EE211
PRINCIPLES OF MICROECONOMICS

Topic 3:

Elasticity: Measure of Response

Topics

- Elasticity of demand
  - Price elasticity of demand
  - Income elasticity of demand
  - Cross-price elasticity of demand
- Elasticity of supply

Introduction

- A scenario…

Suppose you currently sell durians for 200 baht/kg, the price at which you can sell 50 kg. per day.

At the end of the season, the costs rise, and you wish to raise the price to 250 baht/kg.

But the law of demand says that the quantity demanded is lower at a higher price.

Question: How many kilos of durian would you sell at a higher price? Would you revenue increase or decrease?

➔ The answer depends on the price elasticity of demand.

Basic Idea about Elasticity

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

- Formula:

$$Elasticity = \frac{Percentage\ Change\ in\ Y}{Percentage\ Change\ in\ X}$$

$$\varepsilon = \frac{\%\Delta Y}{\%\Delta X} = \frac{\Delta Y/Y}{\Delta X/X}$$

Price Elasticity of Demand

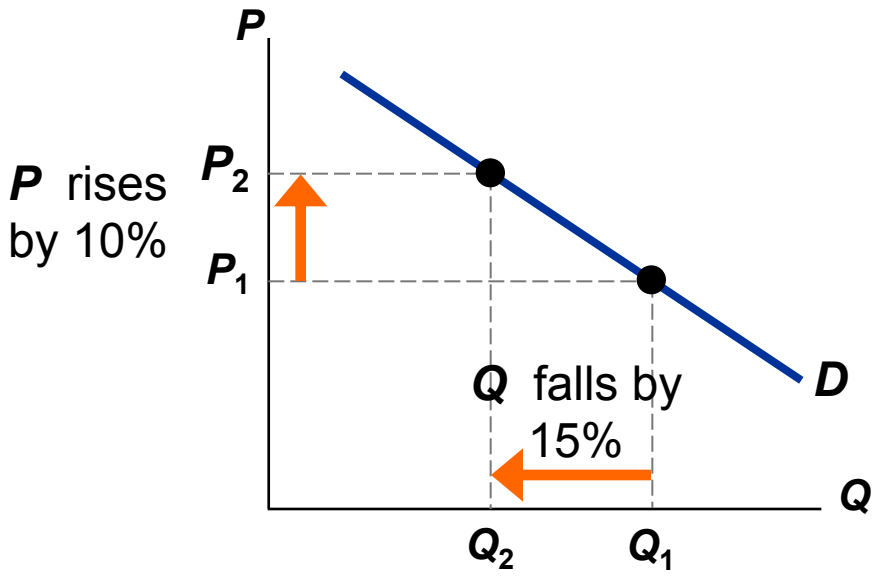
- **Price elasticity of demand** measures how much Q_d responds to a change in P.
  - I.e., it measures the price-sensitivity of buyers' demand.

$$\varepsilon_d = \frac{\%\ \Delta Q_d}{\%\ \Delta P}$$

- Example:

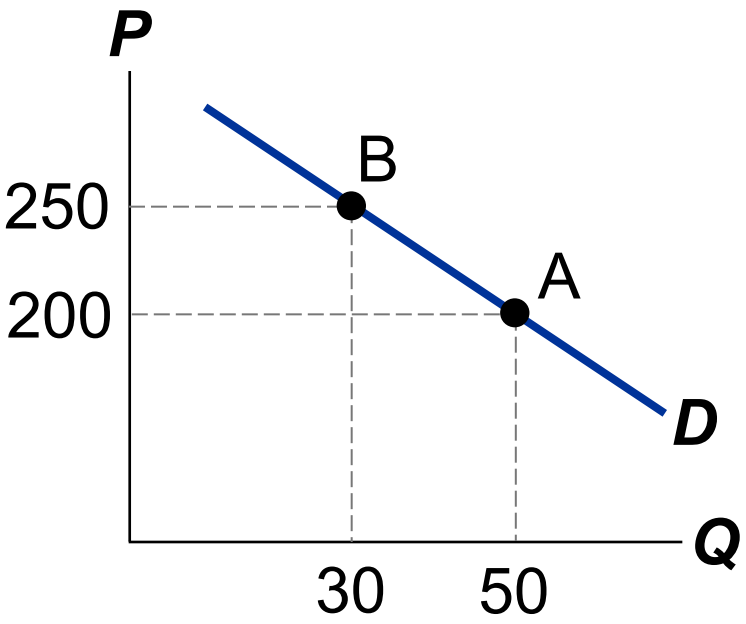
Suppose P rises by 10%, and Q falls by 15%.

➔ $\varepsilon_d = \frac{-15\%}{10\%} = 1.5$



Calculating Percentage Change (1)

Demand for durians



The Standard Method:

$$\%Change = \frac{end\ value\ -start\ value}{start\ value}\ x\ 100\%$$

From A to B:

$$\%\ \Delta Q_d = \frac{30-50}{50} = -0.4 \qquad \varepsilon_d = -1.6$$

$$\%\ P = \frac{250-200}{200} = 0.25$$

From B to A:

