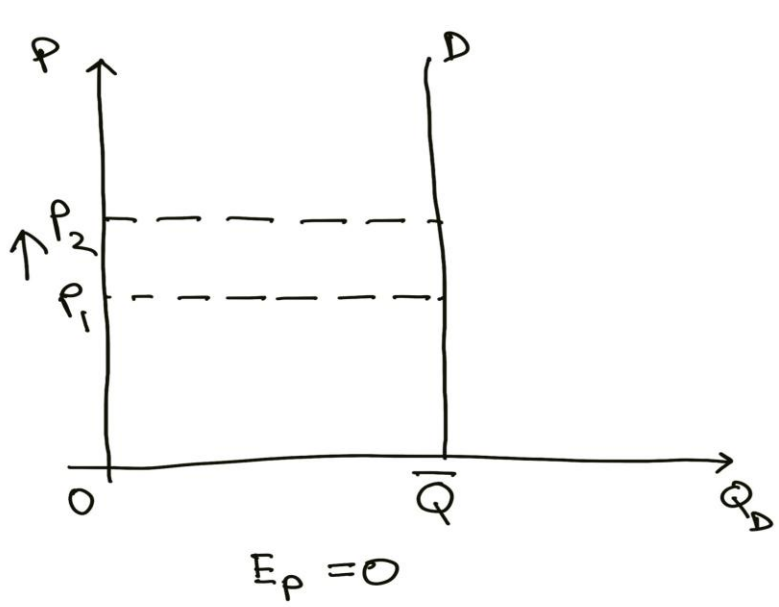
- If $E_P > 1$ – Demand is price elastic
- If $0 < E_P < 1$ – Demand is price inelastic
- If $E_P = 1$ – Demand is unit elastic

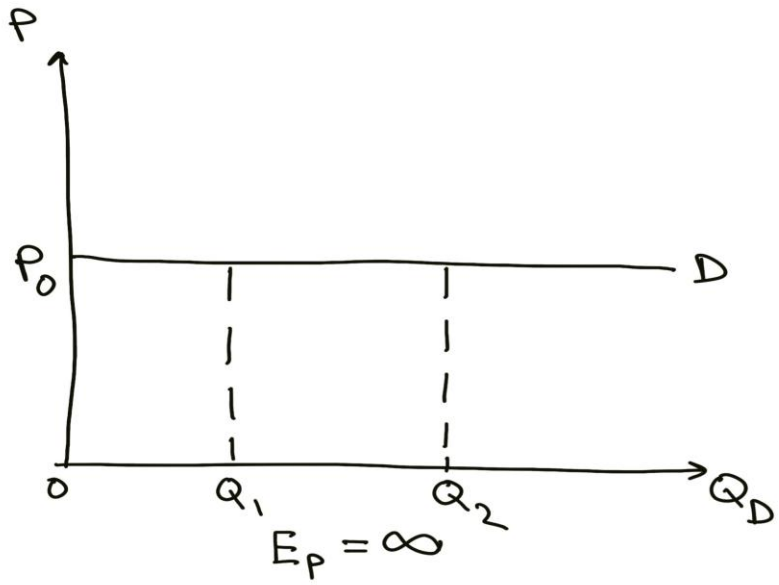
- Inelastic demand
  - It means that a % change in P will have less than a proportionate change in quantity demanded (quantity is not very responsive to price)
- Elastic demand
  - It means that a % change in P will have more than a proportionate change in quantity demanded (quantity is very responsive to price)
- Unit elastic demand
  - A % change in P will have exactly the same % change in quantity



