2.6 Elasticity of supply (includes HL only sub-topics)

Learning objectives

2.5 Elasticity of supply (includes HL only sub-topics)	Depth	Diagrams & calculations
Price elasticity of supply (PES) • $\text{PES} = \frac{\%\Delta Qs}{\%\Delta P}$ • Degrees of PES – theoretical range of values for PES • Determinants of PES – time, mobility of factors of production, unused capacity, ability to store, rate at which costs increase	AO2 AO4	Diagram: relatively elastic and inelastic supply Diagram: constant PES – perfectly elastic, perfectly inelastic and unitary PES along a supply curve Calculation: PES, change in price or quantity supplied from data provided
• **Reasons why the PES for primary commodities is generally lower than the PES for manufactured products (HL only)**	AO2	

Price elasticity of supply

Price elasticity of supply measures the responsiveness of quantity supplied in a market as a result of a change in price.

$$\text{PES} = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}} = \frac{\%\Delta Qs}{\%\Delta P}$$

Due to the law of supply, the mathematical value for PES is always greater than or equal to zero.

Real world example

Watch from 0:00 to 5:18

Why are avocado farms struggling to respond to rising demand?

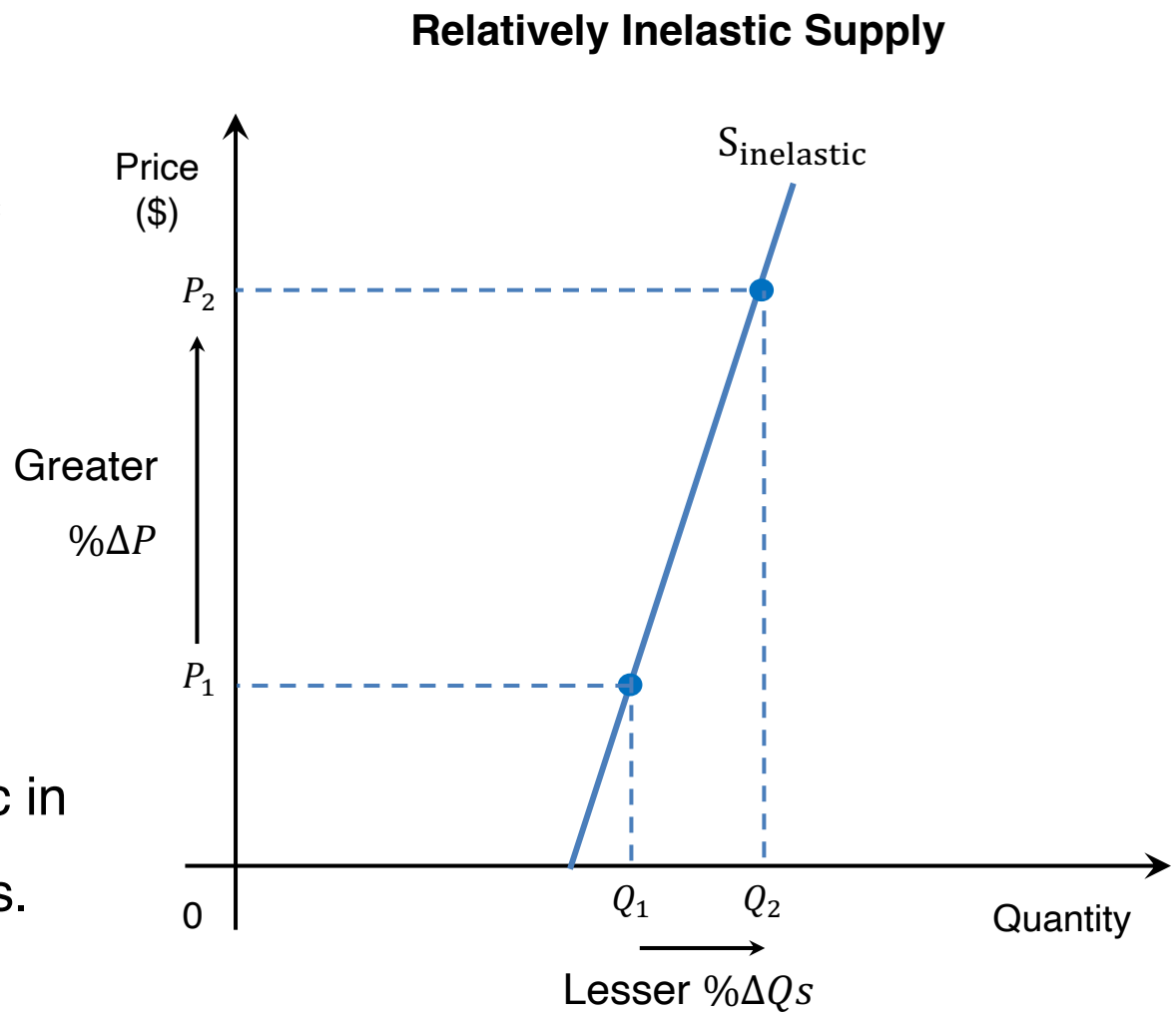
Relatively Inelastic Supply

When a change in price leads to a proportionally lesser change in quantity supplied, supply is **relatively price inelastic**. A relatively price elastic supply curve will intersect the Q-axis.

$$\%\Delta Qs < \%\Delta P$$

$$\therefore \ \text{PES} < 1$$

Examples of products which may be price inelastic in supply include agricultural products, e.g. avocados.



