Elasticity

Law of demand tells us about "Direction" of change, i.e,

As $P_x \uparrow$, $Q^D_x \downarrow$

and as $P_x \downarrow$, $Q^D_x \uparrow$

However, we now want to know more about "Magnitude" of change, i.e.,

For example, If price of x ↑ by 10%, quantity demanded for x will ↓ by ___?___ %

- Fall more than 10%
- Fall less than 10% or
- fall by 10% or

Elasticity: responsiveness of a variable you are interested in to a change in another variable

$$E = \frac{\%\Delta Y}{\%\Delta X}$$

$\%\Delta Y$ → percentage change in Y

$\%\Delta X$ → percentage change in X

For example,

- if 10% change in x leads to 50% change in Y,

$$E = \frac{50\%}{10\%} = 5 > 1$$

Y is quite sensitive to a change in X.

- If 10% change in x leads to 1% change in Y,

$$E = \frac{1\%}{10\%} = 0.1 < 1$$

Y is not so sensitive to a change in X.

Note

$\frac{\Delta Y}{\Delta X}$ → this is about "absolute change"

$\frac{\%\Delta Y}{\%\Delta X}$ → this is about "percentage change"

Now we apply this concept to Economics.

Price Elasticity of Demand (E^P)

Q^D_x , P_x

Q^D_x: treated it as variable on the top

P_x: treated as variable at the bottom

$$E = \frac{\%\Delta Y}{\%\Delta X}$$

$$\boxed{E^P = \frac{\%\Delta Q^D_x}{\%\Delta P_x}}$$

recipe for computing Price Elasticity of Demand.

Case 1 If $|\%\Delta Q^D_x| > |\%\Delta P_x|$, then $|E^P| > 1$

EXAMPLE if price of x rises by 10%, Q^D_x falls by 50%

EXAMPLE if price of x rises by 10%, Q_x^D falls by 50%

$$E^P = \frac{\% \Delta Q_x^D}{\% \Delta P_x} = \frac{-50}{+10} = -5 \quad \text{or} \quad \underline{\underline{|E^P| = |-5| = 5}} > 1$$

We then say that <u>Demand for good x is price-elastic.</u>

(i.e, buyers are price-sensitive.)

<u>case 2</u> IF $|\% \Delta Q_x^D| < |\% \Delta P_x|$, then $|E^P| < 1$

Example if price of x rises by 10%, Q_x^D falls slightly by 2%

$$E^P = \frac{\% \Delta Q_x^D}{\% \Delta P_x} = \frac{-2}{+10} = -0.2 \quad \text{or} \quad |E^P| = |-0.2| = 0.2 < 1$$

We then say that <u>Demand for good x is price-inelastic,</u>

<u>case 3</u> IF $|\% \Delta Q_x^D| = |\% \Delta P_x|$, then $|E^P| = 1$

EX: if price of x rises by 10%, Q_x^D Falls by 10%

$$E = \frac{\% \Delta Q_x^D}{\% \Delta P_x} = \frac{-10}{+10} = -1 \quad \text{or} \quad |E^P| = |-1| = 1$$

We say that Demand for good x is price-unitary elastic.

<u>case 4</u> IF $|\% \Delta Q_x^D| = 0$ for any $|\% \Delta P_x|$, then $|E^P| =$

$$E^P = \frac{\% \Delta Q_x^D}{\% \Delta P_x} = \frac{0}{\text{any}\%} = 0$$

We say that <u>demand for good x is perfectly price-inelastic.</u>

(i.e, Buyers pay no attention on price change)

<u>case 5</u> IF $\% \Delta Q_x^D$ is very very very BIG for a very very very small $\% \Delta P_x$, then

$$\boxed{E^P = \frac{\% \Delta Q_x^D}{\% \Delta P_x} \quad \frac{\text{BIG}}{\text{small}}} = \text{VERY VER}$$

∞

called

Then we say that <u>Demand for good x is perfectly price-elastic.</u>

perfectly price inelastic

price elastic

0

Y BIG

)

infinity

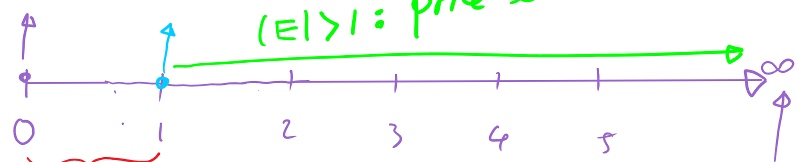
called perfectly price-elastic.