$$\%\ \Delta Q_d = \frac{50-30}{30} = 0.67 \qquad \varepsilon_d = -3.35$$

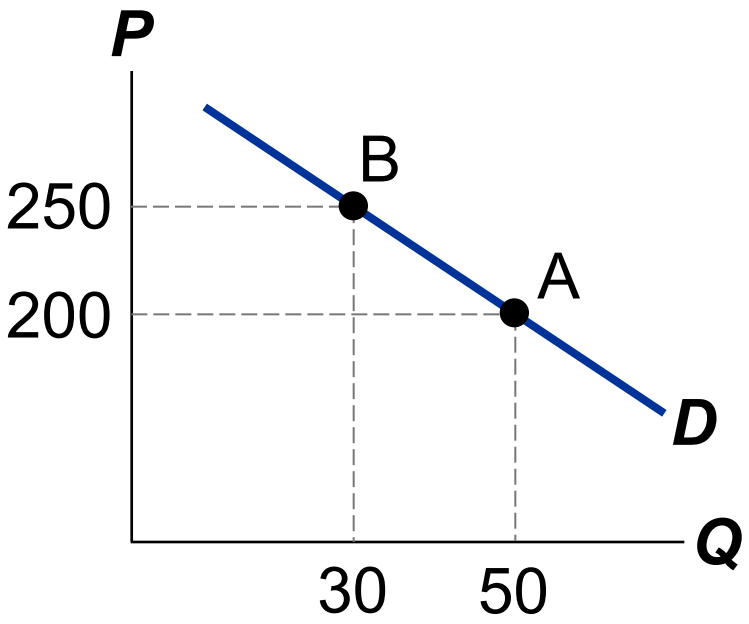
$$\%\Delta\ P = \frac{200-250}{250} = -0.2$$

Problem:

The standard method gives different answers depending on where you start.

Calculating Percentage Change (2)

Demand for durians



The Midpoint Method:

$$\%Change = \frac{end\ value\ -start\ value}{midpoint}\ x\ 100\%$$

$$\%\ \Delta Q_d = \frac{30-50}{40} = -0.5$$

$$\%\ P = \frac{250-200}{225} = 0.22$$

$$\rightarrow\ \varepsilon_d = \frac{-0.5}{0.22} = -2.27$$

Point Elasticity (Linear Demand Curve)

- $\varepsilon_d = \frac{\%\ \Delta Q_d}{\%\ \Delta P} = \frac{1}{Slope} \times \frac{P}{Q_d}$
- Given P = 20 – Q, determine the price elasticities of demand when P = 20, 10, and 0.

The slope of a linear demand curve is constant, but its elasticity is not.

The Variety of Demand Curves

- The price elasticity of demand is closely related to the slope of the demand curve.
- Rule of thumb:
  The flatter the curve, the bigger the elasticity.
  The steeper the curve, the smaller the elasticity.

- Summary:

  D is perfectly elastic if $\varepsilon_d = -\infty$ (i.e. $|\varepsilon_d| = \infty$).

  D is elastic if $-\infty < \varepsilon_d < -1$ (i.e. $1 < |\varepsilon_d| < \infty$).

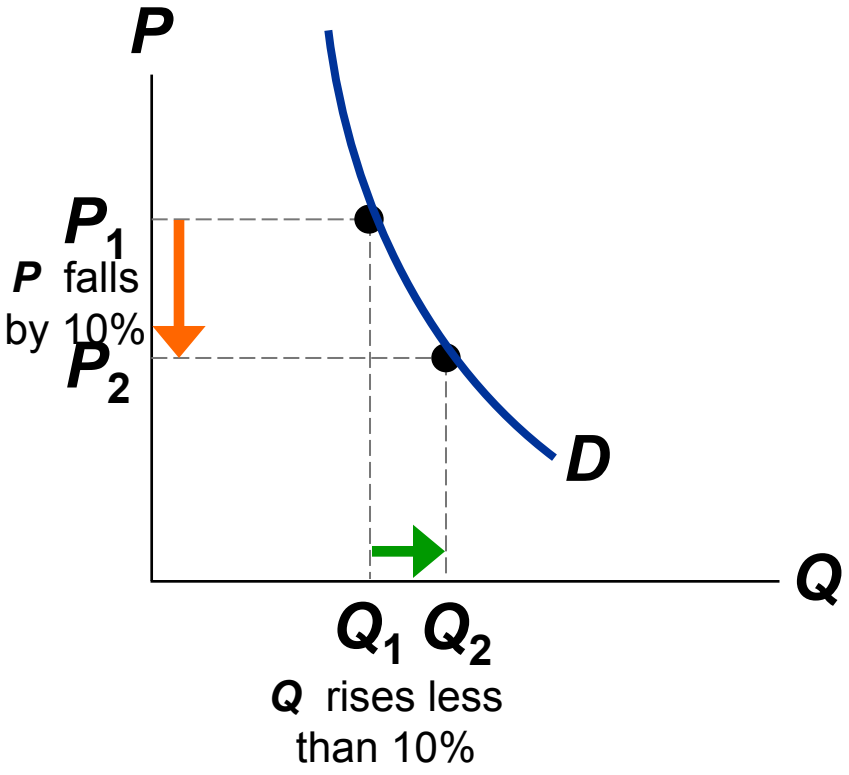
  D is inelastic if $-1 < \varepsilon_d < 0$ (i.e. $0 < |\varepsilon_d| < 1$).

  D is perfectly inelastic if $\varepsilon_d = 0$ (i.e. $|\varepsilon_d| = 0$).