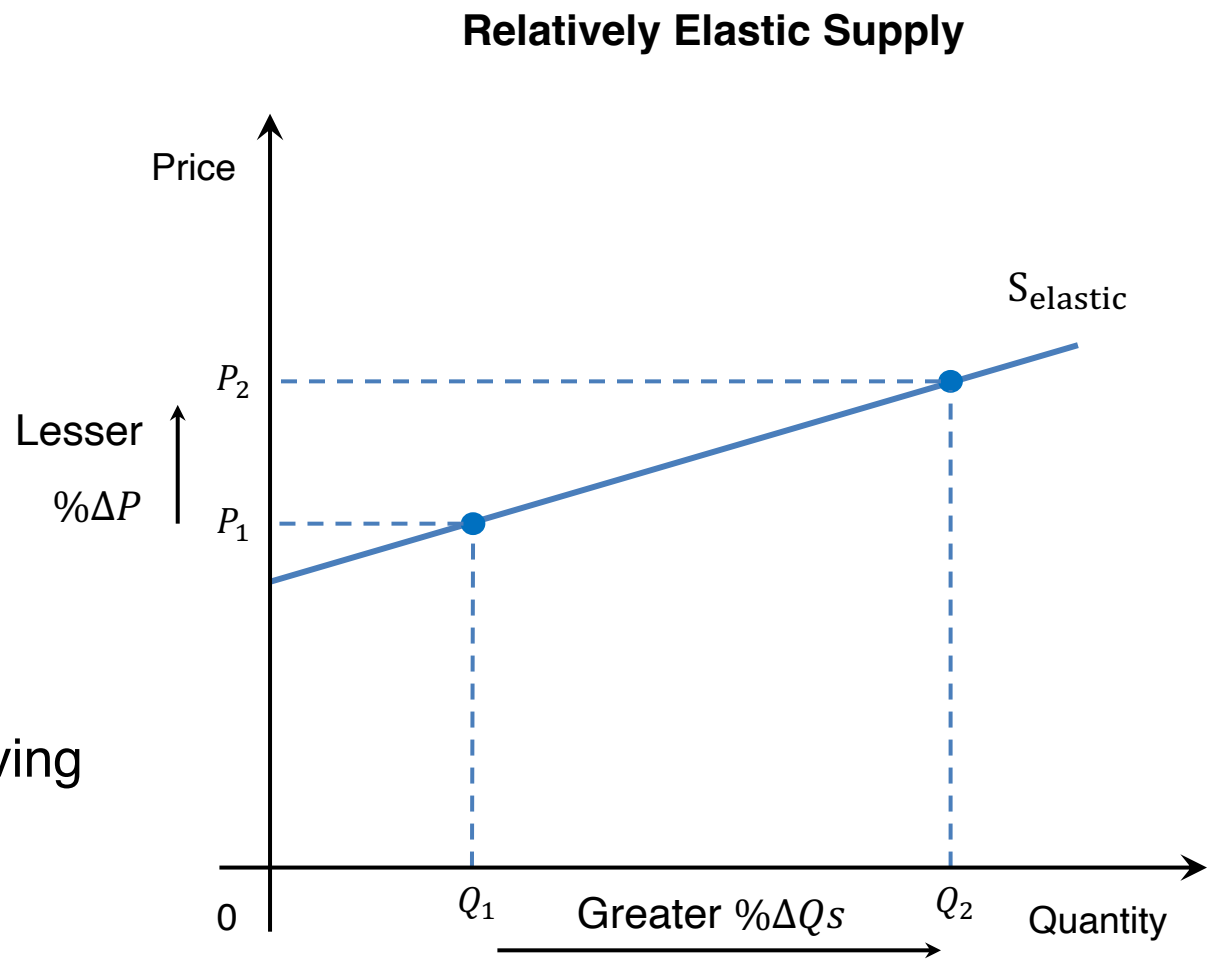
Relatively Elastic Supply

When a change in price leads to a proportionally greater change in quantity supplied, supply is **relatively price elastic**. A relatively price elastic supply curve will intersect the P-axis.

$$\%\Delta Qs > \%\Delta P$$

$$\therefore \ \text{PES} > 1$$

Examples of price elastic supply include fast moving consumer goods that are often mass produced.

