Chapter 8 Price Elasticity of Supply

Price Elasticity of Supply is the percentage change of the quantity supplied per 1 percentage change in price

$$\eta_S = \frac{\%\Delta Q_S}{\%\Delta P} = \frac{Percentage\ change\ of\ Q_S}{Percentage\ change\ of\ P}$$

- η_S measures how sensitive the supply is to a change in price.

Example If the price increases by 10% ($\%\Delta P = 10\%$), the quantity supplied increases by 25% ($\%\Delta Q_D = -25\%$)

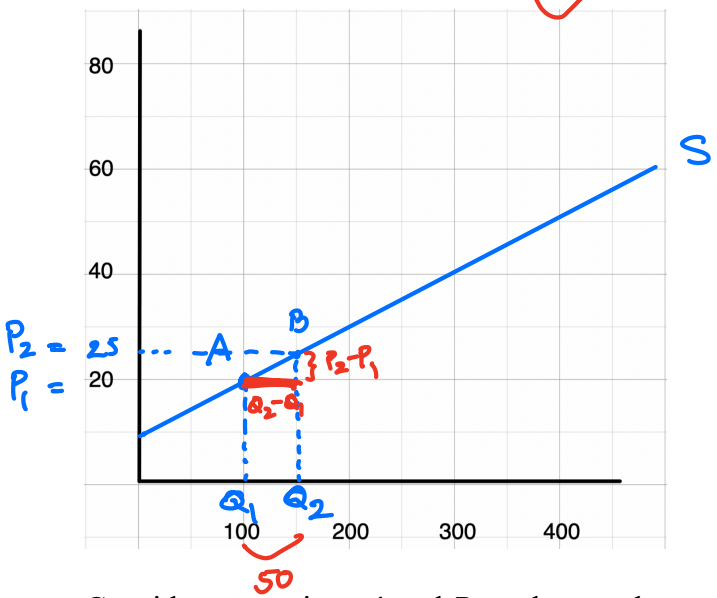
$$\eta_S = \frac{\%\Delta Q_S}{\%\Delta P} = \frac{25}{10} = 2.5$$

- Positive sign reflects the Law of Supply
- η_S does not have unit
- $\eta_D = 2.5$ means that if the price increases by 1%, the quantity supplied increases by 2.5%

Example

$$Supply\text{: } P = 10 + \frac{1}{10}Q_S$$

slope



Consider two points, A and B on the supply

$$A = (100,20), Q_1 = 100, P_1 = 20$$
$$B = (150,25), Q_2 = 150, P_2 = 25$$

From $A \rightarrow B$,

$\Delta Q_S = 50 = 150-100 = Q_2 - Q_1$
$\Delta P = 5 = 25-20 = P_2 - P_1$

$\%\Delta Q_S = \frac{50}{100} = 50\% = (Q_2-Q_1)/Q_1$
$\%\Delta P = \frac{5}{20} = 25\% = (P_2-P_1)/P_1$

$\eta_S = \frac{\%\Delta Q_S}{\%\Delta P} = \frac{60\%}{25\%} = 2$

$= \frac{(Q_2-Q_1)/Q_1}{(P_2-P_1)/P_1}$

$= \frac{(Q_2-Q_1)}{(P_2-P_1)} \cdot \frac{P_1}{Q_1} = \frac{1}{slope} \cdot \frac{P_1}{Q_1} = 10 \cdot \frac{20}{100} = 2.$

- η_S from A to B is given by:

$$\eta_S = \frac{1}{Slope}\frac{P_1}{Q_1}$$

where P_1 and Q_1 are price and quantity supplied at A.

- Is η_S the same for $B \rightarrow A$?

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

- η_S from $B \rightarrow A$ is given by:

$$\eta_S = \frac{1}{Slope}\frac{P_2}{Q_2} = \frac{1}{1/10} \cdot \frac{25}{150} = \frac{5}{3}.$$

where P_2 and Q_2 are price and quantity supplied at B.