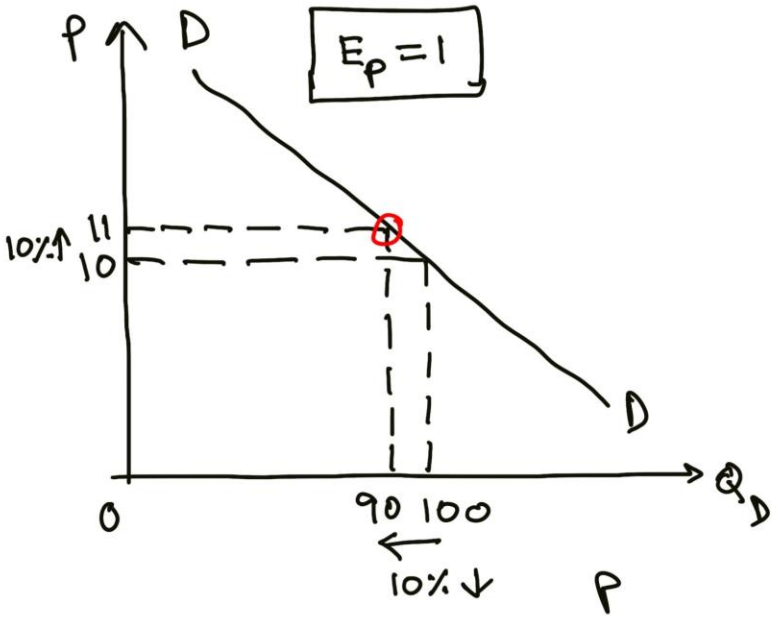
Elasticity: Demand

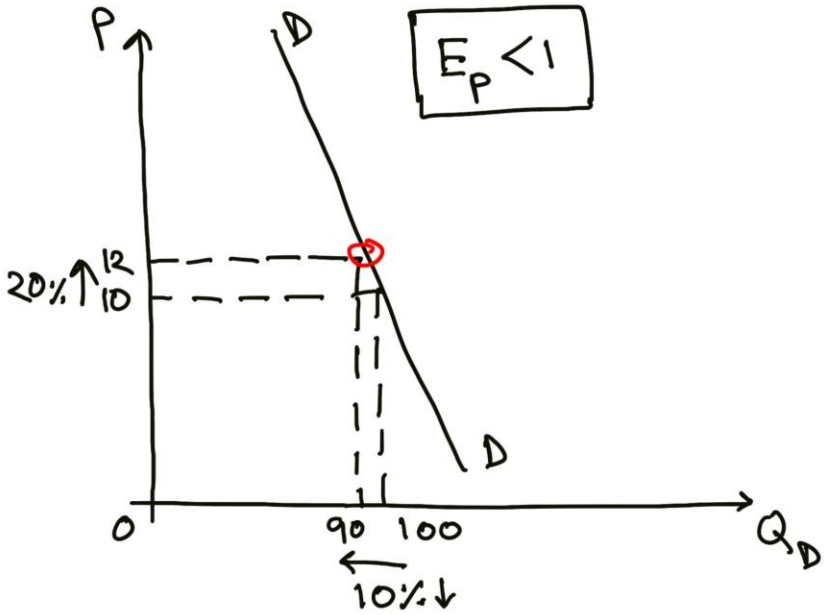
- **Perfectly inelastic demand: $E_P = 0$**
  - It means that a % change in P will have no impact on the quantity demanded [**Demand curve will be vertical**] – Consumers buy a fixed amount $\bar{Q}$
- **Perfectly elastic demand: $E_P = \infty$ (infinite)**
  - Buyers will buy any quantity of the good at any particular price (P_0); however, they will demand no good if the price is above P_0, or if the price is below P_0, there will be infinite demand [**Demand curve will be horizontal**]

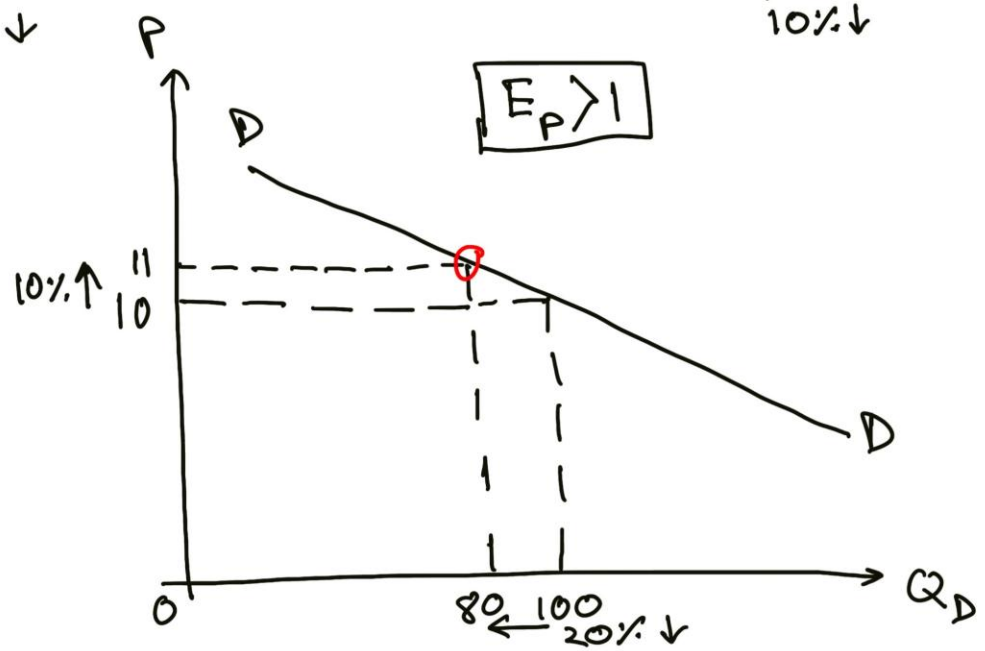




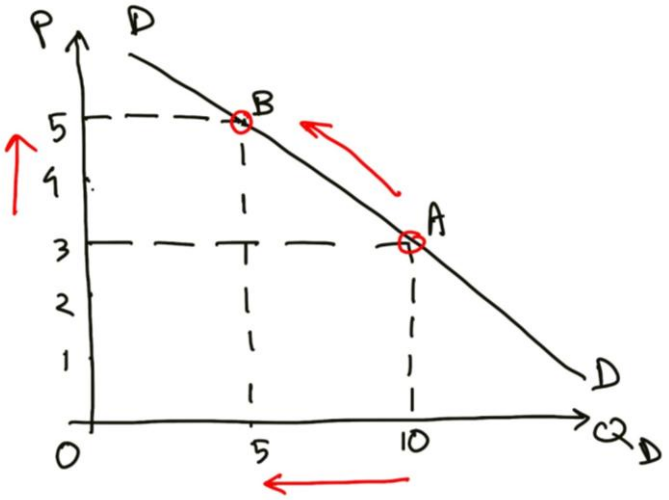
Demand Elasticity (Examples)

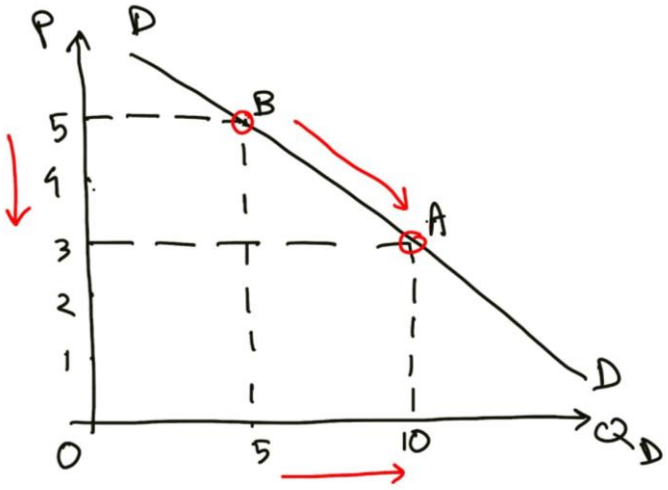






Elasticity: Base Effect





How does the direction of movement impact elasticity?