$(|E^P| = \infty)$

$|E|=0$: perfectly price inelastic

$|E|=1$: unit-price elastic

$|E|>1$: price-elastic



$|E^P| = \left|\frac{\% \Delta Q}{\% \Delta P}\right|$

$0<|E|<1$ price-inelastic

$|E|=\infty$ perfectly price-elastic

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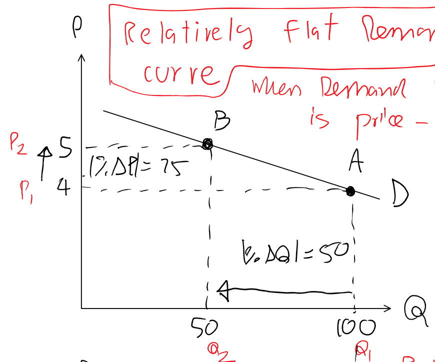
Variety of Demand Curves

Key point: Shape of a demand curve tells us about buyers' price sensitivity or price responsiveness.



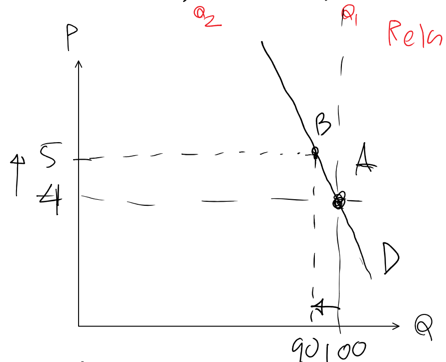
Relatively Flat Demand curve when Demand for X is price-elastic

$E^P = \frac{\% \Delta Q}{\% \Delta P}$

$\% \Delta Q = \frac{Q_2 - Q_1}{Q_1} \times 100 = \frac{50-100}{100} \times 100 = -50$

$\% \Delta P = \frac{P_2 - P_1}{P_1} \times 100 = \frac{5-4}{4} \times 100 = +25$

$E^P = \frac{-50}{+25} = -2$ or $|E^P| = 2 > 1$

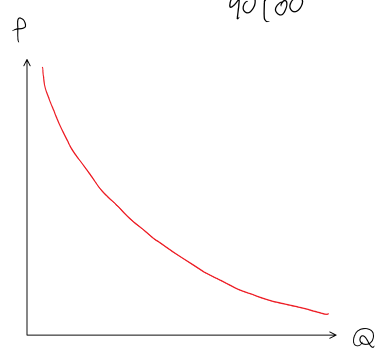


Relatively Steep demand curve when demand for good x is price-inelastic.

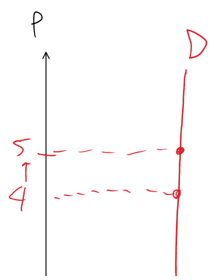
$\boxed{\% \Delta P = +25}$

$\% \Delta Q = \frac{Q_2 - Q_1}{Q_1} \times 100 = \frac{90-100}{\cancel{100}} \times \cancel{100} = -10$

$E^P = \frac{-10}{+25} = -0.4$ or $|E^P| = 0.4 < 1$



- Shape: Rectangular Hyperbola
- $|E^P| = 1$ throughout the curve.
- Demand is so called " Unitary price



- Shape: Vertical
- $E^P = \frac{\% \Delta Q}{\% \Delta P} = \frac{0}{+25} = 0$
- Demand is perfectly price-inelastic.
- consumers' price sensitivity → none

infinity

Note

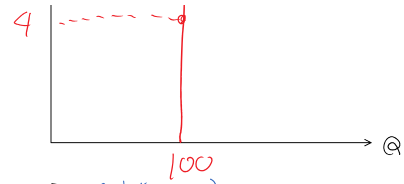
ignore

e sign

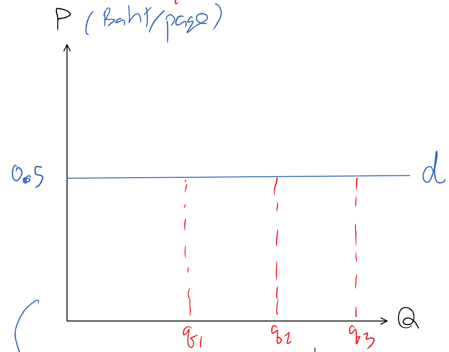
care about

e magnitude

e -elastic.



