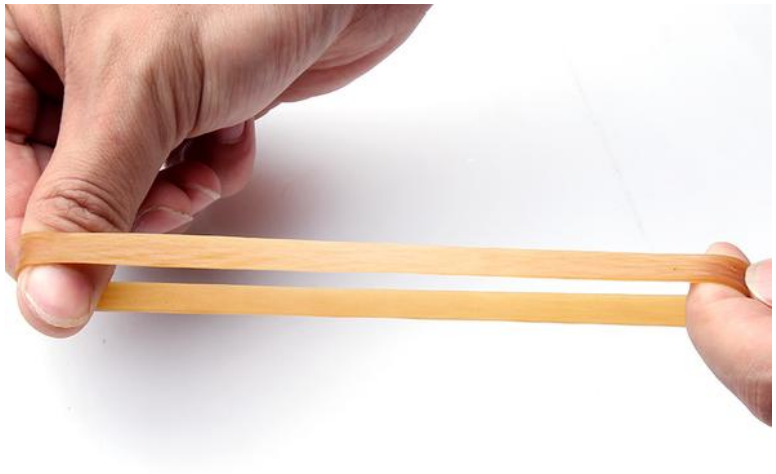
Elasticity of demand

Charlene

What is elasticity?



- Elasticity measures how much one variable responds to changes in another.

Elasticity of demand measures how much the changes in the quantity demanded respond to the changes in other factors

Recap: what factors have an impact on demand?

- Price
- Disposable income
- Wealth
- The prices of other goods
- Individual tastes & preference
- Population size
- Interest rate

Price elasticity of demand

Price elasticity of demand: a measure of the percentage change in quantity demanded as a result of a given percentage change in price, or simply, **the responsiveness of quantity demanded to a change in price.**

- Loosely speaking, it measures the ***price-sensitivity*** of demand.

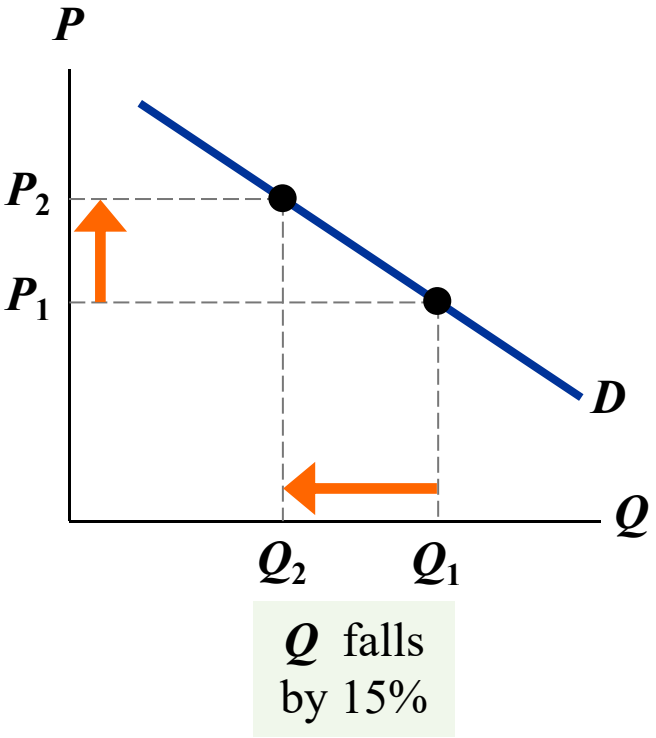
$$\textit{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } \textit{QD}}{\%\ \Delta \text{ in } \textit{P}}$$

Price elasticity of demand

$$\textbf{\textit{Price elasticity of demand}} = \frac{\%\ \Delta \text{ in } \boldsymbol{QD}}{\%\ \Delta \text{ in } \boldsymbol{P}}$$

Example:

Price elasticity of demand equals $\frac{-15\%}{+10\%} = -1.5$

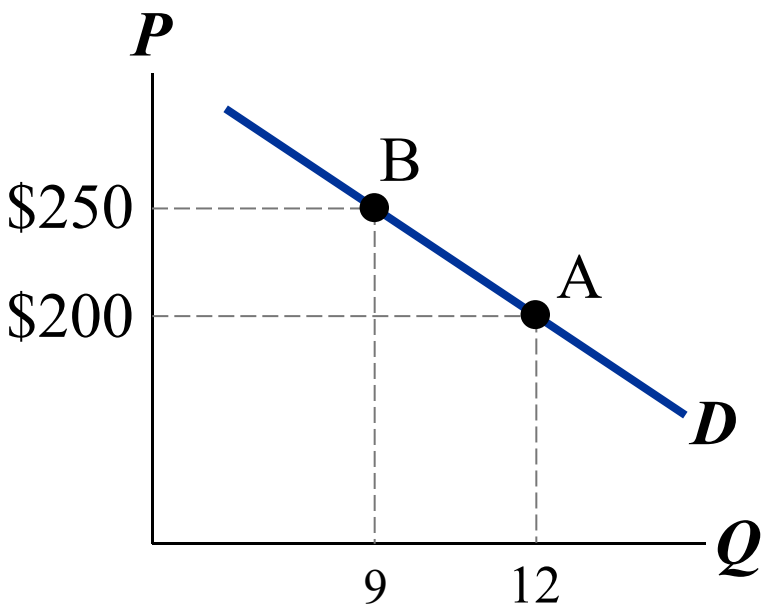


Along a ***D*** curve, ***P*** and ***Q*** move in opposite directions, which would make price elasticity negative.