Case 1: Movement from A to B

% change in Q = (5–10)/10= –50%

% increase in P = (5–3)/3 = 67%

E_P = |(–50%/67%)| = 0.75 **<<<** We take the absolute value, negative sign is obvious (as generally, the demand curve is downward sloping)

Case 2: Movement from B to A

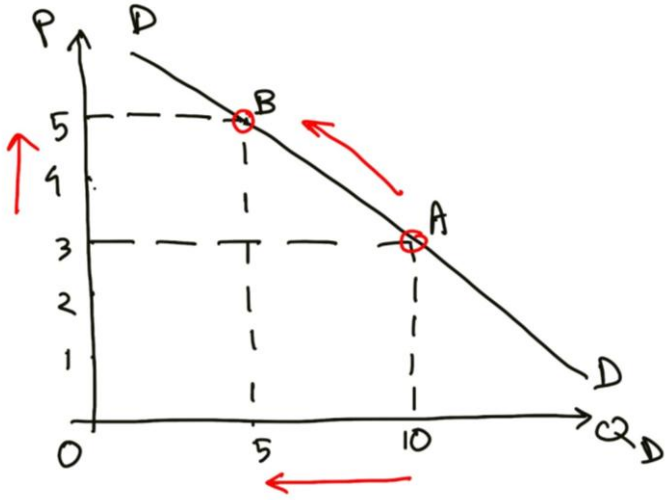
% change in Q = (10–5)/5= 100%

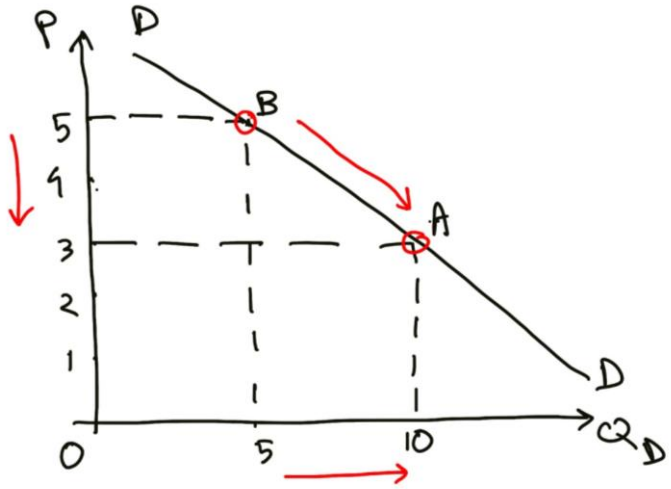
% change in P = (3–5)/5 = –40%

E_P = |(100%/(–40%))| = 2.5

Base Effect- The base is the initial point (A in the upper panel and B in the lower panel); **it distorts the elasticity calculation**.

Demand Elasticity: Midpoint Method





The Midpoint Method

$$E_P = \frac{(Q_2 - Q_1)/[\frac{Q_2 + Q_1}{2}]}{(P_2 - P_1)/[\frac{P_2 + P_1}{2}]}$$

The midpoints between the two quantities and two prices are considered as bases → To address the problem of base effect with the previous method of calculating elasticity

How does the Midpoint Method impact Price Elasticity?

Case 1: Movement from A to B

% change in Q = (5–10)/7.5= –67%

% increase in P = (5–3)/4 = 50%

E_P = |(–67%/50%)| = 1.34

Case 2: Movement from B to A

% change in Q = (10–5)/7.5= 67%

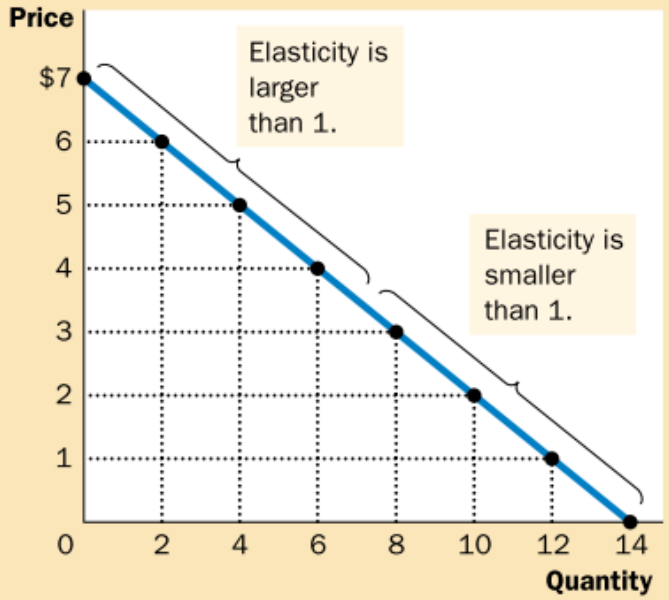
% change in P = (3–5)/4 = –50%

E_P = |(67%/(–50%))| = 1.34

Base Effect is eliminated, and we get the same elasticity

Demand Elasticity Example: Midpoint Method

Elasticity varies along a linear demand curve



Price	Quantity	Total Revenue (Price × Quantity)	Percent Change in Price	Percent Change in Quantity	Elasticity	Description
$7	0	$ 0				
			15	200	13.0	Elastic
6	2	12				
			18	67	3.7	Elastic
5	4	20				
			22	40	1.8	Elastic
4	6	24				
			29	29	1.0	Unit elastic
3	8	24				
			40	22	0.6	Inelastic
2	10	20				
			67	18	0.3	Inelastic
1	12	12				
			200	15	0.1	Inelastic
0	14	0				

Source: p.95, N. G. Mankiw (Principles of Microeconomics)

Demand Elasticity

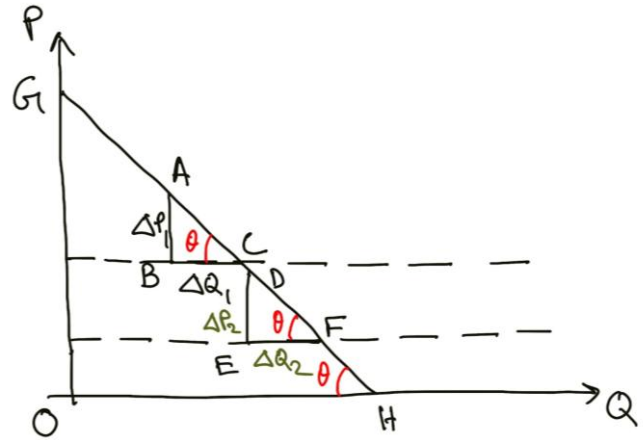
1. What will the demand curve look like for **insulin** for a diabetic patient?- **Vertical** (as it is demanded at fixed quantities)
2. What will the demand curve for **water bottles from company XYZ** look like in the economy?- **Horizontal** (as there are many substitutes available from other companies, at a price above the fixed price ($\bar{P}$) consumers shift to other companies)→ 0 demand for P< $\bar{P}$ comes from sellers' side (it is not sustainable- we will see that later)