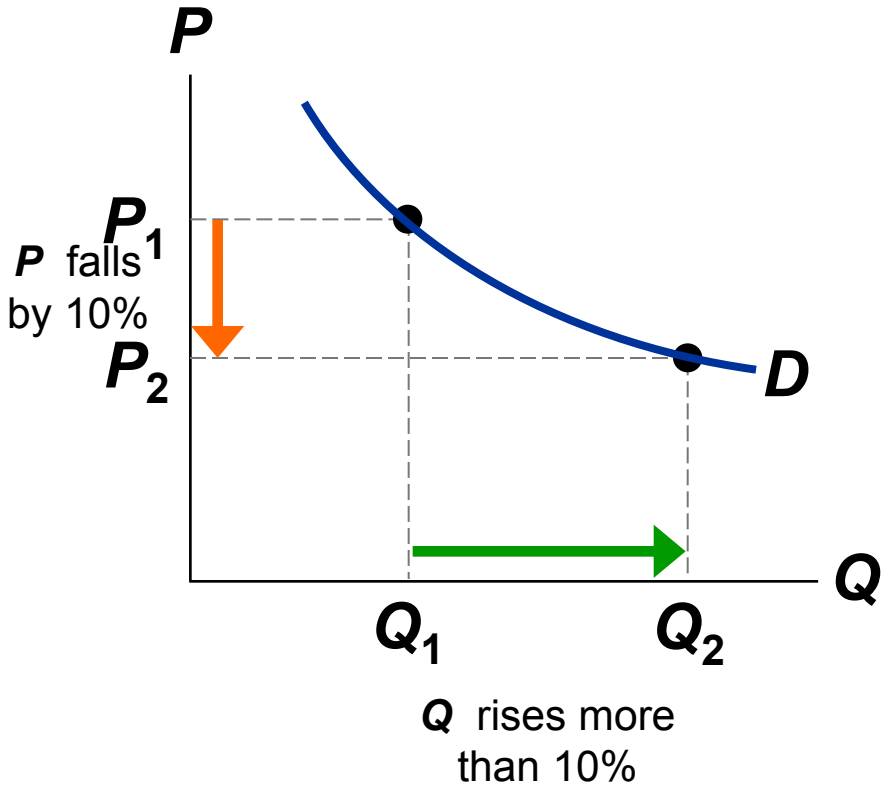
  D is unitary elastic if $\varepsilon_d = -1$ (i.e. $|\varepsilon_d| = 1$).