- Demand is perfectly price-inelastic.
- consumers' price sensitivity ⇒ none



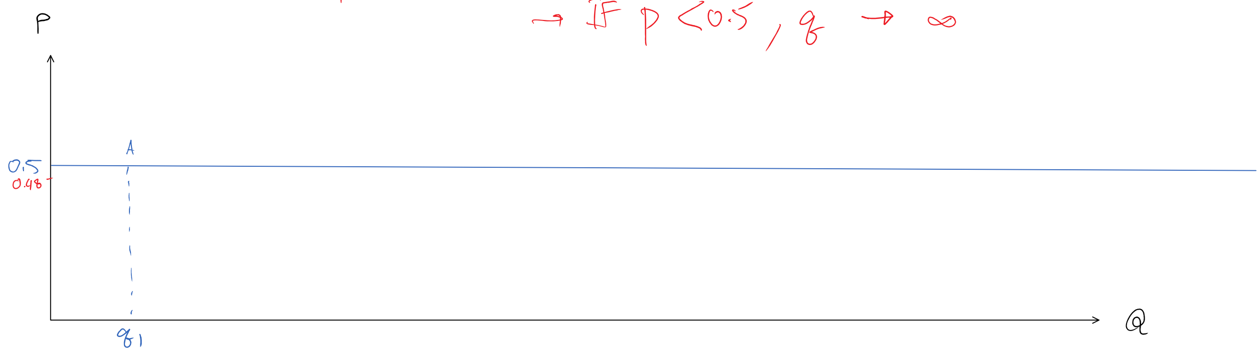
- many many buyers
  many many sellers
- non-differentiated products
- The demand curve above is from a seller's perspective.

- Shape: horizontal
- $E^P = \frac{\%\Delta Q \rightarrow \text{BIG}}{\%\Delta P \rightarrow \text{small}} \Big\} = $ VERY VERY BIG
  so, we call "∞" (INFINITY)
- Demand is perfectly price elastic.
- Consumers' price sensitivity ⇒ super super sensitive.

→ If $p = 0.5$, q can be at any quantity

→ If $p > 0.5$, $q = 0$ or q will move from any positive q to zero!

→ If $p < 0.5$, $q \rightarrow \infty$



What factors determine Price Elasticity of Demand (E^P or PED)?

Let's consider...

Ex1: Rice Crackers Vs. Sunscreen

Q: If price of the two goods above rises by 20%, which good that quantity demanded will drop the most?

A: Rice cracker!

Lesson #1 PED will be higher when close substitutes are available.

Ex2: luxury travel Vs. medicine

Q: same question as above.

A: luxury travel

Lesson #2 PED is higher for luxury goods than for necessity goods.

Ex3 Blue Jeans Vs. Clothes

Q: same as above

A: Blue Jeans

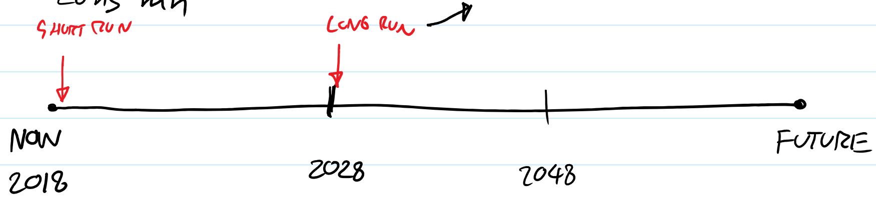
Lesson #3 PED is higher for Narrowly defined goods than or Broadly defined goods.