<u>Gradient/Slope of a Linear Demand Function</u>

The gradient of a straight line is also known as the slope of a straight line

Suppose, P = 10 + (–5).Q ---- Inverse demand function
Demand Function---- Q = 2 – (1/5).P

Here,
Slope of the inverse demand function is: (–5) = **dP/dQ** [**How does the function P=f(Q) change with respect to a unit change in Q?**]
Slope of the demand function is: (–1/5) = **dQ/dP**



$$\frac{\Delta P_1}{\Delta Q_1} = \frac{AB}{BC}$$

$$\frac{\Delta P_2}{\Delta Q_2} = \frac{DE}{EF}$$

Slope of GH line:

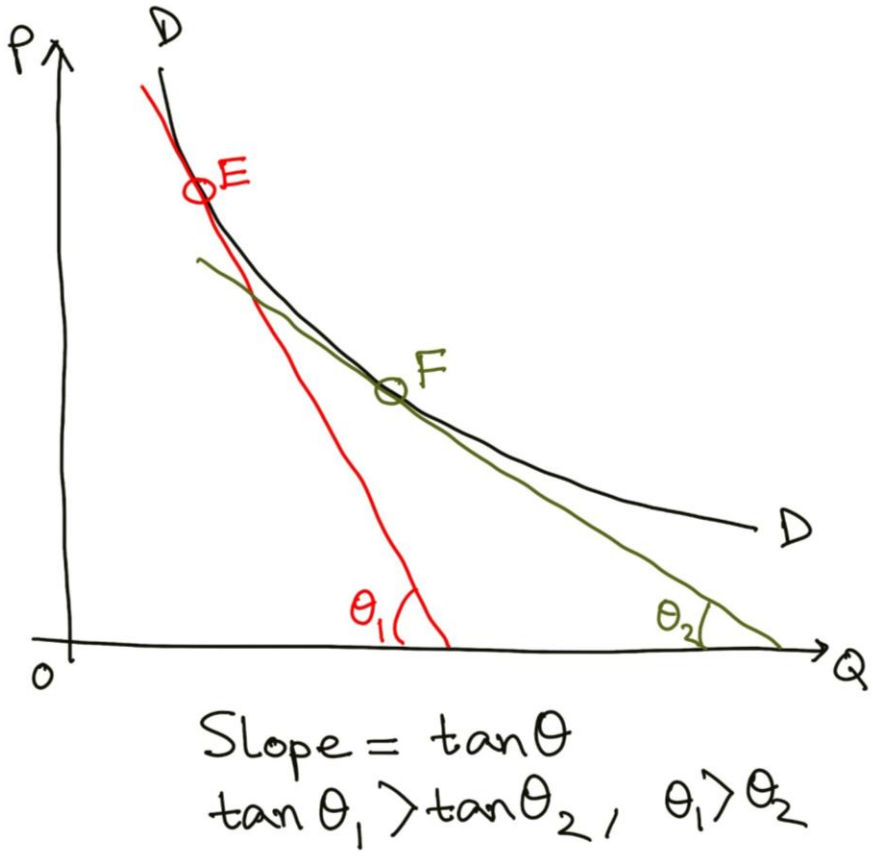
$$\frac{AB}{BC} = \frac{DE}{EF} = \frac{GO}{OH} = \frac{\Delta P}{\Delta Q} = tan\theta$$

Demand Elasticity

Gradient/Slope of a Non-linear Demand Function

For a non-linear demand curve (function) the slope changes continuously.

Slope at any point on the demand curve is given by the slope of the tangent line at that point.

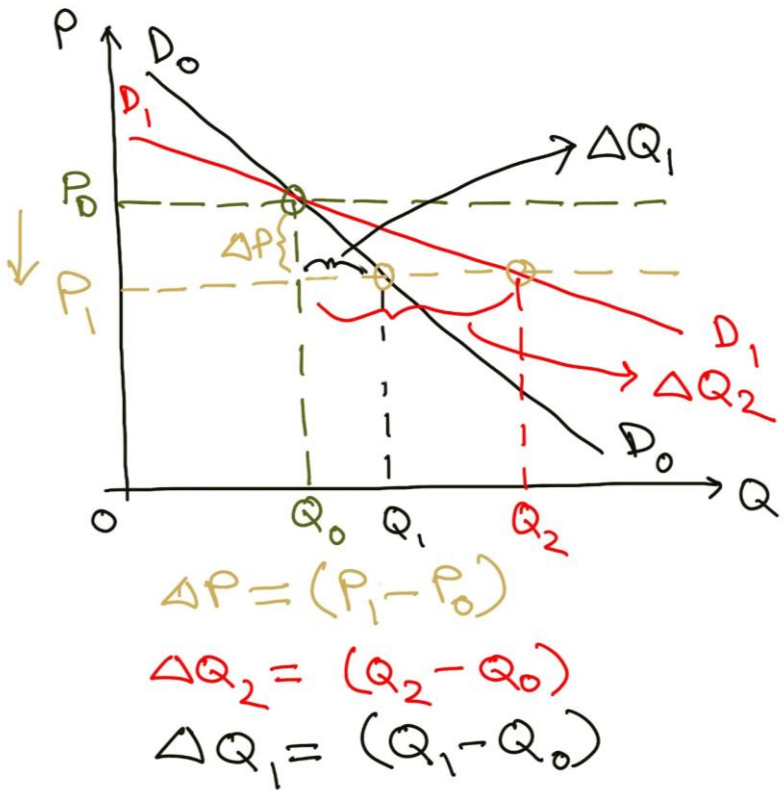


Slope of Demand curve DD at E = $Slope\ of\ Red\ Line = tan\theta_1$

Slope of Demand curve DD at F= $Slope\ of\ Green\ Line = tan\theta_2$

tanθ is an increasing function in θ

Demand Elasticity: Elastic vs. Inelastic Demand



What difference does elasticity make in terms of the quantity's response to changes in prices?