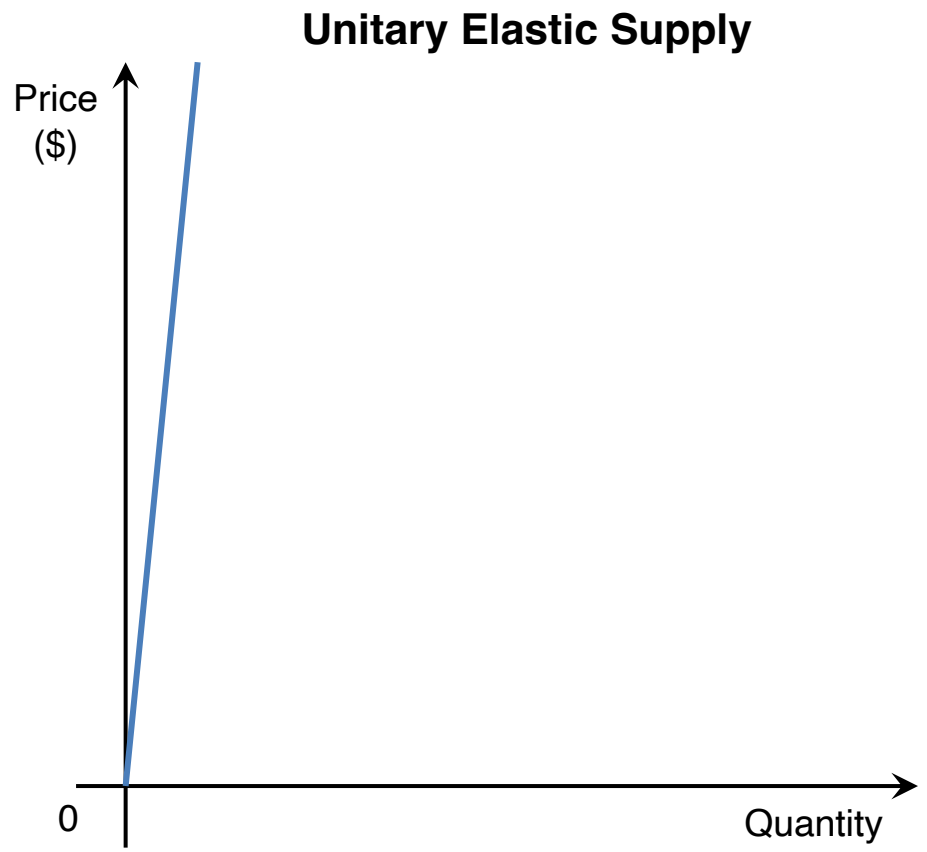


Unitary Elastic Supply

A supply curve passing through the origin will always have a PES of 1, i.e., **unitary elastic**. This can be explained through the PES formula:

$$\text{PES} = \frac{\%\Delta Qs}{\%\Delta P}$$

As the price and the quantity supplied are directly proportional, the percentage change in quantity supplied will always equal the percentage change in demand.