Arc Elasticity of Supply

From $A \rightarrow B$, $\eta_S = \frac{1}{Slope}\frac{P_1}{Q_1} = 2.$ ✓
From $B \rightarrow A$, $\eta_S = \frac{1}{Slope}\frac{P_2}{Q_2} = 1.67$ ✓

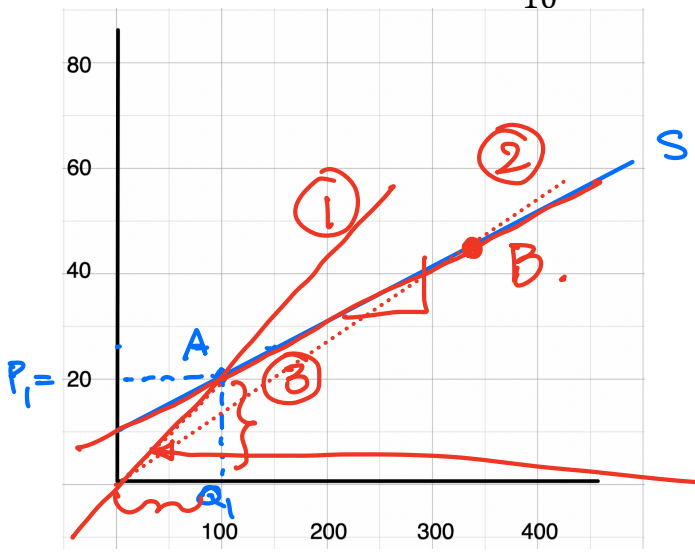
If we want to find, η_S between A and B (without specifying from where to where) we use ***Arc Elasticity by Midpoint method***.

Average Price $= \bar{P} = \frac{P_1+P_2}{2}$

Average Quantity $= \bar{Q} = \frac{Q_1+Q_2}{2}$

$$\eta_S = \frac{1}{Slope}\frac{\bar{P}}{\bar{Q}} = \frac{1}{Slope}\frac{\bar{P}}{\bar{Q}} = \frac{1}{Slope}\frac{P_1+P_2}{Q_1+Q_2} = \frac{1}{1/10}\cdot\frac{(20+25)}{(100+150)} = 10\,\frac{45}{250} = \frac{9}{5}.$$

$$Supply:\ P = 10 + \frac{1}{10}Q_S$$



η_S at A > 1
η_S at B > 1
and
$(\eta_S)_{atA} > (\eta_S)_{atB}$

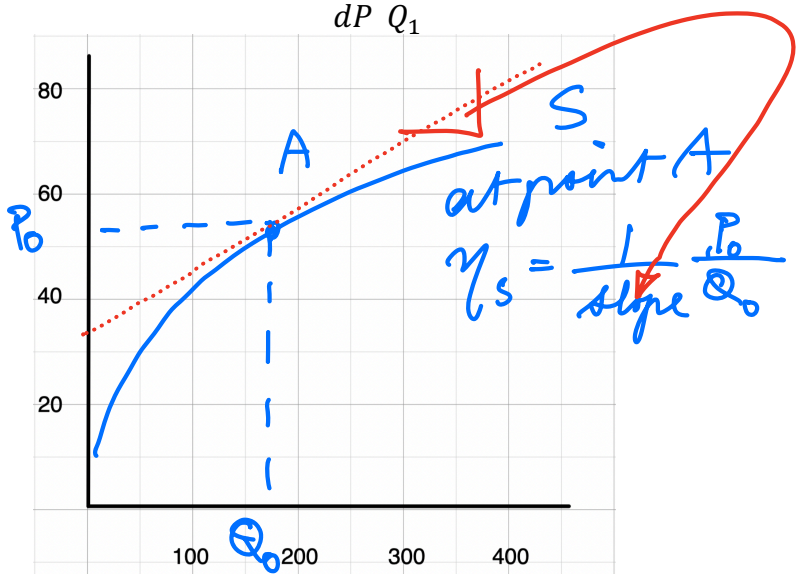
$\frac{P_1}{Q_1}$ is the slope of

Point Elasticity of Supply at a point $A = (Q_1, P_1) = (100,20)$.