Ex-

D_0D_0 and D_1D_1 – Two demand curves (**D_1D_1 is relatively more elastic**)

Suppose the price drops by ΔP

Change in quantity ΔQ_1 for D_0D_0 and ΔQ_2 for D_1D_1

$\Delta Q_2 > \Delta Q_1$

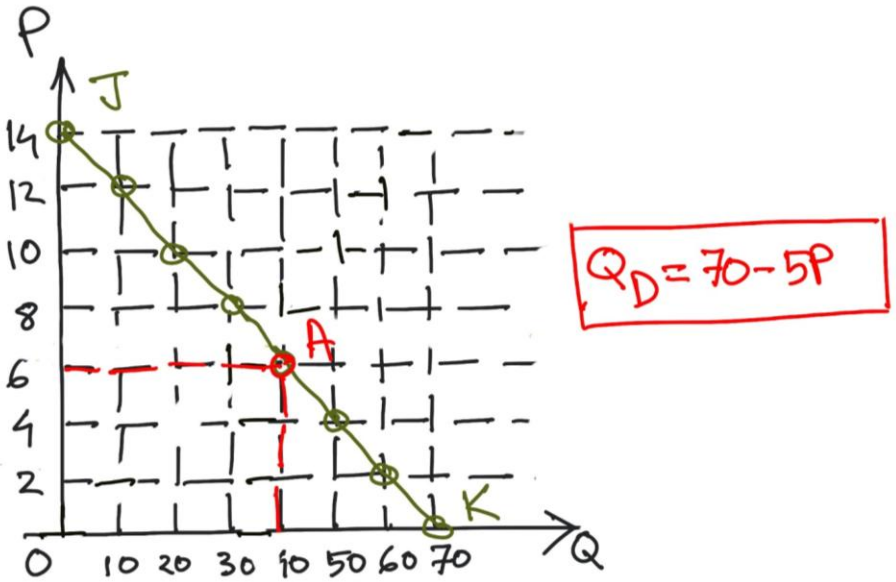
A demand curve with greater elasticity will have a greater impact on the quantity demanded as a response to a change in its price

Demand Elasticity: Point vs. Arc Elasticity

Point Elasticity of Demand—

It measures the change in demand at any point of the demand curve, given a small price change.

$$E_P = \frac{\%\Delta Q_X}{\%\Delta P} = \frac{P}{Q_X}\frac{dQ_X}{dP}$$



Ex-
Calculate the elasticity at point A

Slope = (dP/dQ) = (0–6)/(70–40) = –(1/5)
Slope of demand function = dQ/dP = –5
Point elasticity at A= (P at A/Q at A)*(slope of demand function)= $E_P^A = |\frac{P^A}{Q^A} \times \frac{dQ}{dP}|$ = |(6/40)*(–5)| = **0.75**

It is only used for estimating elasticity at a particular point on the demand curve

Demand Elasticity: Point vs. Arc Elasticity

Arc Elasticity of Demand— (Midpoint Formula)

It measures the change in demand over a segment of the demand curve

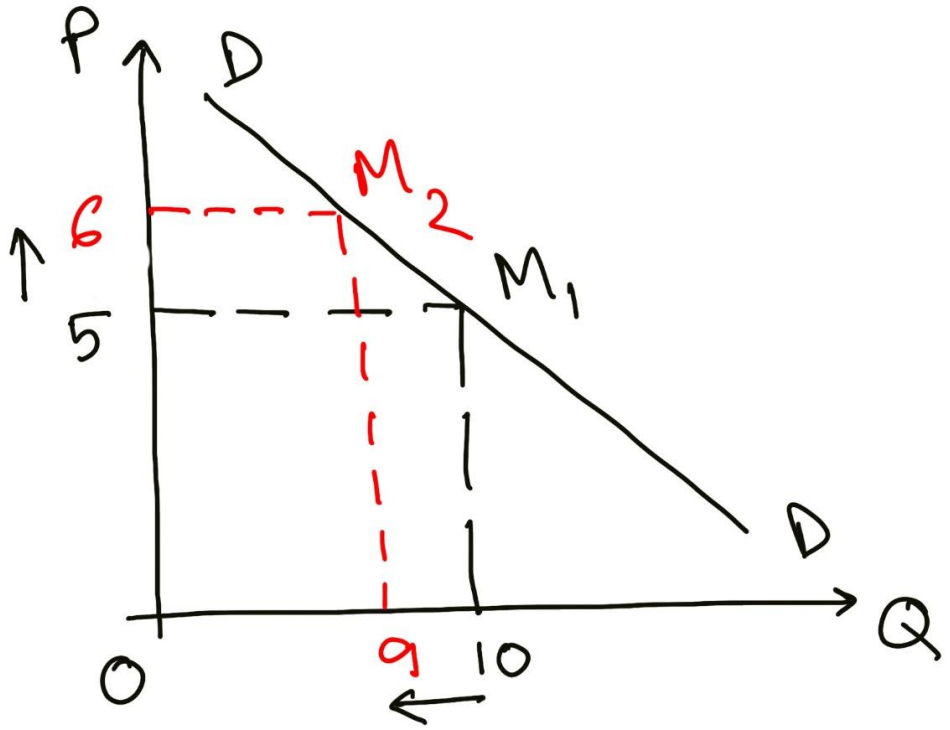
$$E_P = \frac{(Q_2 - Q_1)/[\frac{Q_2 + Q_1}{2}]}{(P_2 - P_1)/[\frac{P_2 + P_1}{2}]}$$

If you want to see the impact of a large change in price on the quantity demanded----- You should then use Arc Elasticity formula