Calculating Percentage Changes

Percentage (%) change:

$$\frac{\text{end value} - \text{start value}}{\text{start value}} \times 100\%$$



Going from A to B,
the % change in ***P*** equals

(250–200)/200 = 25%

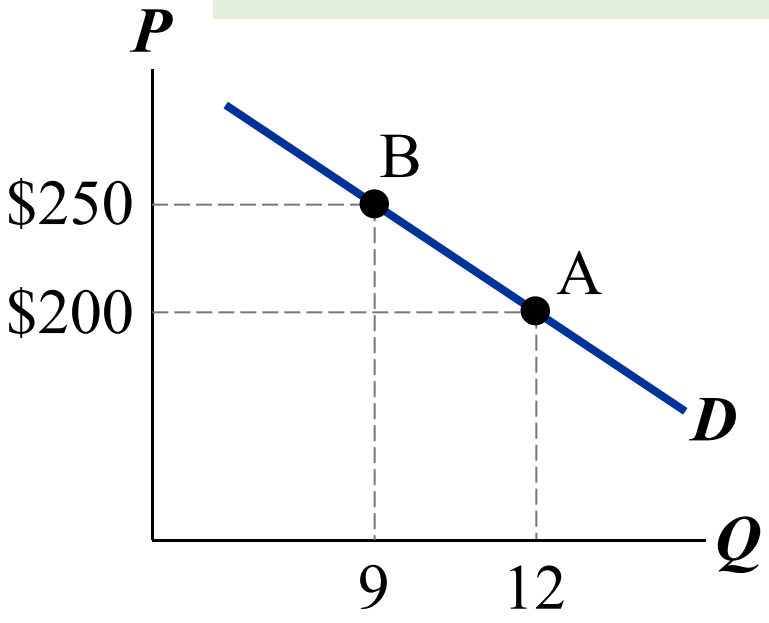
the % change in ***Q*** equals

(9–12)/12 = -25%

Price elasticity of demand equals $\frac{-25\%}{25\%} = -1$

Calculating Percentage Changes

***Problem*:** you will get different answers depending on where you start and where you end.



Going from **B** to **A**,
the % change in ***P*** equals

$$(200–250)/250 = -20\%$$

the % change in ***Q*** equals

$$(12\text{-}9)/9 \approx 33.3\%$$

Price elasticity of demand equals

$$\frac{33.3\%}{-20\%} \approx -1.67$$

Classifications of Demand Curves

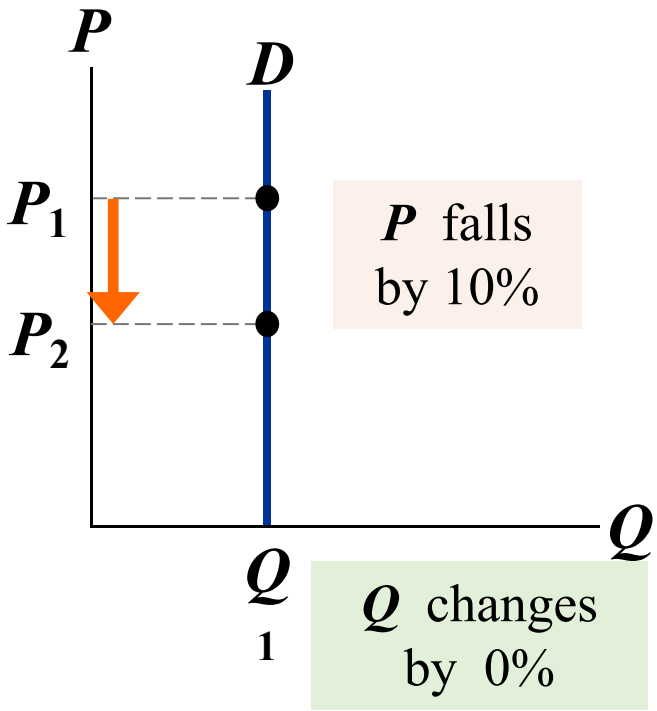
- According to their elasticity, we classify the ***D*** curves into five classifications...

Perfectly inelastic demand

$$\text{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } QD}{\%\ \Delta \text{ in } P} = \frac{0\%}{-10\%} = 0$$

D curve: vertical

Elasticity: 0

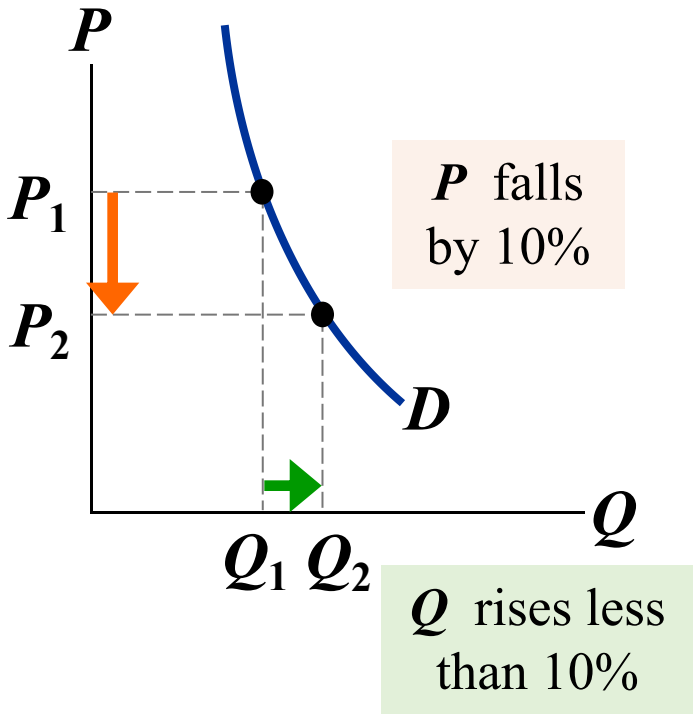


Inelastic demand

$$\text{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } \boldsymbol{QD}}{\%\ \Delta \text{ in } \boldsymbol{P}} = \frac{< 10\%}{-10\%} \quad > -1$$