$$\eta_S = \left(\frac{1}{Slope\ at\ A}\right)\frac{P_1}{Q_1} = \frac{1}{1/10}\cdot\frac{20}{100} = 2$$

$$= \frac{1}{\frac{dP}{dQ_S}}\frac{P_1}{Q_1}$$

$$= \frac{dQ_S}{dP}\frac{P_1}{Q_1} =$$



at point A
$\eta_S = \frac{1}{slope}\frac{P_0}{Q_0}$

Elastic and Inelastic Supply

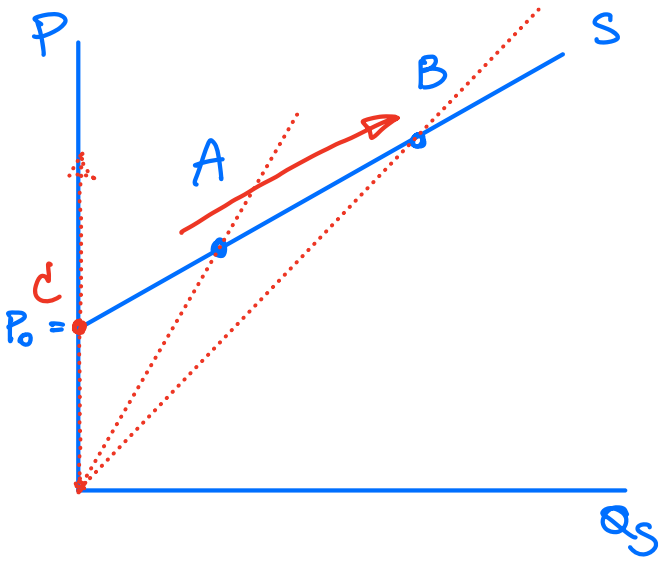
Supply is Elastic when $\eta_S > 1$
Supply is Inelastic when $\eta_S < 1$.

Point Elasticity of along a Linear Supply Curve

1. η_S when Supply has positive intercept.

η_S always > 1
but keep decreasing as we go up the S curve.
at C, $Q_S = 0 = Q_0$

$$\eta_S = \frac{1}{\text{slope}} \cdot \frac{P_0}{Q_0} = \infty$$



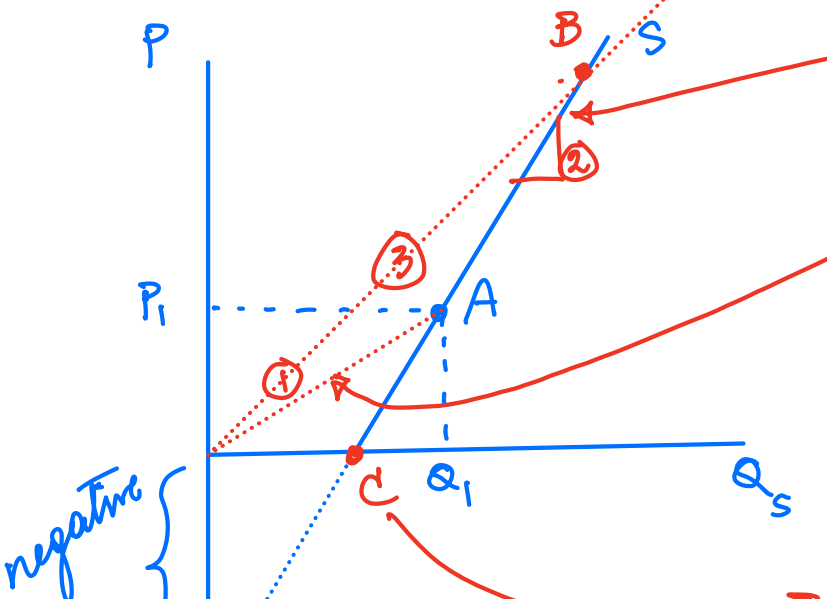
2. η_S when Supply has negative intercept.

at A $\eta_S = \frac{1}{\text{slope}} \cdot \frac{P_1}{Q_1} < 1$ always

slope of this red dotted line.

and as we move up the S curve η_S keeps increasing but never ≥ 1.

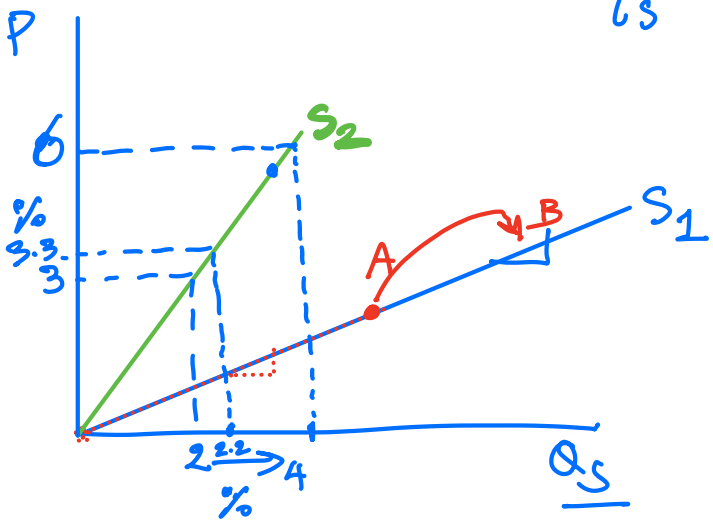
$\eta_S = 0$



3. η_S when Supply has zero intercept.