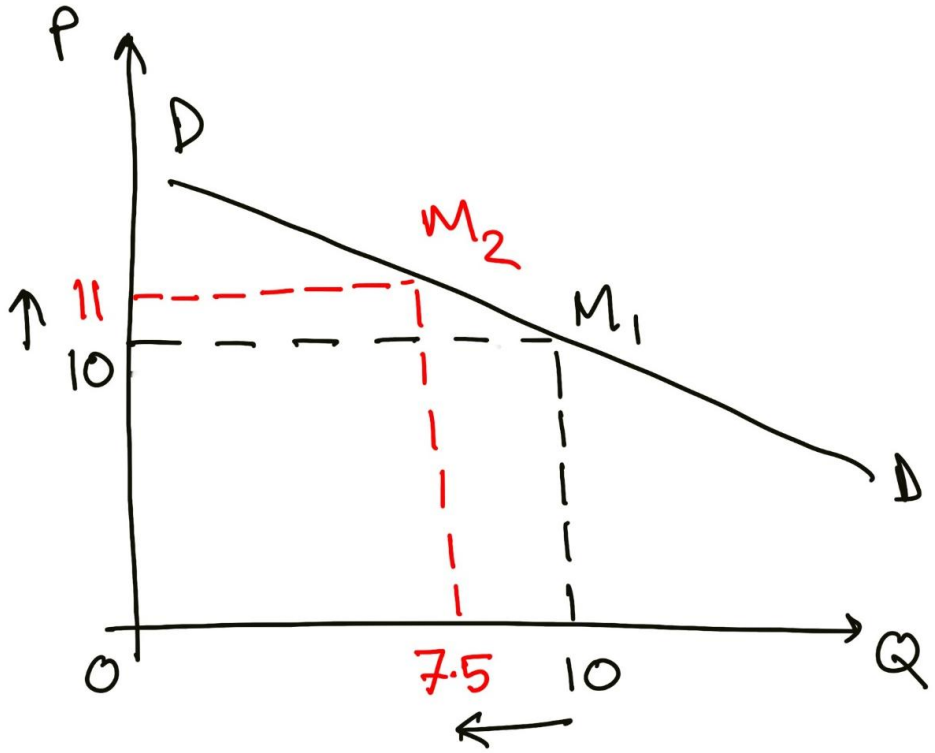
When we want to say if a curve is elastic or inelastic, using Arc Elasticity is best.

Demand Elasticity: Impact on Revenue

Revenue for a firm = Price it charges * Quantity it sells at that price = P * Q



Change in Revenue= (6*9) – (5*10)= 4



Change in Revenue= (11*7.5) – (10*10)= –17.5

For inelastic demand curve, increasing price results in revenue gain for a seller

Demand Elasticity: Others

Two other demand elasticities---

- **Income Elasticity**
- **Cross-price Elasticity**

Though here we discuss the point-elasticities, the arc elasticities will follow similar formulae as used for own price elasticity

Two goods: **X** and **Y**; Income: **I**

Income elasticity of demand for good X (E_I)

= (% change in quantity of X demanded) / (% change in income)

$$= \frac{\%\Delta Q_X}{\%\Delta I} = \frac{I}{Q_X}\frac{dQ_X}{dI}$$

Cross-price elasticity of demand for good X $(E_{Q_X P_Y})$

= (% change in quantity demanded of good X) / (% change in price of good Y)

$$= \frac{\%\Delta Q_X}{\%\Delta P_Y} = \frac{P_Y}{Q_X}\frac{dQ_X}{dP_Y}$$

Demand Elasticity: Signs

Cross-price elasticity for Complementary Good

1. **This elasticity is negative** because as the price of a complementary good rises, the quantity demanded of the good itself falls.
2. Example- Software vs. computers. When the price of software rises the quantity demanded of computers falls.

Cross-price elasticity for Substitutes

1. **This elasticity is positive** because as the price of a substitute good rises, the quantity demanded of the original good rises.
2. Example- hockey vs. basketball. The quantity demanded of basketball tickets rises when the price of hockey tickets rises.

Income Elasticity

1. **When the income elasticity of demand is positive** (**normal good**), consumers increase their purchases of the good as their incomes rise (e.g. automobiles, clothing).
2. **When the income elasticity of demand is negative** (**inferior good**), consumers reduce their purchases of the good as their incomes rise (e.g. potatoes).
3. **When the income elasticity is 0,** we say that there is no impact of income change on demand → these are **necessities**

Supply Elasticity

Price elasticity of supply $(E_S) =$

$$\frac{\%\ change\ in\ Quantity\ supplied}{\%\ change\ in\ Price} = \frac{(\frac{\Delta Q_S}{Q_S})}{(\frac{\Delta P}{P})} = \frac{P}{Q_S} \times \frac{\Delta Q_S}{\Delta P}$$

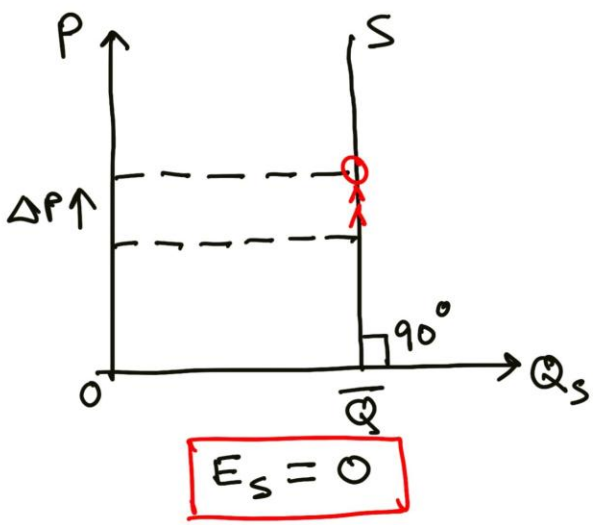
E_S is always non-negative

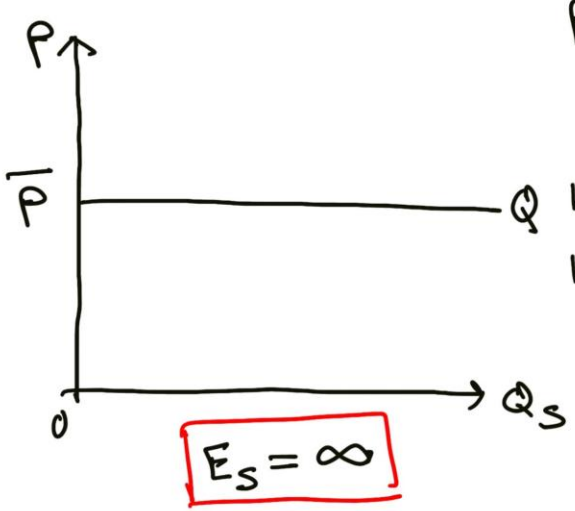
- $E_S = 0$ ---- Perfectly inelastic
- $0 < E_S < 1$ ---- Inelastic
- $E_S = 1$ ---- Unit elastic
- $E_S > 1$ ---- Elastic
- $E_S = \infty$