D curve: relatively steep

Elasticity: (-1, 0)



Inelastic demand

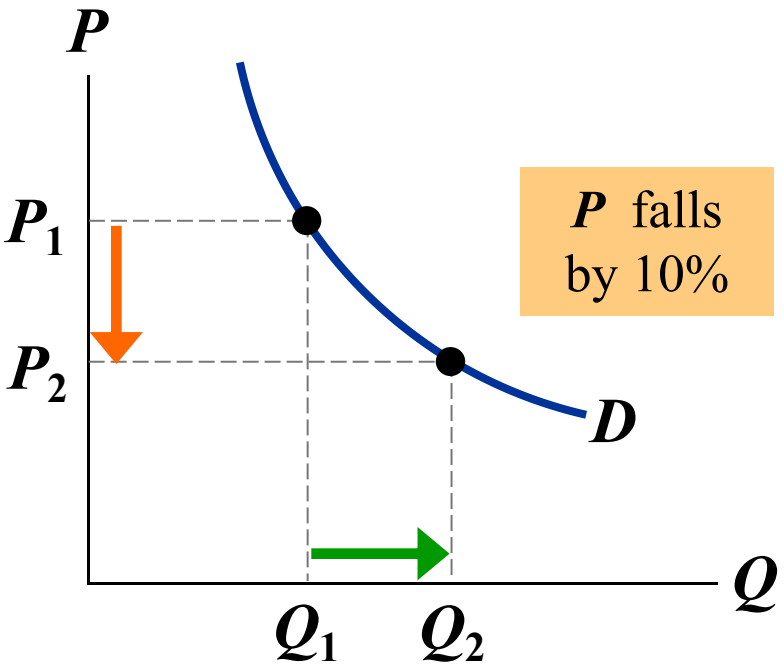
- Can you think of any goods that is inelastic demand?
- Necessities: food, water

Unit elastic demand

$$\text{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } QD}{\%\ \Delta \text{ in } P} = \frac{10\%}{-10\%} = -1$$

D curve: intermediate slope

Elasticity: -1

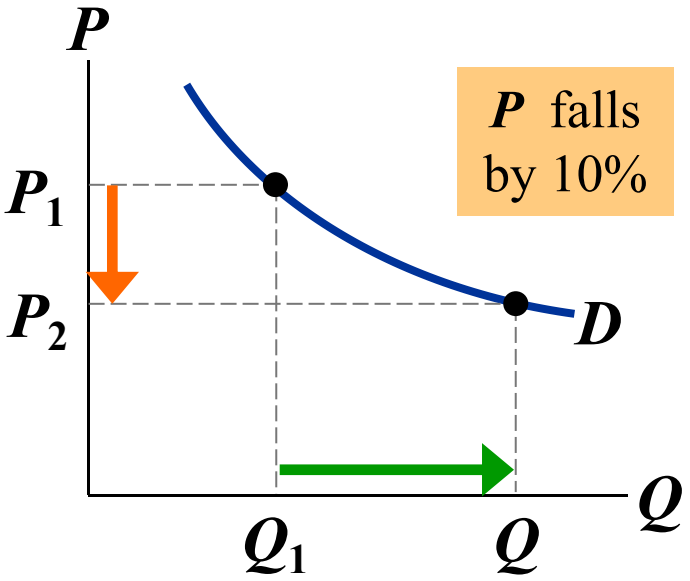


Elastic demand

$$\text{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } \boldsymbol{QD}}{\%\ \Delta \text{ in } \boldsymbol{P}} = \frac{>10\%}{-10\%} < -1$$

D curve: relatively flat

Elasticity: < -1

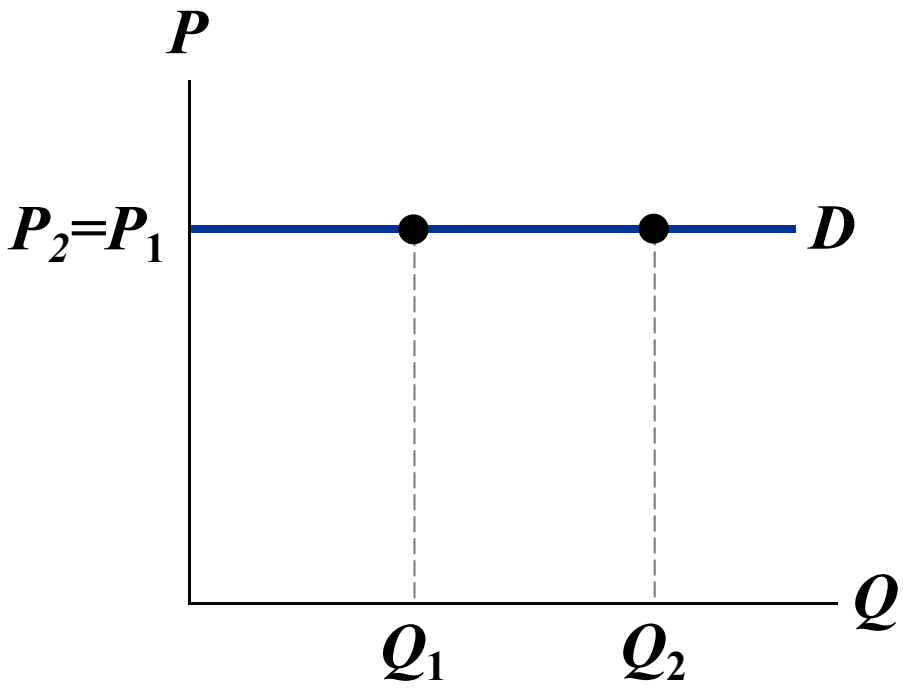


Perfectly elastic demand

$$\text{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } QD}{\%\ \Delta \text{ in } P} = \frac{\text{any amount}}{0\%} = \infty$$