Ex:4 Gasoline in the short run Vs Gasoline in the long run

Q: same as above

A: Long run

Less reliance on gasoline ex: use hybrid cars
use fully integrated BTS, MRT

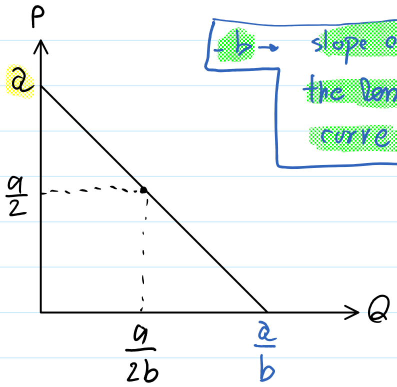


LESSON PED is higher in the long run than in the short run.

Tuesday, September 11, 2018 10:37 AM

PED & Total Revenue of a Firm

B/F talking about PED & TR, let's explore about PED more...



$-b \rightarrow$ slope of the Demand curve

$\boxed{P = a - bQ}$ → INVERSE DEMAND FUNCTION

Let's write PED recipe:

$$E^P = \frac{\%\Delta Q}{\%\Delta P}$$

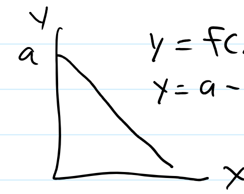
$$= \frac{\frac{Q_2 - Q_1}{Q_1} \times 100}{\frac{P_2 - P_1}{P_1} \times 100}$$

$$= \frac{\frac{\Delta Q}{Q} \cancel{\times 100}}{\frac{\Delta P}{P} \cancel{\times 100}}$$

$$\boxed{E^P = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}}$$

FOR DEMAND FUNCTION

$Q = f(P)$



$y = f(x)$

$y = a - bx$

Recall that $P = a - bQ$.

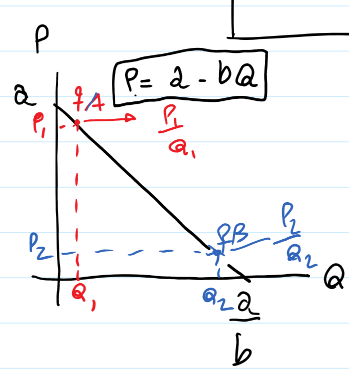
$\frac{\Delta P}{\Delta Q} = -b$ = SLOPE OF THE LINEAR DEMAND CURVE ABOVE!

$y = a - bx$

$\frac{\Delta y}{\Delta x} = -b$

$$E^P = \frac{1}{\frac{\Delta P}{\Delta Q}} \cdot \frac{P}{Q} = \frac{1}{\text{SLOPE}} \cdot \frac{P}{Q}$$

Therefore, $\boxed{E^P = \frac{1}{\text{SLOPE}} \cdot \frac{P}{Q}}$ → we try to make a link between E^P and SLOPE OF THE DEMAND CURVE



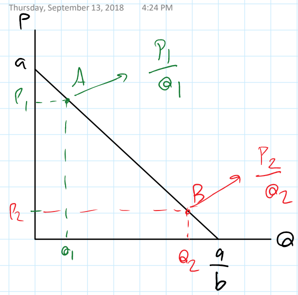
① notice that the slope is constant.

② $E^P = \frac{1}{\text{SLOPE}} \cdot \frac{P}{Q}$ — varies along the curve!

③

Elasticity(Continued)

Thursday, September 13, 2018 4:24 PM



$$\boxed{P = a - bQ}$$

$$|E^P| = \left|\frac{1}{SLOPE}\right| \cdot \frac{P}{Q}$$

① Since SLOPE is constant, $\frac{1}{SLOPE}$ is also constant,

② However, $\frac{P}{Q}$ is not constant along the linear demand curve.