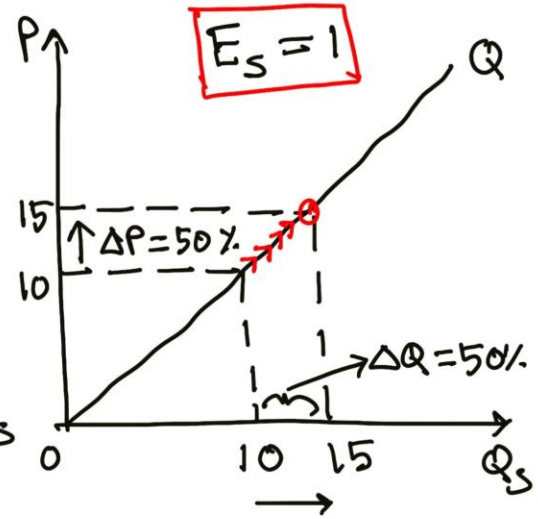
Arc Elasticity = $\dfrac{(Q_2 - Q_1) \Big/ [\frac{Q_2 + Q_1}{2}]}{(P_2 - P_1) \Big/ [\frac{P_2 + P_1}{2}]}$

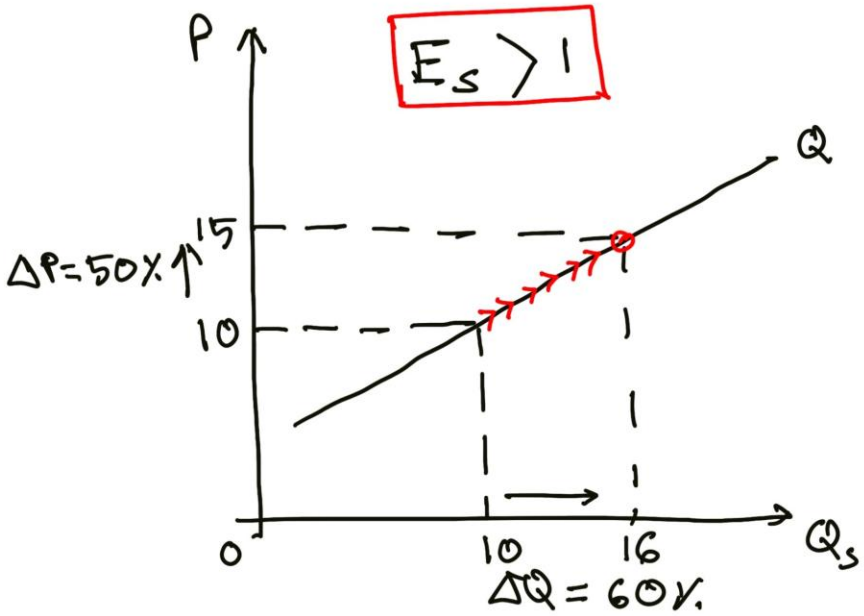
Mid-point method or **Arc Elasticity is preferred when we want to see the impact of a large change in price.**
Point Elasticity Method is used when we want to check the impact of an infinitesimally small price change (**marginal change in price**).

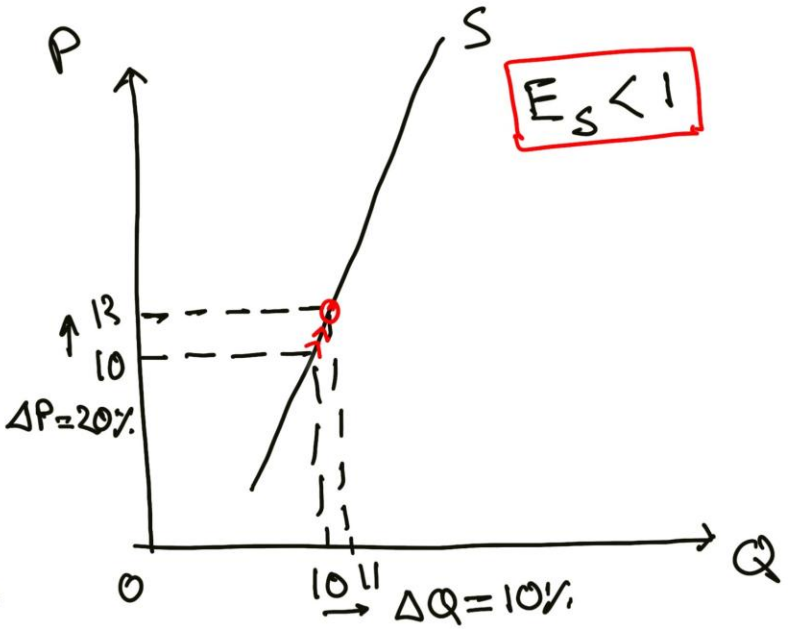
Supply Elasticity: Examples











Supply Elasticity

Examples---

- **Perfectly elastic supply curve**
  - Consider the example of airline pricing. Generally, airline operators charge standardised prices per seat. At that price, any airline operator can provide seats to any number of buyers (**WE ARE NOT CONSIDERING CONSTRAINTS IN TERMS OF NUMBER OF PLANES IT OPERATES**). If it increases the price per seat even by a tiny fraction (from the standardised market price for data), buyers will shift to its competitor airlines. Any price below the standardised price per seat will not make sense for the airline operator, as it can still sell tickets at the fixed (standardised price) and satisfy any existing demand. So, the supply curve is horizontal at the standardised price.

- **Perfectly inelastic supply curve**
  - Consider the example of the availability of land in India's densely populated urban areas (Mumbai, Kolkata). Geographically, land is fixed in supply, no matter how prices change. So, the supply curve is vertical at the fixed amount of land available in the city.