D curve: horizontal

Elasticity: infinity



Q can be any amount

Summary

$$\textit{Price elasticity of demand} = \frac{\%\ \Delta \text{ in } \textit{QD}}{\%\ \Delta \text{ in } \textit{P}}$$

- Ignore the minus sign:
  The flatter the curve, the bigger the elasticity.
  The steeper the curve, the smaller the elasticity.

Category	% Δ in QD vs. % Δ in P	Diagram	Value of PED	Change in revenue when price rise
perfectly elastic				
elastic				
unit elastic				
inelastic				
perfectly inelastic				

Summary

Category	Relationship between % changes in P and QD	Value
Perfectly elastic	QD falls to zero after any rise in P	PED = ∞
Elastic	% change in QD > % change in P	PED < −1
Unit elasticity	% change in QD = % change in P	PED = −1
Inelastic	% change in QD < % change in P	−1 < PED < 0
Perfectly inelastic	No change in QD after any change in P	PED = 0

Practice

1. Is PED positive or negative and why?

2. If PED is -3 and the change in price is a fall of 5%, what is the percentage change in quantity?

The relationship between PED and firm's total revenue

Firm's total revenue

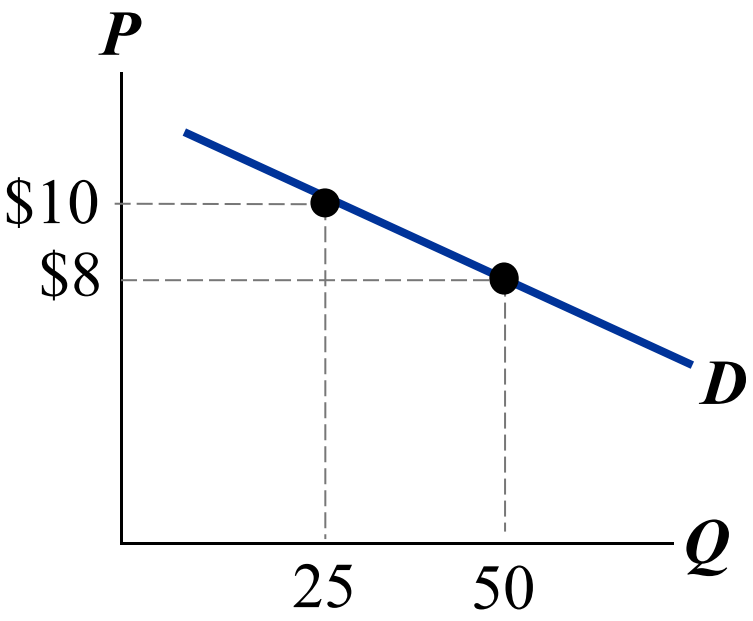
What is total revenue for a firm?

- *income from sales*
- *the total expenditure (spending) of the consumers*

How to calculate total revenue?

Total revenue (TR) = price × quantity sold

Relationships between PED and TR



- Calculate TR_1, when the firm sells at a price of $8

  $TR_1 = \$8 \times 50 = \$400$

- Calculate TR_2, when the firm sells products at a price of $10

  $TR_2 = \$10 \times 25 = \$250$

- When price rises from $8 to $10, calculate the ***% Δ in P***, ***% Δ in QD,*** and ***PED***

  % Δ in P = (10-8)/8 = 25%

  % Δ in QD = (25-50)/50 = -50%

  PED = -50% / 25% = -2

- In this case, when the firm increase the price, how does its total revenue change?

  decrease

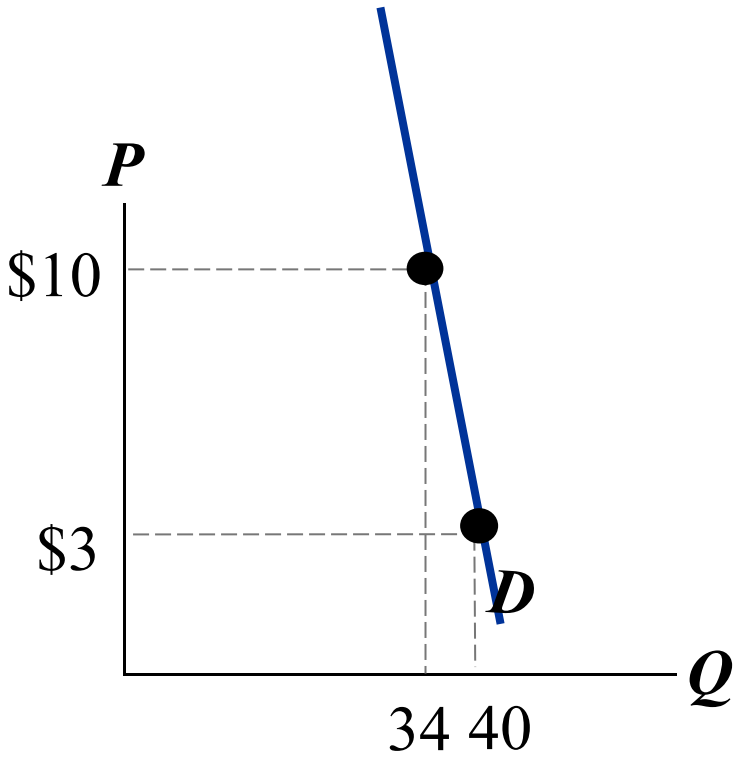
- In this case, is the demand elastic or inelastic?

  elastic (% Δ in P < % Δ in QD)

- Can you find the relationship between PED and TR?