Elastic & Inelastic Demand

- Inelastic demand

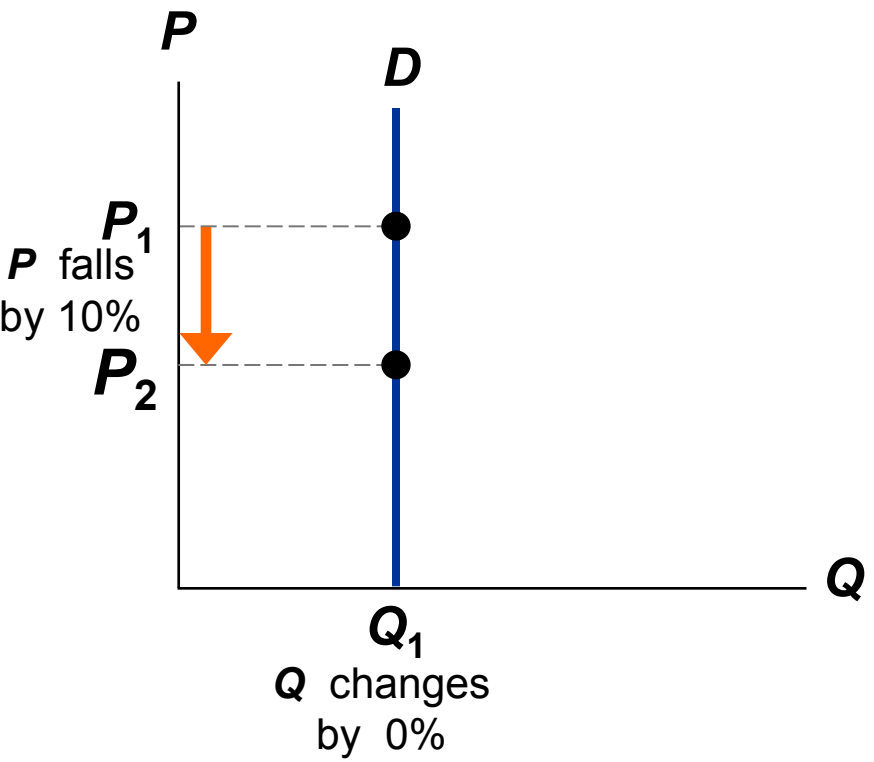


- Elastic demand

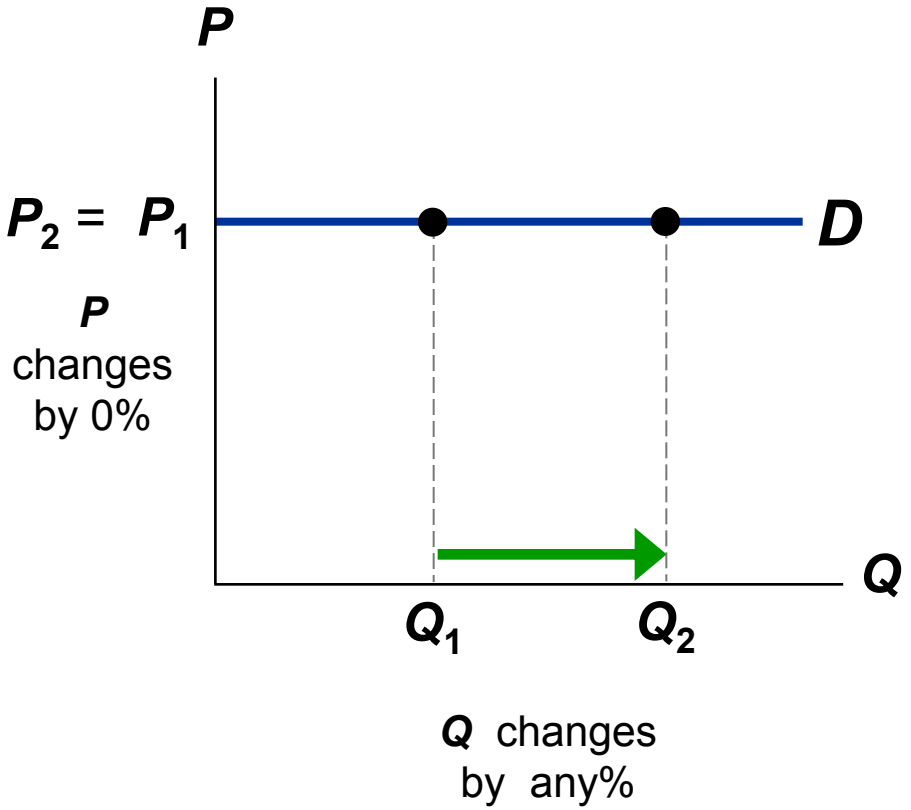


Extreme Cases

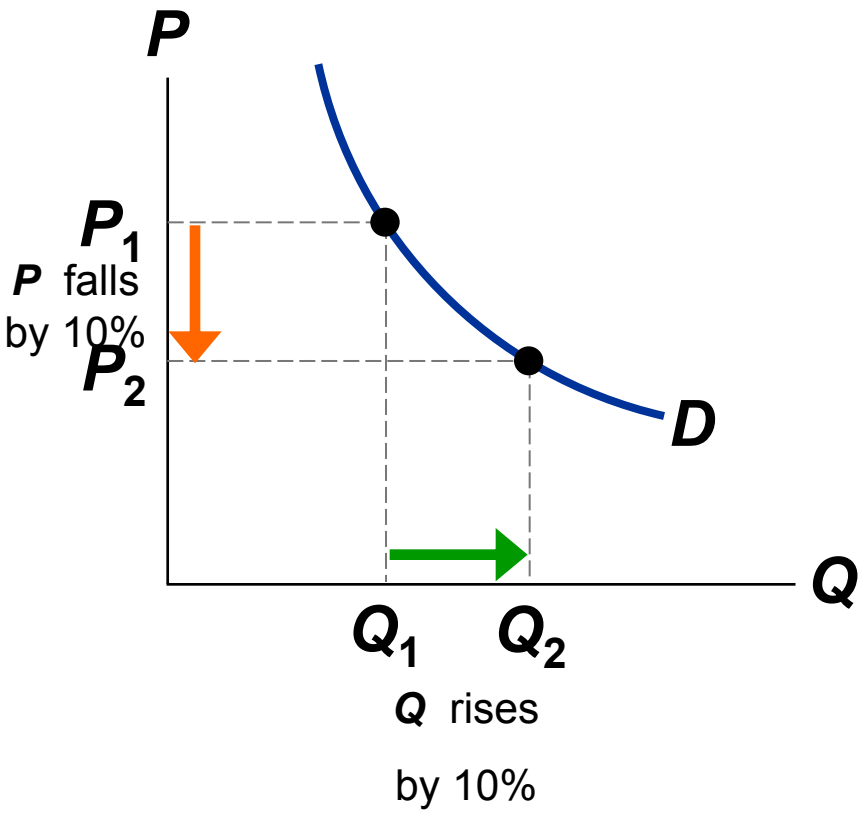
- Perfectly Inelastic Demand



- Perfectly Elastic Demand



Unitary Elastic Demand



- The price elasticity of demand is constant along the demand curve, and it is equal to 1.
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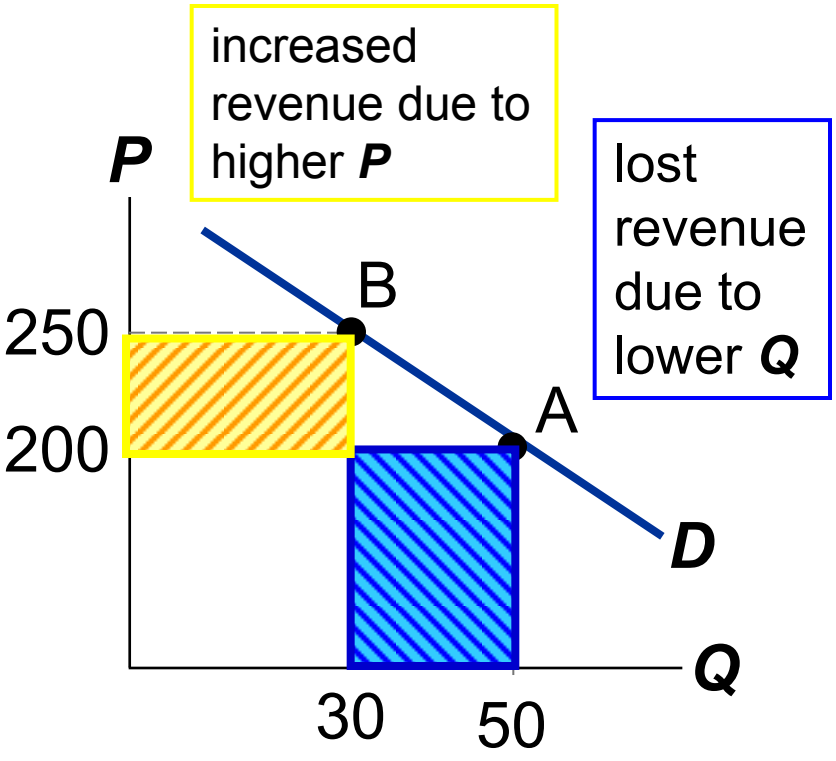
Price Elasticity and Total Revenue (1)