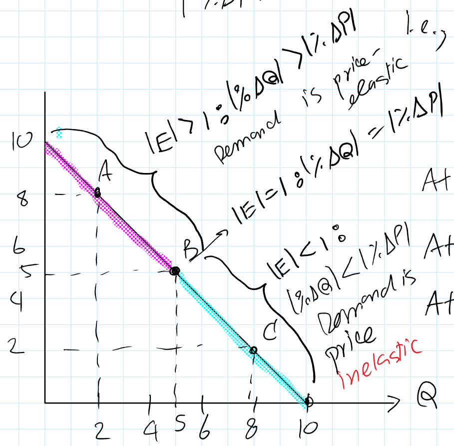
$$\left(\frac{P}{Q}\right)_{AT\ A} > \left(\frac{P}{Q}\right)_{AT\ B}$$

③ Since $\frac{P}{Q}$ varies along the curve, then $|E^P|$ varies too.

$$|E^P| = \left|\frac{\%\Delta Q}{\%\Delta P}\right|$$

i.e., PED varies along the demand curve.

i.e., Different point on the curve → Different $|E^P|$!!!



Consider $P = 10 - Q$. ($a = 10$, $b = -1$) ↓ slope of the curve

At A: $-\frac{1}{SLOPE} \cdot \frac{P}{Q} = \frac{1}{-1} \cdot \frac{8}{2} = -4$ or $|E^P| = 4$.

At B: $E^P = \frac{1}{SLOPE} \cdot \frac{P}{Q} = \frac{1}{-1} \cdot \frac{5}{5} = -1$ or $|E^P| = 1$

At C: $\frac{1}{SLOPE} \cdot \frac{P}{Q} = \frac{1}{-1} \cdot \frac{2}{8} = -\frac{1}{4}$ or $|E^P| = 0.25$

2 Methods of computing PED

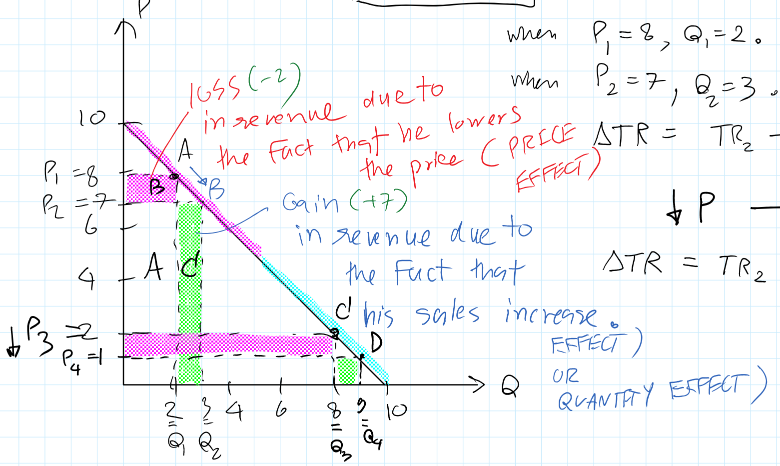
- ARC PED
  - B → C
  - C → B

    $$|E^P| = \frac{\frac{\Delta Q}{Q} \times 100}{\frac{\Delta P}{P} \times 100} = \frac{\frac{Q_2 - Q_1}{Q_1} \times 100}{\frac{P_2 - P_1}{P_1} \times 100}$$

  - $B \rightleftarrows C$ (MIDPOINT METHOD) → $$|E^P| = \frac{\frac{\Delta Q}{\left(\frac{Q_1+Q_2}{2}\right)} \times 100}{\frac{\Delta P}{\left(\frac{P_1+P_2}{2}\right)} \times 100}$$
- POINT PED → $E^P = \frac{1}{SLOPE} \cdot \frac{P}{Q}$ use this recipe

PED & Total Revenue of a Firm

Consider $\boxed{P = 10 - Q}$



when $P_1 = 8$, $Q_1 = 2$. $TR_1 = P_1 \times Q_1 = 8 \times 2 = 16$ Baht. (A+B)

when $P_2 = 7$, $Q_2 = 3$. $TR_2 = P_2 \times Q_2 = 7 \times 3 = 21$ Baht. (A+C)

$\Delta TR = TR_2 - TR_1 = 21 - 16 = +5$ baht ☺

↓P → TR↑ ONLY WHEN Demand is price-elastic.

$$\begin{aligned}\Delta TR = TR_2 - TR_1 &= (A+C) - (A+B) \\ &= \cancel{A} + C - \cancel{A} - B \\ &= \underbrace{+C - B}_{\substack{(+7)\ (-2) \\ +5}} > 0\end{aligned}$$

- involves with gains and losses.