When demand is ***elastic***, changes in price and total revenue ***move in opposite directions***.

Relationships between PED and TR



- Calculate TR_1, when the firm sells at a price of $10

  $TR_1 = \$10 \times 34 = \$340$

- Calculate TR_2, when the firm sells products at a price of $3

  $TR_2 = \$3 \times 40 = \$120$

- When price falls from $10 to $3, calculate the % Δ in P, % Δ in QD, and PED

  % Δ in P = (3-10)/10 = -70%

  % Δ in QD = (40-34)/34 ≈ 17.6%

  PED = 17.6% / -70% ≈ -0.25

- In this case, when the firm decrease the price, how does its total revenue change?

  decrease

- In this case, is the demand elastic or inelastic?

  inelastic (% Δ in P > % Δ in QD)

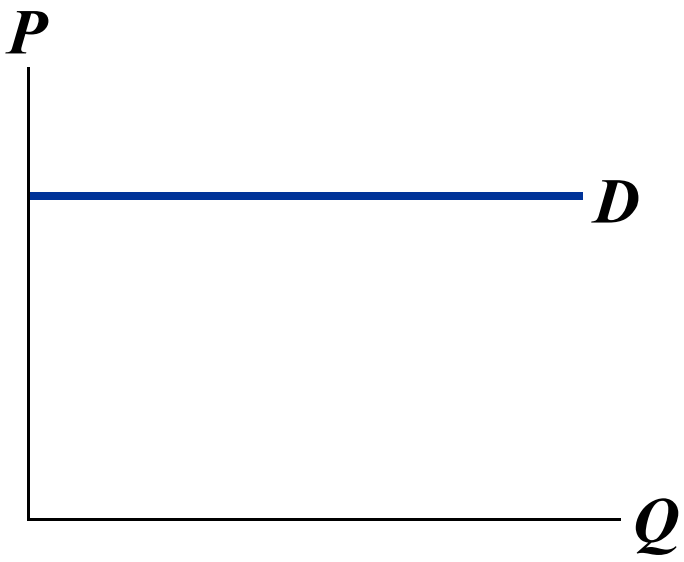
- Can you find the relationship between PED and TR?

When demand is ***inelastic***, changes in price and total revenue ***move in the same direction***.

What if demand is perfectly elastic, perfectly inelastic or of unit elasticity?

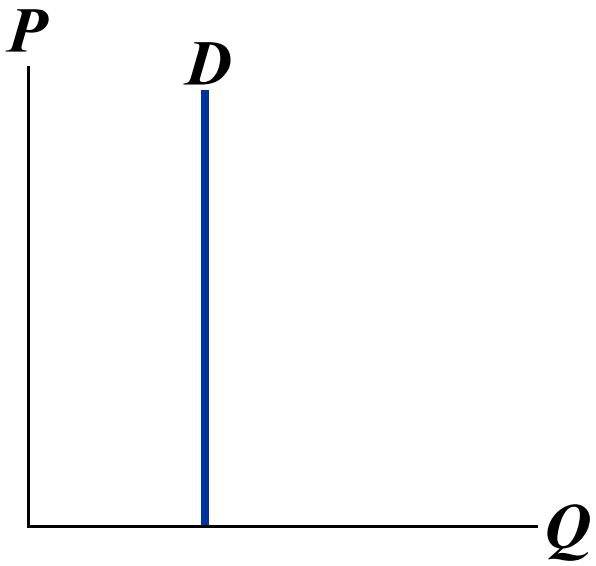
What will happen to TR when price rise or falls?

- Perfectly elastic demand & TR



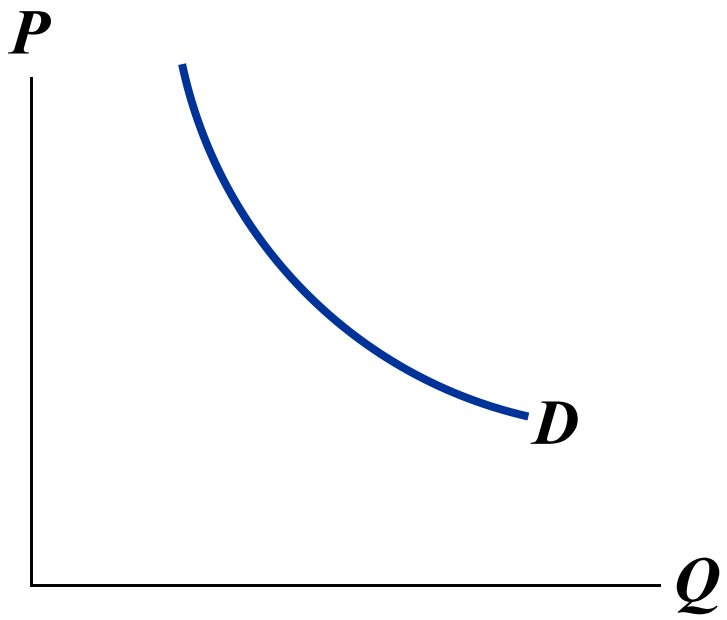
If demand is ***perfectly elastic***, there is no demand at a higher price. ***If price rises, total revenue falls to zero.***

- Perfectly inelastic demand & TR



If demand is ***perfectly inelastic***, the percentage change in total revenue will be the same as the percentage change in price.