Mathematical proof of unitary PES (supplementary)

The linear supply curve can be expressed as…

$$S: P = m \times Qs$$

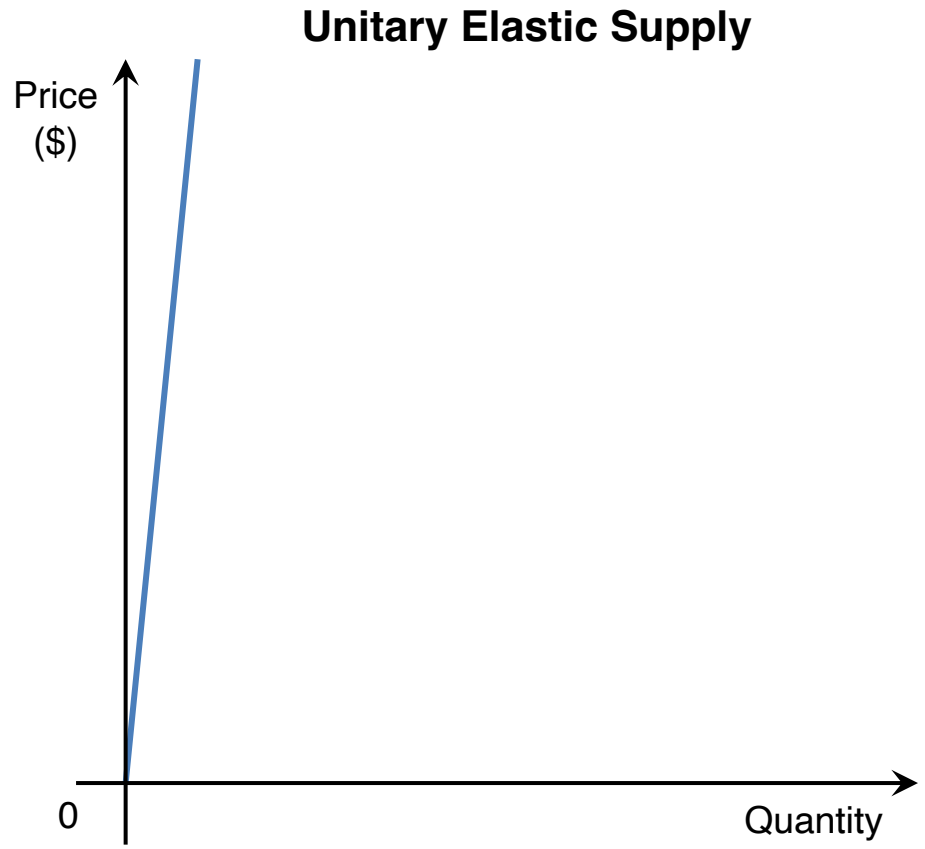
… where m is the slope of the S curve.

$$\text{PES} = \frac{\%\Delta Qs}{\%\Delta P} = \frac{P_i}{Qs_i} \times \frac{\text{"run"}}{\text{"rise"}} = \frac{P_i}{Qs_i} \times \frac{1}{m}$$

By substituting $P = mQ$:

$$\text{PES} = \frac{m \times Qs_i}{Qs_i} \times \frac{1}{m} = m \times \frac{1}{m} = \frac{m}{m} = 1$$

Hence, the price elasticity of supply for a linear supply curve intersecting the origin is always 1.