∘ In this case, Gains outweigh losses and that is why TR ↑

Another case :

When $P_3 = 2$, $Q_3 = 8$. $TR_3 = P_3 \times Q_3 = 2 \times 8 = 16$ Baht

When $P_4 = 1$, $Q_4 = 9$. $TR_4 = P_4 \times Q_4 = 1 \times 9 = 9$ Baht

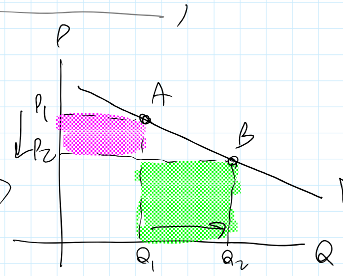
$\Delta TR = TR_4 - TR_3 = 9 - 16 = -7$ baht ☹

↓ P → TR ↓ when Demand is price-inelastic.

YOUR DIY : at home, try to analyse what happen if we move from A ↖ B

from C ↖ D

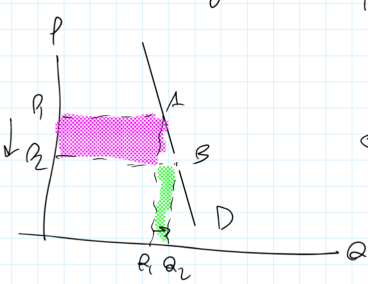
In Mankin, it offers another way to explain this...



Elastic Demand

↓P → TR ↑ ☺

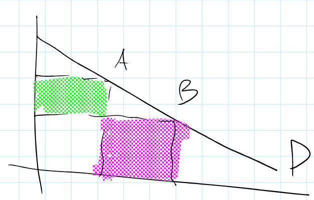
↑P → TR ↓ ☹

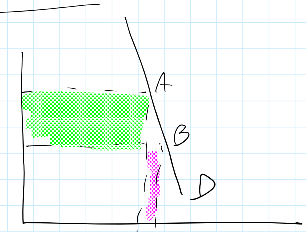


Inelastic Demand

↓P → TR ↓ ☹

↑P → TR ↑ ☺





Other Demand Elasticities

Recall that $Q^D_x = f(P_x, I, P_Y, \ldots)$

$E^P = \dfrac{\%\Delta Q^D_x}{\%\Delta P_x}$ | $E^I = \dfrac{\%\Delta Q^D_x}{\%\Delta I}$ | $E^C = \dfrac{\%\Delta Q^D_x}{\%\Delta P_Y}$

Price Elasticity of Demand | Income Elasticity of Demand | Cross-Price Elasticity of Demand.

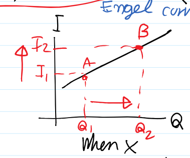
where $\%\Delta Q^D_x$ = Percentage change in Quantity Demanded for good x
$\%\Delta P_x$ = " —— " Price of good x
$\%\Delta I$ = " —— " Consumers' Income
$\%\Delta P_Y$ = " —— " Price of good Y (which is related to good x)

$$\boxed{E^I = \frac{\%\Delta Q^D_x}{\%\Delta I}}$$

$E^I > 0$ for normal goods ($I\uparrow \rightarrow Q\uparrow$, $I\downarrow \rightarrow Q\downarrow$)

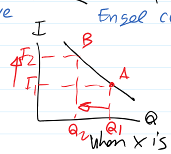
$E^I < 0$ for inferior goods ($I\uparrow \rightarrow Q\downarrow$, $I\downarrow \rightarrow Q\uparrow$)

Engel curve



When x is normal

Engel curve



When x is inferior

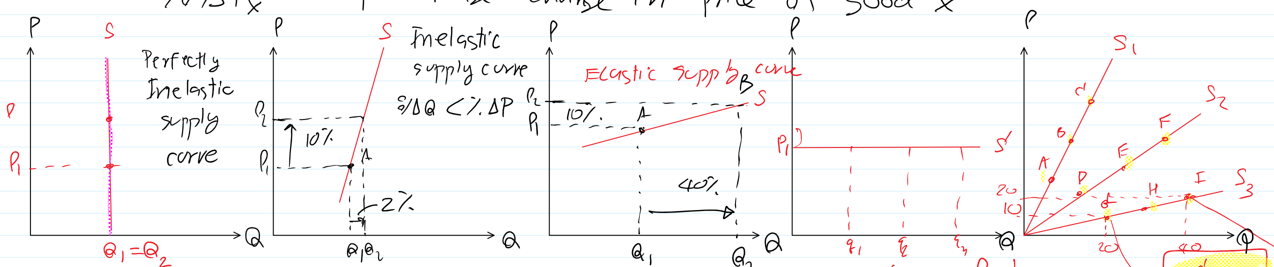
$$\boxed{E^C = \frac{\%\Delta Q^D_x}{\%\Delta P_Y}}$$