- Demand of unit elasticity & TR



If demand is ***of unit elasticity***, any change in price, total revenue will stay the same

Summary

Category	Relationship between % changes in P and QD	Value	What happens to total revenue when price rises
Perfectly elastic	QD falls to zero after any rise in P	PED = ∞	Falls to zero
Elastic	% change in QD > % change in P	PED < −1	Falls
Unit elasticity	% change in QD = % change in P	PED = −1	Stays the same
Inelastic	% change in QD < % change in P	−1 < PED < 0	Rises
Perfectly inelastic	No change in QD after any change in P	PED = 0	Rises by the same percentage as price

Factors that influence PED

Factors that influence PED

- Whether the demand for a particular product is elastic or inelastic depends on:

  - substitutes
  - width of market
  - time
  - percentage of income spent on the product
  - necessities and luxuries
  - Habit-forming/addictive goods

Factors that influence PED - substitutes

- If the price of Coca Cola increase a little, but there is no change on Pepsi's price, what will happen?

If there are similar products that could be bought, demand will usually be elastic.

Factors that influence PED - width of market

- Think about TVs and Sony TVs, which one do you think is more elastic? Why?

Sony TV

Generally, the wider the definition of the market, the less elastic the demand for the product.

Factors that influence PED - time

- Think about the petrol. The price of petrol increased a lot in the first half of 2022. How about the demand? Did the demand changed a lot? Why?

  No.

- What if the price remain high for a long time, is it possible for consumers to switch their demand to other fuels, like electricity?

Usually, the longer the time period, the more elastic the demand for a product.

Factors that influence PED

- **percentage of income spent on the product**

- Think of a 50% increase in the price of ***a pen (from $1 to $1.5)*** and a 50% increase in the price of ***a car (from $10w to $15w).***
- Which demand do you think will be more elastic? Why?

If a large percentage of income is spent on the product, demand may be more elastic.

Factors that influence PED

- necessities and luxuries

- Which one do you think has a more elastic demand?

Luxuries

The demand for necessities is inelastic and that the demand for luxuries is elastic.

Factors that influence PED

– Habit-forming/addictive goods

- Example of addictive goods?
  - alcohol
  - tobacco
- Demand for these goods will be elastic or inelastic?
  - inelastic

The demand for addictive goods or habit-forming goods tend to be more inelastic.

Practice

- If demand is elastic and price rises, does total revenue fall, rise or stay the same? Explain why.

*Fall. Because elastic demand means the percentage rise in price is less than the percentage fall in quantity demanded, so when the price rises, the quantity can be sold will fall even more. The total revenue which equals P*Q will fall.*

Cross elasticity of demand

Cross elasticity of demand

- ***Cross elasticity of demand (XED or CED***) measures the responsiveness of quantity demanded of one good to a change in the price of another.

$$\textbf{\textit{Cross elasticity of demand (CED)}} = \frac{\%\ \Delta \text{ in } \textbf{\textit{QD of A}}}{\textbf{\textit{\% } } \Delta \textbf{\textit{ in P of B}}}$$

Cross elasticity of demand

- What does the value of CED depend on?

  The relationship between two goods.

- There are three possible relationships between two goods:
  - *Substitute goods*
  - *Complementary goods*
  - *No relationship*

$$\textit{Cross elasticity of demand (CED)} = \frac{\% \Delta \text{ in } \textit{QD of A}}{\% \Delta \textit{ in P of B}}$$

- If they are substitute goods, what will the CED be like?

  Positive

$$\textbf{\textit{Cross elasticity of demand (CED)}} = \frac{\%\ \Delta \text{ in } \textbf{\textit{QD of A}}}{\textbf{\textit{\% } } \Delta \textbf{\textit{ in P of B}}}$$

- If they are complementary goods, what will the CED be like?

  Negative

$$\textbf{\textit{Cross elasticity of demand (CED)}} = \frac{\%\ \Delta \text{ in } \textbf{\textit{QD of A}}}{\textbf{\textit{\% } } \Delta \textbf{\textit{ in P of B}}}$$

- If the goods have no relationship, what will the CED be like?

  0

Practice

If XED is −0.3, are the goods in competitive or joint demand?

in joint demand

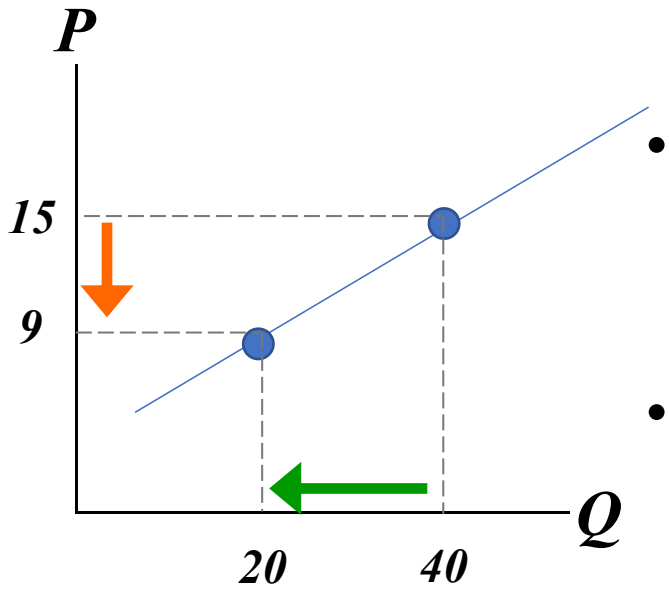
Price elasticity of supply

Price elasticity of supply

Price elasticity of supply (PES): measures the responsiveness of quantity supplied to a change in price.