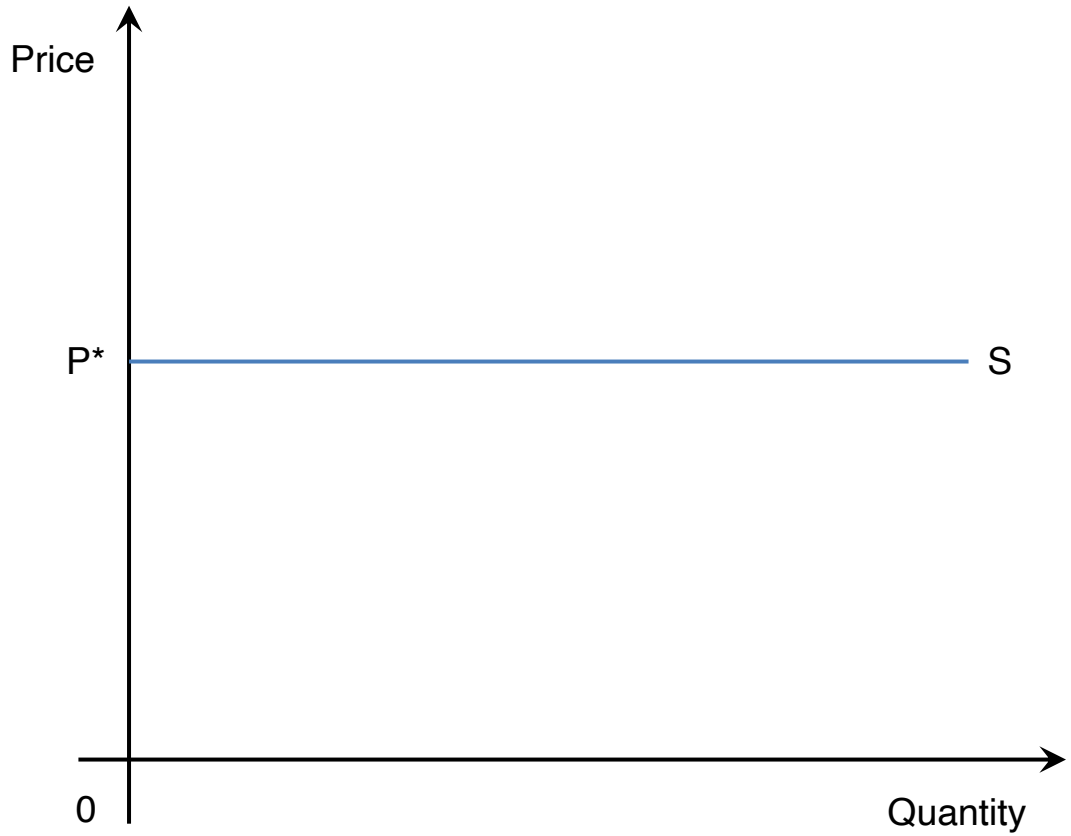
Perfectly Elastic Supply

A horizontal supply curve is **perfectly price elastic**. Here, producers are willing to supply any level of output at P*. This is only the case when marginal costs are constant and there are no limits on productive capacity. For perfectly elastic supply:

$$\text{PES} = \lim_{\%\Delta P \to 0} \left(\frac{\%\Delta Qs}{\%\Delta P} \right) = \infty$$

An example of this is computer software. The marginal costs of creating another copy is negligible and there is no limit on the number of copies made.

Perfectly price elastic (horizontal supply)



Perfectly Inelastic Supply

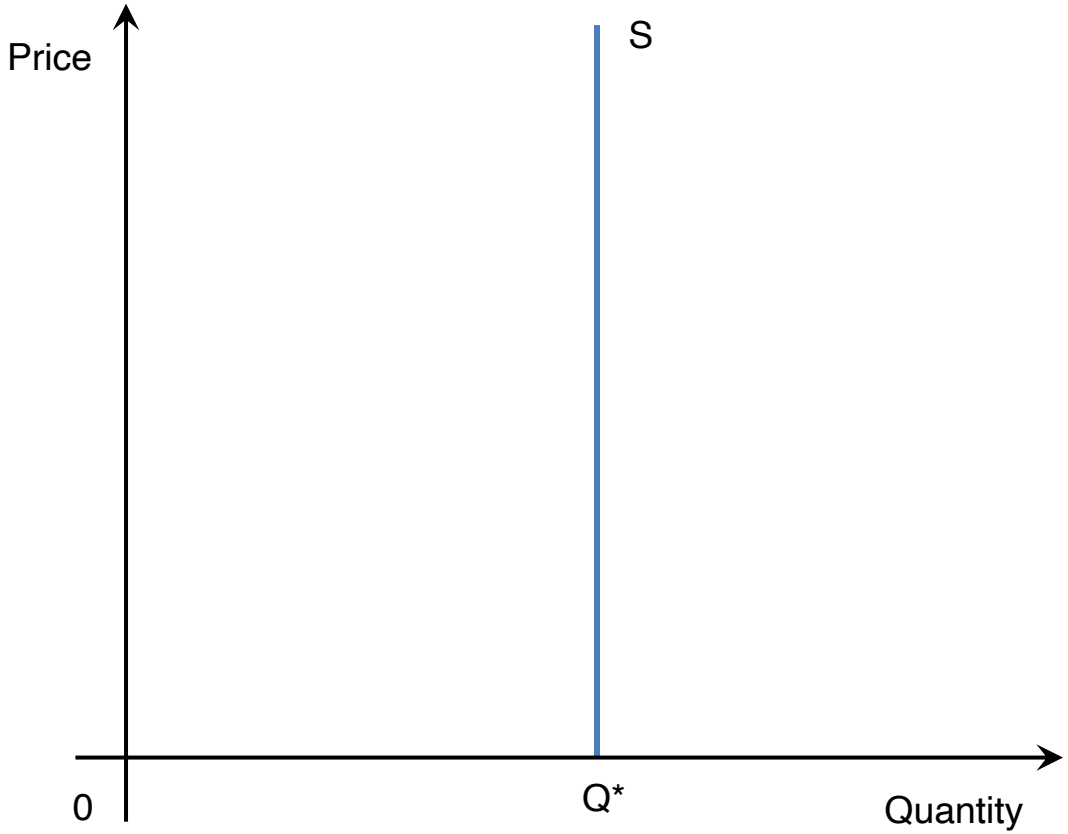
A vertical supply curve is **perfectly price inelastic**. Here, supply is fixed, where producers are only able and willing to supply at Q* irrespective of the price.