Demand for durians

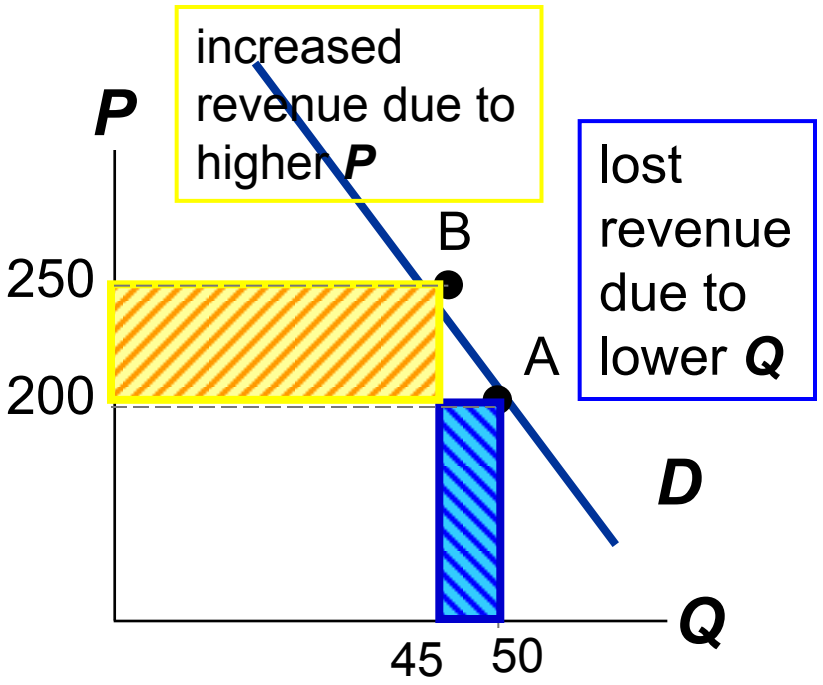


- TR = P x Q
- $\varepsilon_d = \frac{\%\ \Delta Q_d}{\%\ \Delta P}$
- $|\varepsilon_d| > 1$: $\%\ \Delta Q_d > \%\ \Delta P$.
  - Loss = -20x200 = -4,000
  - Gain =30x50 = 1,500
  - Change in TR = -2,500

When ***D*** is elastic, a price increase causes revenue to fall.

Price Elasticity and Total Revenue (2)

Demand for durians



- TR = P x Q
- $\varepsilon_d = \frac{\%\ \Delta Q_d}{\%\ \Delta P}$
- $|\varepsilon_d| < 1$: $\%\ \Delta Q_d < \%\ \Delta P$.
  - Loss = -5x200 = -1,000
  - Gain =45x50 = 2,250
  - Change in TR = 1,250

When ***D*** is inelastic, a price increase causes revenue to rise.

Determinants of Price Elasticity of Demand

- Definition of the good
- Availability of close substitutes
- Whether the good is a necessity or a luxury
- The time horizon: short run and long run

Other Elasticities of Demand

- In addition to its own price, quantity demanded is determined by income and price of other products.
  - Income elasticity of demand

$$\varepsilon_I = \frac{\%\,\Delta Q_d}{\%\,\Delta I}$$

  - Cross-price elasticity of demand for X (with respect to change in price of Y).

$$\varepsilon_{XY} = \frac{\%\,\Delta Q_X}{\%\,\Delta P_Y}$$

Income Elasticity of Demand

- **Income elasticity of demand** measures how much Q_d responds to a change in ***income***: $\varepsilon_I = \frac{\%\,\Delta Q_d}{\%\,\Delta I}$.

- $\varepsilon_I \geq 0$ ➔ Normal goods
  - $0 \leq \varepsilon_I \leq 1$ ➔ Necessary goods
  - $1 < \varepsilon_I \leq \infty$ ➔ Luxury goods
- $\varepsilon_I < 0$ ➔ Inferior goods

Example

- Suppose when the average income increases from $18,000 to $22,000, the quantity demanded at a given price P_0 rises from 40 to 60 units. What is the income elasticity of demand?

Cross-Price Elasticity of Demand

- **Cross-price elasticity of demand** measures how much $\boldsymbol{Q_d}$ responds to a change in ***price of other goods***:

$$\varepsilon_{XY} = \frac{\%\,\Delta Q_X}{\%\,\Delta P_Y}.$$

- $\varepsilon_{XY} < 0$ → X and Y are complements.
- $\varepsilon_{XY} > 0$ → X and Y are substitutes.

Example

- Suppose the quantity demanded for good X increases from 100 units to 110 units when the per price of good Y drops from 60 baht to 40 baht. Determine the cross-price elasticity of the demand for good X with respect to the price of good Y.

Price Elasticity of Supply

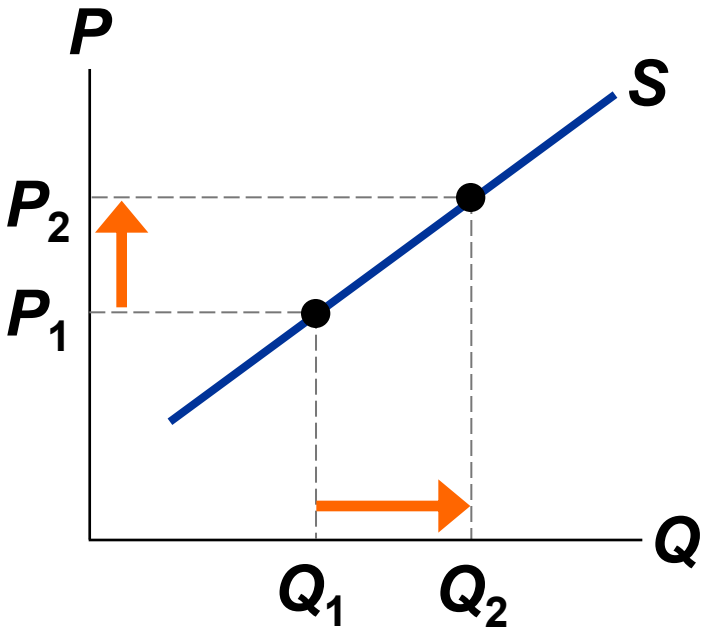
- **Price elasticity of supply** measures how much Q_S responds to a change in ***P***.
  - I.e., it measures the price-sensitivity of sellers' supply.