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

Price elasticity of supply



- Calculate the % Δ in P

  *% Δ in P = (9-15)/15*100% = -40%*

- Calculate the % Δ in QS

  *% Δ in QS = (20-40)/40*100% = -50%*

- Calculate PES

  PES = -50% / -40% = 1.25

Price elasticity of supply

- PES is negative or positive? Why?

Positive, because price and quantity supplied move in the same direction.

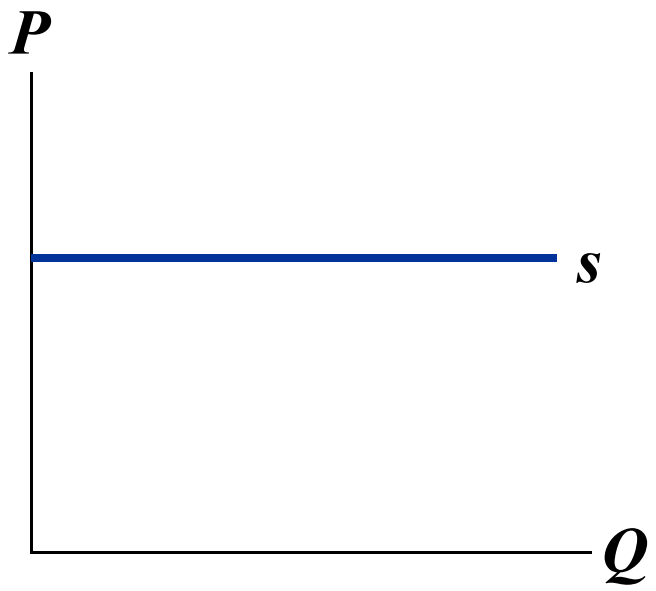
Price elasticity of supply

- Different categories of PES
  - Perfectly elastic
  - Elastic
  - Unit elastic
  - Inelastic
  - Perfectly inelastic

Perfectly elastic supply

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

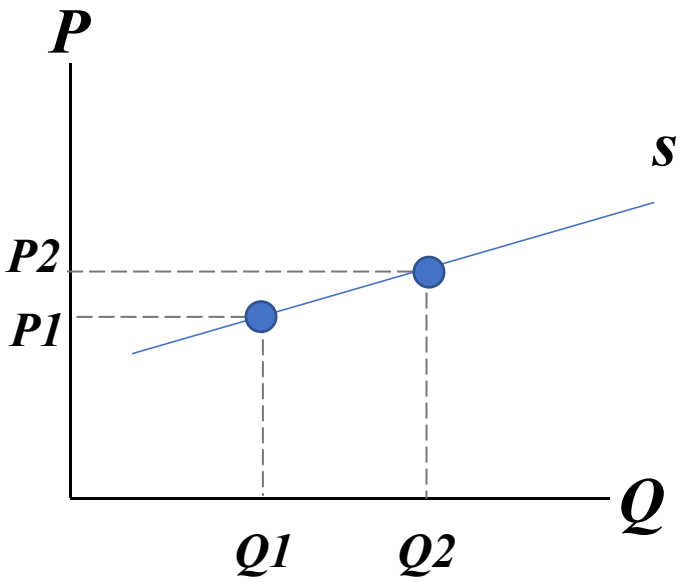
- If supply is perfectly elastic, firms will supply whatever is demanded ***at the given price or above***, but ***none*** at any ***lower*** price.
- ***S*** curve: horizontal
- PES = ∞



Elastic supply

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

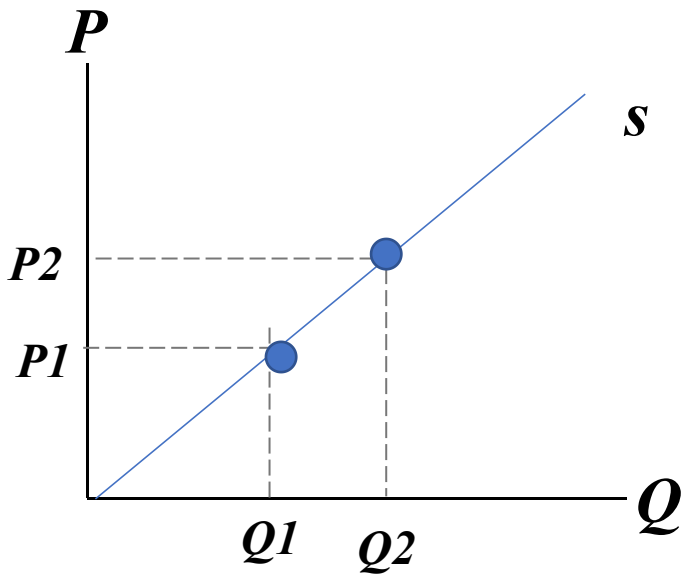
- % Δ in P < % Δ in QS
- S curve: relatively flat
- PES >1