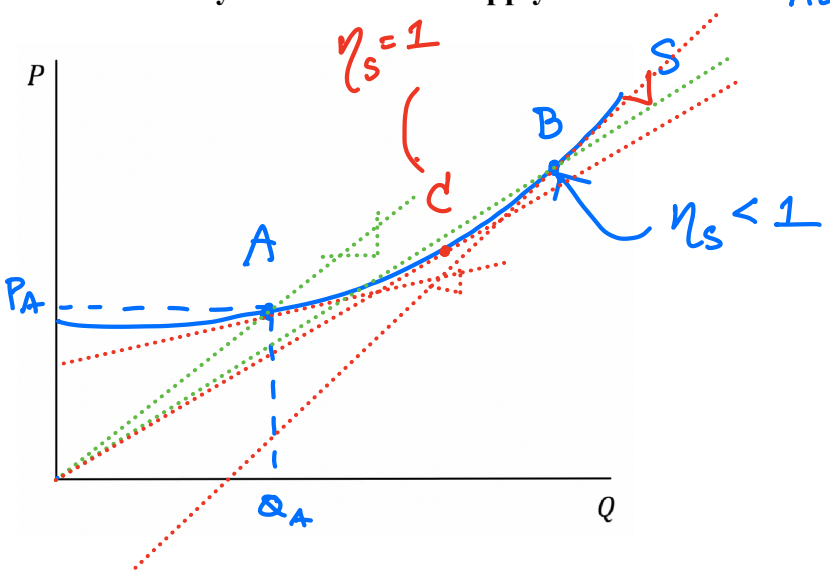
$\eta_S = 1$ everywhere on S_1 or S_2.

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



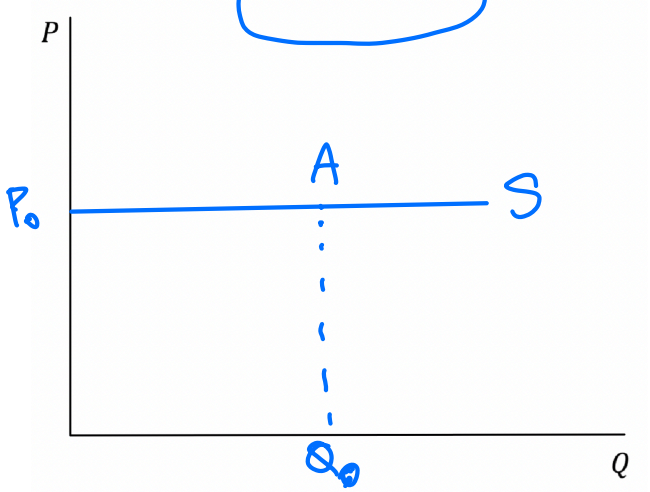
Point Elasticity of a Nonlinear Supply curve

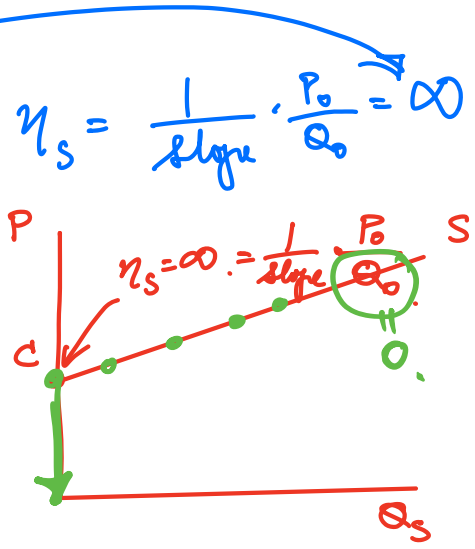
At A, $\eta_S = \frac{1}{\text{slope}} \cdot \frac{P_A}{Q_A} > 1$



Extreme Cases

1. Supply is Perfectly Elastic





2. Supply is Perfectly Inelastic