$$\varepsilon_S = \frac{\%\ \Delta Q_S}{\%\ \Delta P}$$

- Example:

Suppose P rises by 8%, and Q increases by 16%.

➔ $\varepsilon_S = \frac{16\%}{8\%} = 2\%$



The Variety of Supply Curves

- Rule of thumb:
  The flatter the curve, the bigger the elasticity.
  The steeper the curve, the smaller the elasticity.

- Summary:

  S is perfectly elastic if $\varepsilon_s = \infty$.

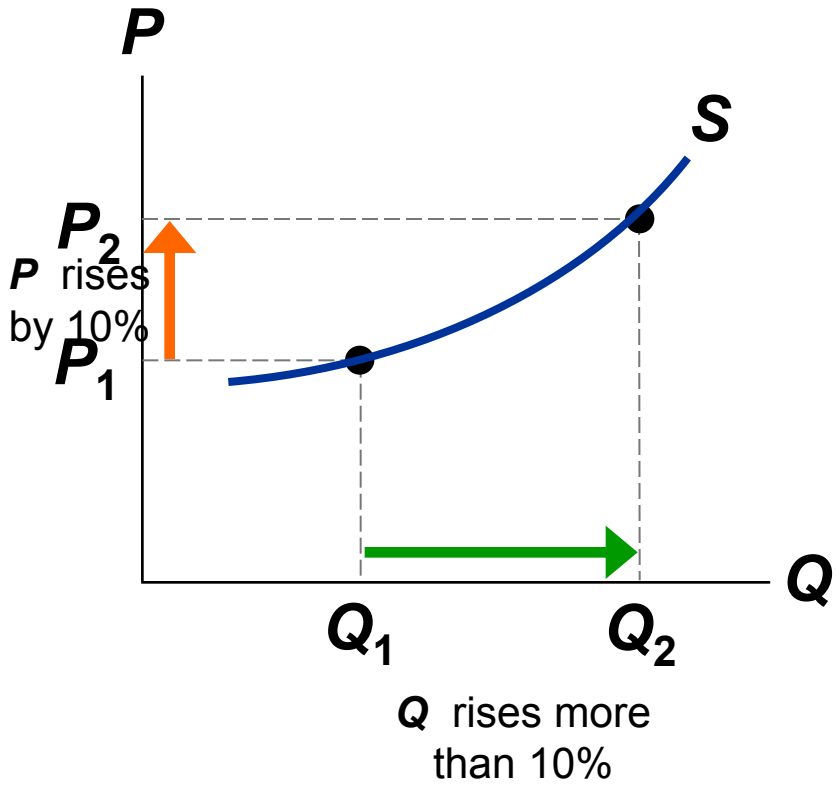
  S is elastic if $\varepsilon_s > 1$.

  S is inelastic if $\varepsilon_s < 1$.

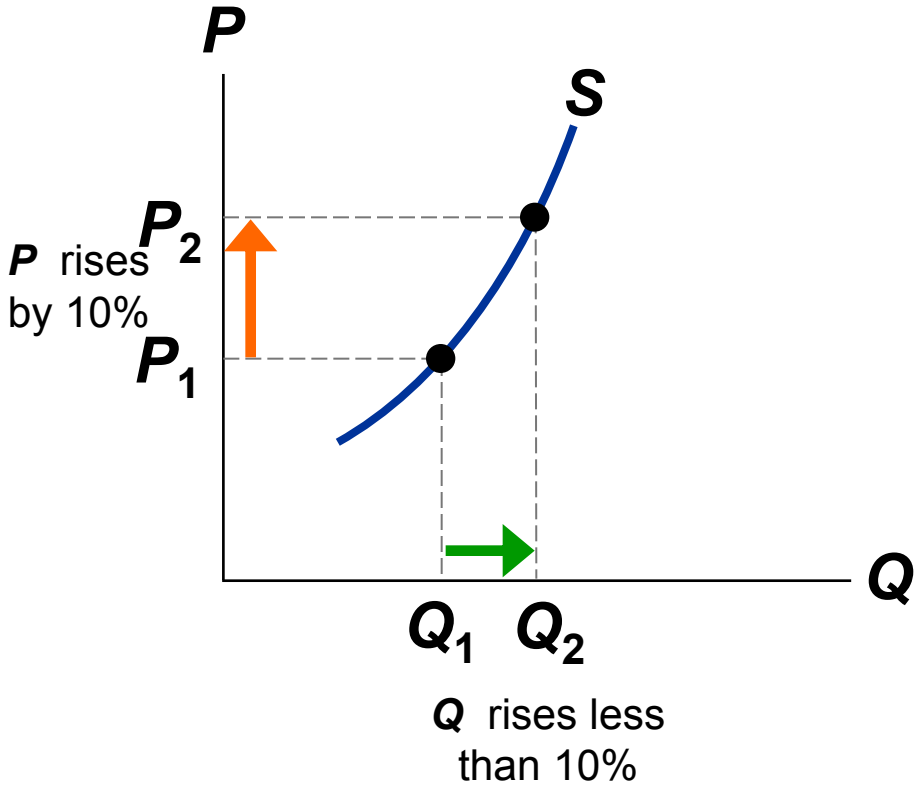
  S is perfectly inelastic if $\varepsilon_s = 0$.