Supply Elasticity: Determinants

Supply Elasticity depends on multiple factors

1. **Availability of inputs** (if inputs are easily available, then it is easier for other sellers to also come to market and sell exactly the same product, so any seller cannot change price beyond the standardised price, more price elastic supply curve ----- if inputs are scarce, it is difficult to increase supply even if prices increase, more price inelastic supply curve)
2. **Production capacity of the seller**/firm (A firm **operating with excess capacity** can increase production more than proportionately w.r.t a price change, so a more elastic supply curve. A firm **operating at full capacity** cannot respond to a price change; as all the inputs are being fully used in production, so a more inelastic supply curve)
3. **In the long-run** supply curve is more elastic (in the short-run, the producers cannot adjust their firm's capacity or expand their scale of operation; however, **in the long-run, they can adjust their capacity or expand their scale**)
4. **Better technology** (suppose there are two firms A & B, producing the same good X → A uses more efficient technology than B → firm A can increase supply more than proportionately with any change in price compared to firm B → Firm A will have more elastic supply curve than Firm B)

Summary: Demand and Supply

Demand

- **Law of demand-** Negative relationship between 'own price' and quantity demanded
- **Q_D = f(P, Income, Tastes, Expectation, Number of Buyers, P_r)**
- **Own-price elasticity-** How much a % change in P impacts in % change in Q_D
  - **Point elasticity-** When measured at 'one point' on the demand curve
  - **Arc elasticity-** When measured over a section of the demand curve (Midpoint method)
- **Income elasticity; Cross-price elasticity**

Supply

- **Law of supply-** Positive relationship between the price of the good and quantity supplied
- **Q_S = f(P, Input prices, Technology, Expectation, Number of Sellers)**
- **Price elasticity-** How much a % change in P impacts in % change in Q_S
  - **Point elasticity-** When measured at 'one point' on the supply curve
  - **Arc elasticity-** When measured over a section of the supply curve (Midpoint method)

Demand and supply curves together decide the equilibrium price and quantity

SHIV NADAR
INSTITUTION OF EMINENCE DEEMED TO BE
UNIVERSITY
DELHI NCR

SCHOOL OF
MANAGEMENT AND
ENTREPRENEURSHIP

Economics for Business - I

Policy Implications: Price Controls and Taxation

Policy Implications: Price Control, Taxation

Price Ceiling and Price Floor (set by the authority or the government)

- **A price ceiling is an upper-bound** that is set on the price of a commodity
- **A price floor is a lower-bound** (minimum) of the price of a commodity
- Both of these can be binding or non-binding, depending upon where they are fixed
- **There are possibilities of excess supply or demand because of the price controls**

Impact of (Indirect) Taxation (on price)

- Tax on the price of the commodity impacts both buyers and sellers
- Buyers pay more than the equilibrium price
- Sellers get less than the equilibrium price
- Quantity sold is lower than the equilibrium level

Policy Implications: Price Controls

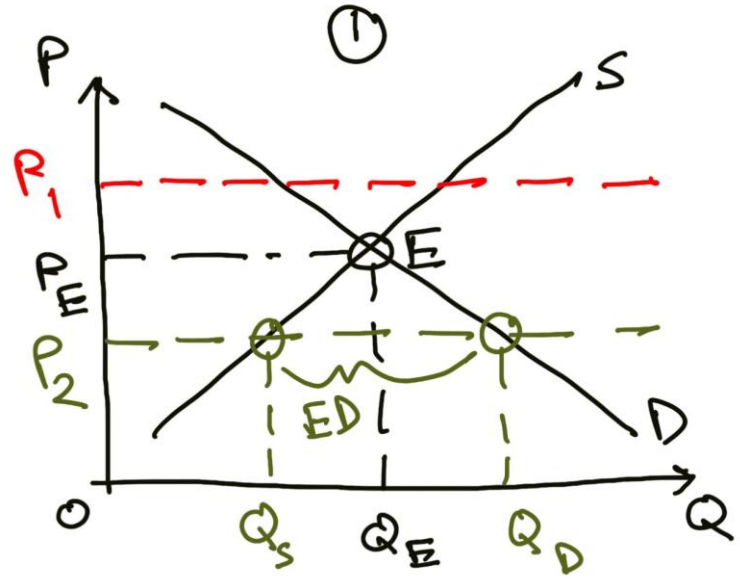


Figure 1 (Price Ceiling)

- Market **equilibrium at E**, corresponding price P_E
- A **price ceiling at P_1 is non-binding**
- A **price ceiling of P_2 is binding**, creating **excess demand** of Q_DQ_S
- Shortage of the good in the market for price control at P_2

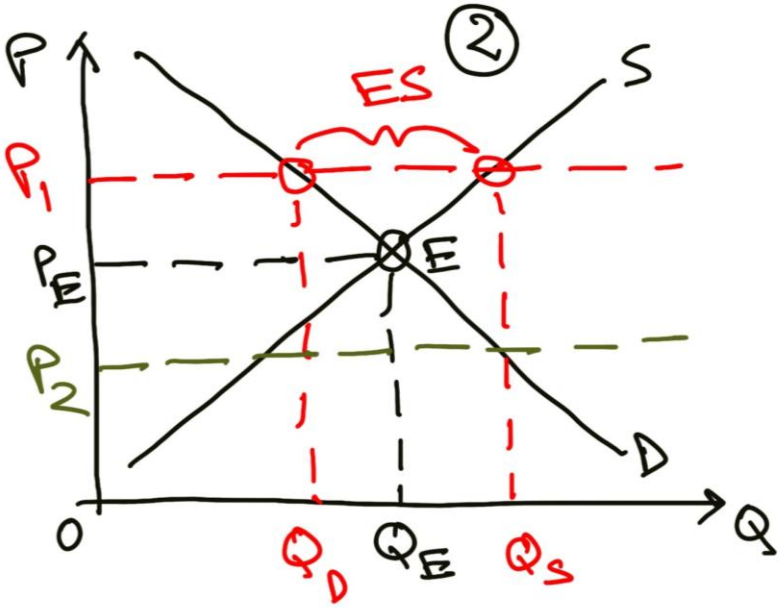


Figure 2 (Price Floor)

- Market **equilibrium at E**, corresponding price P_E
- A **price floor at P_2 is non-binding**
- A **price floor of P_1 is binding**, creating **excess supply** of Q_SQ_D
- Surplus of the good in the market for price control at P_2