Unit elastic supply

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

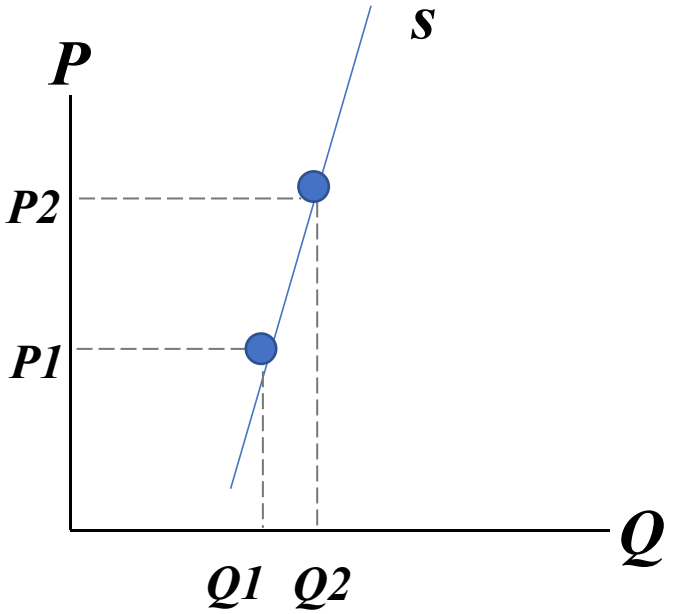
- % Δ in P = % Δ in QS
- S curve: intermediate flat
- PES =1



Inelastic supply

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

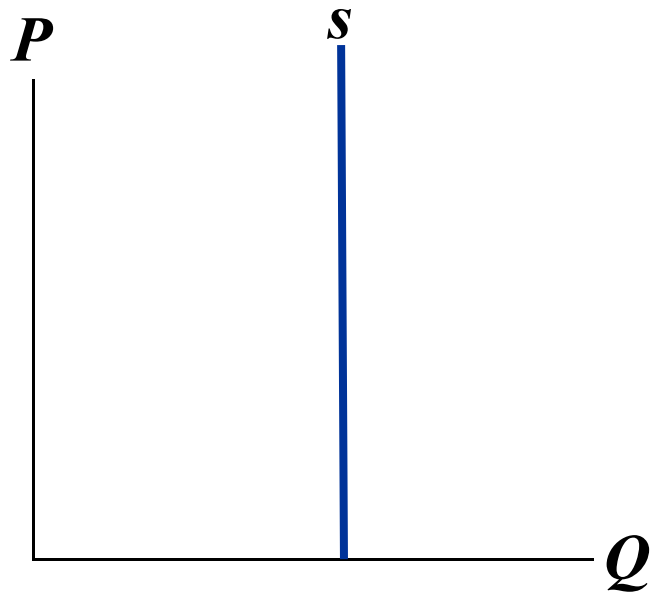
- % Δ in P > % Δ in QS
- S curve: relatively steep
- 0 <PES <1



Perfectly inelastic supply

$$\textit{Price elasticity of supply} = \frac{\%\ \Delta \text{ in } \textit{QS}}{\%\ \Delta \text{ in } \textit{P}}$$

- If supply is perfectly inelastic, the percentage change in supply is zero
- S curve: vertical
- PES = 0



Summary

Category	Relationship between % changes in P and QS	Value
Perfectly elastic	QS falls to zero after any fall in P	PES = ∞
Elastic	% change in QS > % change in P	PES > 1
Unit elasticity	% change in QS = % change in P	PES = 1
Inelastic	% change in QS < % change in P	1 > PES > 0
Perfectly inelastic	No change in QS after any change in P	PES = 0

Factors that influence PES

Factors that influence PES

- Whether the PES is elastic or inelastic depends on :

  - Availability of Resources
  - Storage Capacity
  - Technology
  - Number of firms
  - Time Horizon

Factors that influence PES - Availability of Resources

- If firms have more resources available, they will be able to make supply more elastic or inelastic? Why?

  - *Elastic, because it's easier to increase production.*

Factors that influence PES - Storage Capacity

- If firms have stock available, they will be able to make supply more elastic or inelastic? Why?
  - *Elastic.*
  - *Because if the product can be stored, when price decreases, firms may add to their stock, so that they can sell the stock when the price rises.*
- If the product cannot be stored easily and cheaply, supply will be less elastic.
  - *e.g. fresh milk*

Factors that influence PES - Technology

- Advances in technology can make it easier to increase or decrease production quickly, affecting elasticity to be more elastic or inelastic?
  - *Elastic*

Factors that influence PES - Number of Producers

- In markets with many producers, supply is more likely to be elastic or inelastic?
  - *Elastic, as there are more options for consumers and the supply from each producer may change easily.*

Factors that influence PES - Time Horizon

- The longer the time period the more elastic the supply.
  - *Because there will be more time for firms to change their supply by changing their factors of production. Also, firms can more easily enter or leave the market.*

Short run: the time period when at least one factor of production is fixed in supply.

***Long run*:** the time period when all factors of production are variable.

- The short run and long run are not set periods of time in terms of weeks or years. They will vary according to the product.
- *For example, a window-cleaning service could be set up or closed down much more quickly than a power station producing electricity.*

Practice

In the long term, supply tends to be:

a) More elastic

b) Less elastic

c) Perfectly elastic

d) Perfectly inelastic

Practice

How does the concept of supply elasticity relate to pricing decisions by businesses?

a) It doesn't affect pricing decisions.

b) It helps businesses set optimal prices.

c) It determines government-set price controls.

d) It only applies to services, not physical goods.

Practice

If the initial quantity supplied of a product is 500 units, and due to a 15% increase in price, the quantity supplied increases to 550 units, what is the elasticity of supply (PES)?

a) 0.67

b) 1.00

c) 1.50

d) 2.00

Thank you for your attention!