For perfectly inelastic supply:

$$\text{PES} = \frac{\%\Delta Qs}{\%\Delta P} = \frac{0}{\%\Delta P} = 0$$

An example of perfectly inelastic supply are seats in a sports stadium. Irrespective of prices, stadiums can only supply at its capacity.

Perfectly price inelastic (vertical supply)

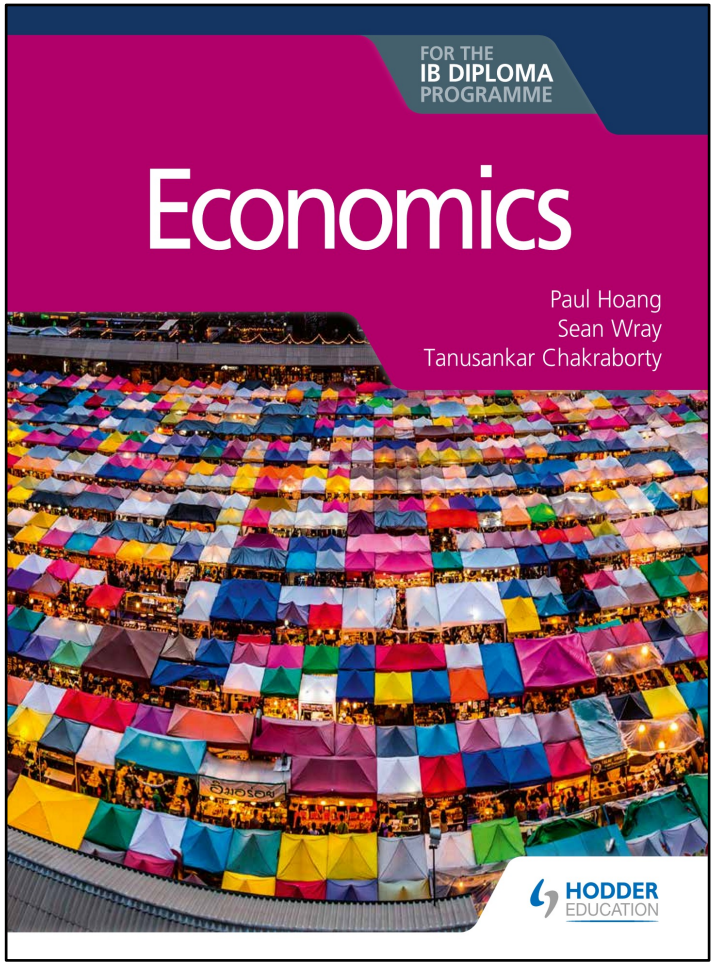


Over to you…

Hoang, Wray, & Chakraborty (2020)

Economics for the IB Diploma Programme

- Page 113 to 118
- Questions 9.1 to 9.6



Determinants of PES

The determinants of PES can be remembered through the following mnemonic:

T - Time

R - Rate at which costs increase

I - Inventory

C - Capacity

S - Substitute Factors of Production

Determinants of PES - Time

Supply tends to be inelastic in the short run as there are several types of time lags between the increase of price and the increase in quantity supplied:

- Time is required to produce the products
- Time is required to obtain more factors of production
- Time is needed to distribute goods to consumers

Over time, supply becomes more elastic and responsive.

Determinants of PES - Time

Primary commodities vs manufactured goods (HL only)

The production time for primary commodities tends to be longer than that of secondary manufactured goods.