Elastic & Inelastic Supply

- Elastic Supply

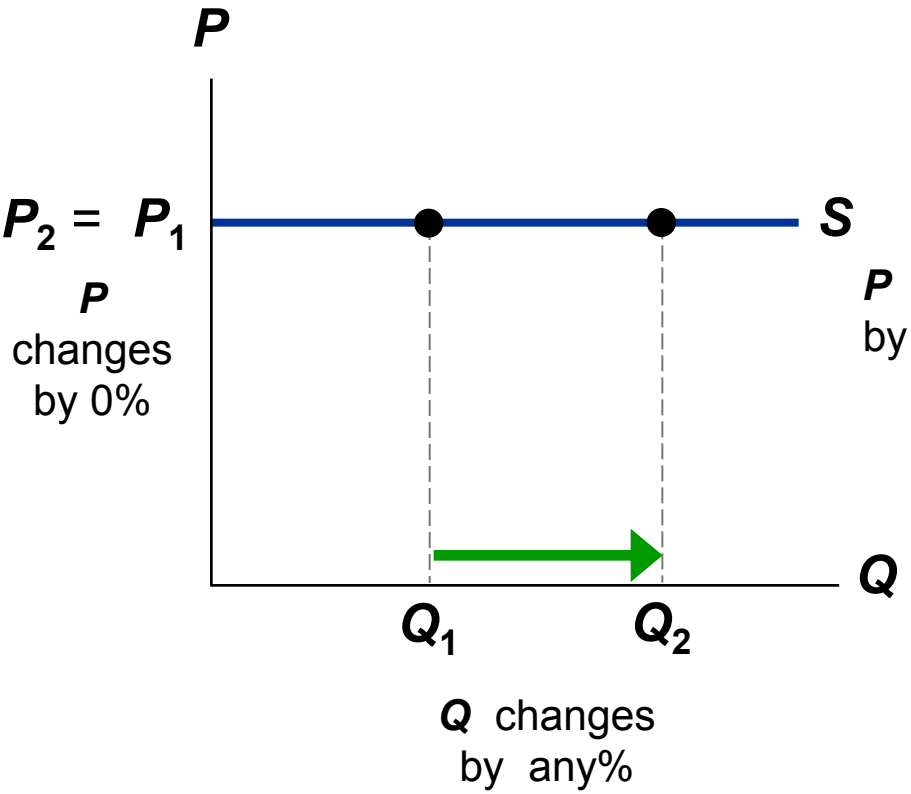


- Inelastic Supply

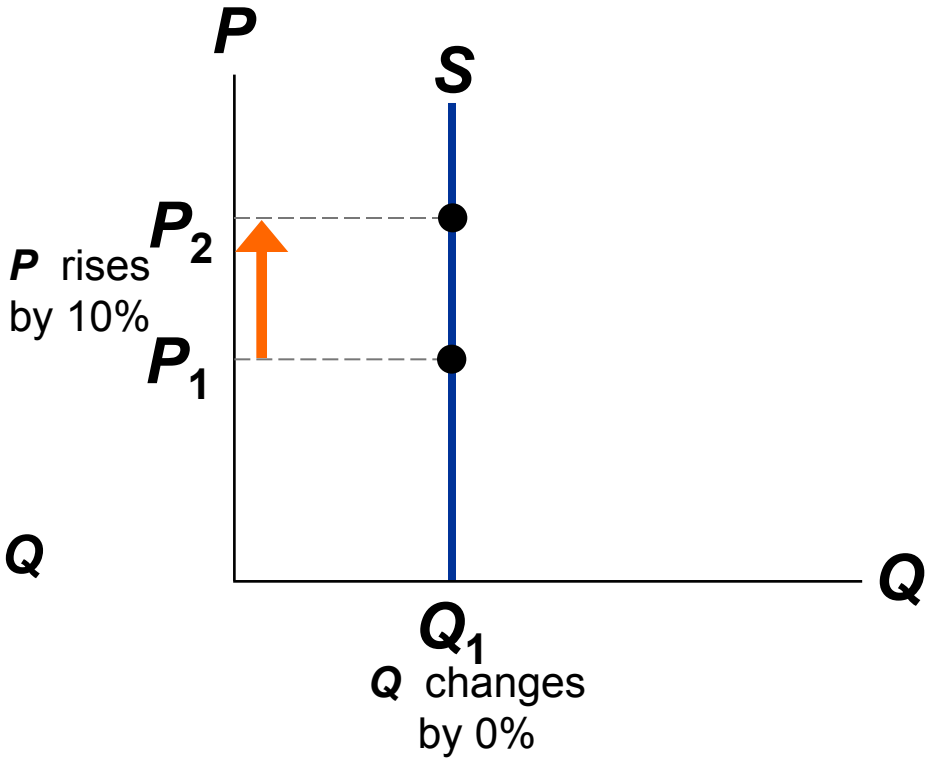


Extreme Cases

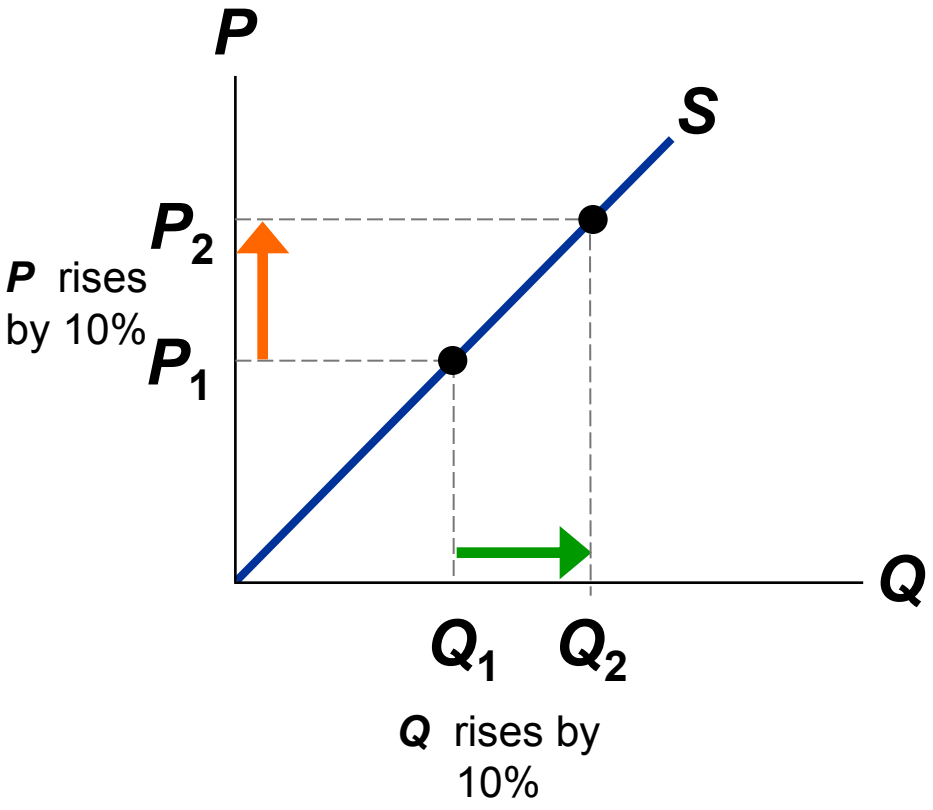
- Perfectly elastic supply



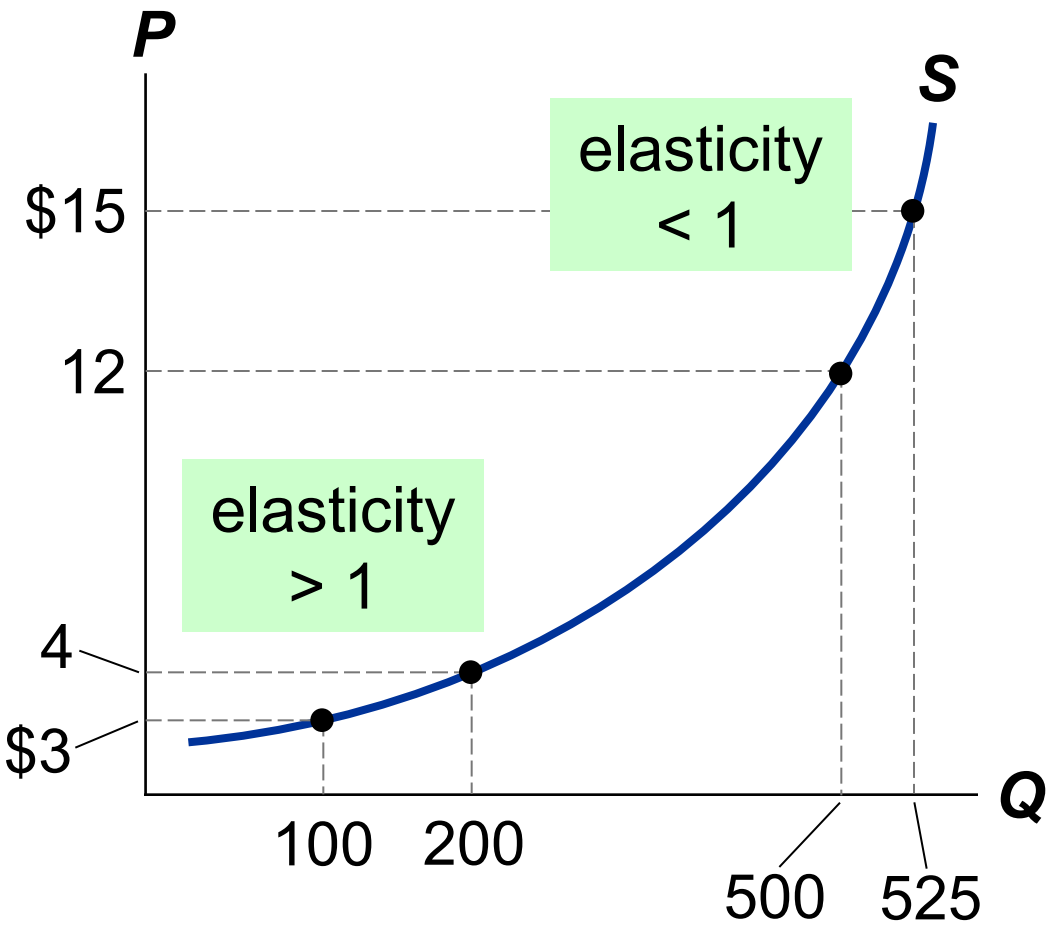
- Perfectly inelastic supply



Unitary Elastic Supply



How the Price Elasticity of Supply Can Vary



Determinants of Price Elasticity of Supply

- Substitution and production costs.
  - The more easily sellers can change the quantity they produce, the greater the price elasticity of supply.
- The time horizon: Short run and long run