$E^C > 0$ when x & Y are substitutes (ex: x = coke, Y = pepsi)

$E^C < 0$ when x & Y are complements (ex: x = new cars, Y = gasoline)

Price Elasticity of Supply (E^S)

$E^S = \dfrac{\%\Delta Q^S_x}{\%\Delta P_x}$ → percentage change in quantity supplied of good x / → percentage change in price of good x



- $E^S = \dfrac{\%\Delta Q}{\%\Delta P} = \dfrac{0\%}{\text{any }\%} = 0$
- supply is perfectly price-Inelastic
- shape: Vertical

- $E^S = \dfrac{\%\Delta Q}{\%\Delta P} = \dfrac{2}{10} = \dfrac{1}{5} = 0.2$
- supply is price-inelastic ($0 < E^S < 1$)
- shape: Relatively Steep.

- $E^S = \dfrac{\%\Delta Q}{\%\Delta P} = \dfrac{40}{10} = 4$
- Supply is price-elastic ($E > 1$)
- shape: Relatively Flat

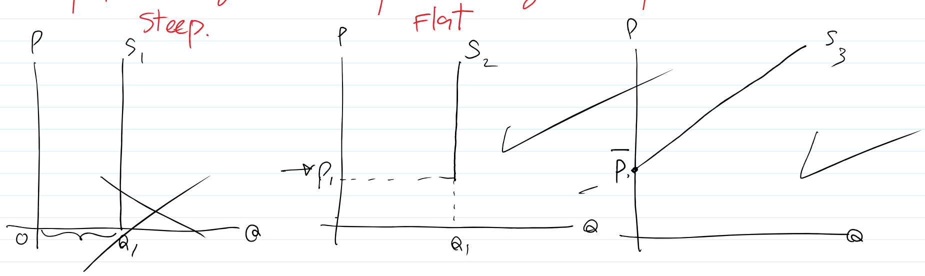
- $E^S = \dfrac{\%\Delta Q}{\%\Delta P} = \dfrac{\text{BIG}}{\text{small}} = \infty$
- supply is perfectly price-elastic ($E = \infty$)
- shape: horizontal

$E^P = \dfrac{1}{\text{SLOPE}} \cdot \dfrac{P}{Q}$

$E^S = \dfrac{1}{\text{SLOPE}} \cdot$

$E^S = \dfrac{1}{\text{SLOPE}} \cdot$

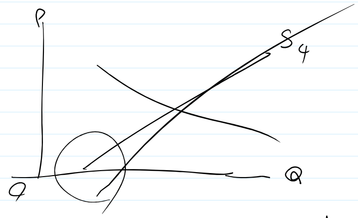
$E^S = \dfrac{1}{\text{SLOPE}} \cdot$



$$\boxed{\frac{P}{Q}}$$

$$\frac{P}{Q} = \frac{1}{\frac{1}{2}} \cdot \frac{\cancel{10}^{1}}{\cancel{20}2} = 1$$

$$\frac{P}{Q} = \frac{1}{\frac{1}{2}} \cdot \frac{\cancel{20}^{1}}{\cancel{40}2} = 1$$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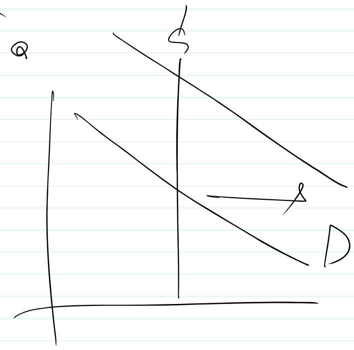
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