Primary commodities

- Agriculture must be sowed, grown, and harvested before supply can be increased
- The extraction of precious metals and crude oil is dependent on the rate of their discovery

Manufactured goods

- Fast-moving consumer goods are made with flow (mass) production, which is easy to increase
- Manufactured goods are often not perishable, meaning higher levels of inventory can be kept.

Determinants of PES - Rate at which costs increase

The marginal costs of a firm refer to the cost incurred from producing one additional unit:

$$\mathrm{MC} = \frac{\Delta \mathrm{TC}}{\Delta \mathrm{Q}}$$

Due to the law of diminishing marginal returns, marginal costs will rise as production increases.

Hence, a firm will only produce at $\mathrm{P} = \mathrm{AR} \geq \mathrm{MC}$ to make a profit.

As a result, the PES of a firm is dependent on how quickly marginal costs rise.

- If MC rises **slowly**, supply is **more** price elastic as small increases in price stimulate production
- If MC rises **quickly**, supply is **less** price elastic so larger increases in price are needed.

Determinants of PES - Rate at which costs increase

Primary commodities vs manufactured goods (HL only)

As manufactured goods are often made through mass production, the marginal costs of a unit is less significant. However, marginal costs rise at a higher rate for primary commodities.

For example, supply for crude oil is price inelastic due to the high costs of oil discovery as well as the high monetary and opportunity costs of building an oil drill. Hence, a greater change in price is needed to incentivise crude oil producers to increase production.

Determinants of PES - Inventory

Inventory refers to the stocks of unused raw materials, work-in-progress goods, and finished goods. Firms that are able to hold inventory can respond quickly to an increase in price and can hold more inventory when price falls.

As a result, firms who are able to hold inventory have relatively price _____elastic_____ supply, whereas firms who cannot hold inventory have relatively price _____inelastic_____ supply.

Determinants of PES - Inventory

Primary commodities vs manufactured goods (HL only)

Primary commodities such as agricultural goods tend to be perishable and cannot be stored for long periods of time. As such, their supply is relatively price inelastic.

Secondary manufactured goods often do not perish, and hence supply is more price elastic.

Determinants of PES - Unused Capacity

Unused capacity refers to the spare available resources a firm has but does not utilise. Firms that choose to have spare capacity can increase production following an increase in price, or decrease production following a fall in price.

Firms that choose to operate at or near full capacity are less price elastic as factors of production are immobile in the short run.

Determinants of PES - Unused Capacity

Primary commodities vs manufactured goods (HL only)

The supply of land is fixed in the short run and thus primary producers often operate at or near full capacity, resulting in inelastic supply.

Firms in the secondary sector can increase the number of working hours to increase output to respond to increases in demand, hence supply is more elastic.

Determinants of PES - Factor Mobility

Factor mobility refers to a firm's ability to substitute factors of production in the production process.

When it is easier to substitute factors of production, producers are more able to adjust supply following a change in price.

As a result, firms with mobile factors of production have relatively price _____elastic_____ supply. Meanwhile, firms are less able to substitute factors of production and hence have relatively price _____inelastic_____ supply.

Determinants of PES - Factor Mobility

As primary commodities are often land or labour intensive, primary sector producers suffer a higher degree of geographical and occupational immobility. Additionally, capital such as oil drills, harvesters, and tractors are more specialised and have fewer substitutes.

Secondary manufactured goods have more flexible and adaptable capital. Land factors such as different plastics and metals have many substitutes.

Real world example – group research activity

Article: The global chip shortage could last until 2023

Using the article, determine the price elasticity of supply of the automobile market.

Real world example – group research activity

The reasons behind the IC (chip) shortage can be analyzed using the determinants of price elasticity of supply:

T ‘the situation may improve for some sectors in the next six months, but that there may be a “knock-on effect” into 2022.’

R As ICs (chips) are produced using flow (mass) production, marginal costs do not increase significantly as production increases.

I A failure to stockpile factors with low mobility led to the shortage of ICs.

C The shortage is a result of a lack of spare capacity and “the industry is putting more capacity in place, but it does take time (T).”

S The shortage isn't the result of a genuine lack of resources, such as a shortage of the raw silicon, but rather a disequilibrium between demand and supply. Rebalancing will require expanding capacity (C) – and time (T).

Test your knowledge on this unit: Kahoot!