(I)

"THE ELASTICITY (OR RESPONSIVENESS) OF DEMAND IN A MARKET IS GREAT OR SMALL ACCORDING AS THE AMOUNT DEMANDED INCREASES MUCH OR LITTLE FOR A GIVEN FALL IN PRICE, AND DIMINISHES MUCH OR LITTLE FOR A GIVEN RISE IN PRICE"

– A. MARSHALL IN HIS (1890) PRINCIPLES OF ECONOMICS

WHAT DOES HE MEAN BY MUCH VS LITTLE !?

IF DEMAND INCREASES BY 10 UNITS FOR A FALL IN PRICE OF 1$ IS THIS MUCH OR LITTLE?

HOW WOULD YOU MAKE SENSE OF HIS STATEMENT?

ELASTICITY IS THE MEASUREMENT (II)

PUSH AN ELASTIC & IT GOES FAR!

OF HOW RESPONSIVE AN ECONOMIC VARIABLE (IN OUR CASE DEMAND) IS TO A CHANGE IN ANOTHER (IN OUR CASE PRICE) COKE, WEED, GASOLINE

q AS FUNCTION & p AS VARIABLE

TO MAKE SENSE OF CHANGES

MUCH VS LITTLE

BIG VS SMALL

WE CAN COMPARE THE AMOUNT OF CHANGE TO THE VALUE AT THE POINT

EX) IF $q(3) = 2$ THEN A CHANGE OF 10 UNITS IS BIG 500%

IF $q(3) = 10{,}000{,}000$ THEN A CHANGE OF 10 UNITS IS SMALL $<<0\%$

QUANTITY WE CARE ABOUT ARE RELATIVE CHANGE

$\frac{\Delta q}{q}$ & $\frac{\Delta p}{p}$

HOW ARE THEY RELATED? B/C p IS VARIABLE

$$E(p) \cdot \frac{\Delta p}{p} = \frac{\Delta q}{q} = \frac{q(p+\Delta p) - q(p)}{q(p)}$$

FOR SOME FUNCTION $E(p)$

Q Is $E(p)$ POSITIVE OR NEGATIVE? WHY?

Q WHAT IS $E(p)$ MEASURING?

↳ HOW STRONGLY A RELATIVE CHANGE IN p IMPACTS $q(p)$

$$E(p) = \frac{\left(\frac{\Delta q}{q}\right)}{\left(\frac{\Delta p}{p}\right)} = \frac{\%\text{ CHANGE DEMAND}}{\%\text{ CHANGE PRICE}}$$

$$E(p) = \frac{(\Delta q/q)}{(\Delta p/p)}$$

CAN WE INTERPRET E(p) USING CALCULUS? (IV)

$$\boxed{E(p) = \frac{p}{q} \cdot \frac{\Delta q}{\Delta p}} \underset{\lim_{\Delta p \to 0}}{\approx} \frac{p}{q(p)} \cdot \frac{d}{dp}[q(p)]$$

DEFINE PRICE ELASTICITY OF DEMAND BY

$$\boxed{\mathcal{E}(p) := \frac{p}{q(p)} \frac{d}{dp}[q(p)]}$$

FOR PURPOSE OF THIS COURSE YOU WON'T NEED TO UNDERSTAND ALL THE MOTIVATIONAL DETAILS... BUT YOU WILL NEED TO UNDERSTAND HOW $\mathcal{E}(p)$ AFFECTS MARGINAL REVENUE

↳ ON FIRST GLANCE THIS SHOULD SEEM WEIRD TO YOU

[Q] ANYONE WHO HAS TAKEN ECON HAVE INTUITIVE INSIGHT HERE?

RECALL IF THINK OF p INDEP

$q = q(p)$ A DEP.

$$R(p) = p \cdot q(p)$$

WE OFTEN CARE ABOUT $R'(p)$

[Q1] WHY?

[Q2] CAN WE COMPUTE $R'(p)$?

$$R'(p) = q(p) + p \cdot \frac{d}{dp}[q(p)]$$

PRODUCT RULE OR IMPLICIT DIFFERENTIATION

$$= q(p)\left[1 + \frac{p}{q(p)} \frac{d}{dp}[q(p)]\right]$$

$\mathcal{E}(p)$

WHY IS THIS OK?

- $q(p) > 0$
- $\frac{dq}{dp} < 0$
- $p > 0$

$\Rightarrow \mathcal{E}(p) < 0$

$\Rightarrow$ COMPARING $\mathcal{E}(p)$ TO -1 TELLS US THE SIGN OF $R'(p)$

$|\mathcal{E}(p)| < 1 \Rightarrow ?$ $|\mathcal{E}(p)| > 1 \Rightarrow ?$ $|\mathcal{E}(p)| = 1 \Rightarrow ?$

EXAM QUESTION

VI

$$qp + 30p + 50q = 8500$$

CELLS PER WEEK SUPPLIER CAN SELL AT PRICE p

(a) IF CURRENTLY $p = 150\$$

COMPUTE $E(p)$ AT THIS POINT

WILL REVENUE INCREASE OR DECREASE IF p LOWERED SLIGHTLY?

$$E(p) = \frac{p}{q}\frac{dq}{dp}$$

p: KNOWN

q: UNKNOWN

$\frac{dq}{dp}$: UNKNOWN

FIND $\frac{dq}{dp}$

$$q(p)\cdot p + 30p + 50\,q(p) = 8500$$

$$\frac{d}{dp}(\quad) = \frac{d}{dp}(\quad)$$

$$\frac{d}{dp}[q(p)]\cdot p + q(p) + 30 + 50\frac{d}{dp}[q(p)] = 0$$

$$\Rightarrow \boxed{\frac{dq(p)}{dp} = \frac{-q(p) - 30}{p + 50}}$$

VII

FIND $q(p)$

AT $p = 150\$ \rightsquigarrow q \cdot (150) + 30 \cdot 150 + 50 \cdot q = 8500$

$\Rightarrow 200q = 8500 - 4500 = 4000$

$\Rightarrow \boxed{q = 20}$

COMBINE IT ALL

$$\mathcal{E}(p) = \frac{p}{q}\frac{dq}{dp} \Rightarrow \mathcal{E}(150) = \frac{150}{20} \cdot \left(\frac{-20-30}{150+150}\right)$$

$$= \frac{-150 \cdot 50}{4000} = \frac{-75}{40}$$

$$= \boxed{-\frac{15}{8}}$$

SINCE $|\mathcal{E}(150)| > 1 \Rightarrow$ REVENUE INCREASES IF PRICE DECREASES

(b) IF $p = 150\$$ & YOU DECREASE IT BY 5%, WHAT IS THE % CHANGE IN DEMAND?

$$\mathcal{E}(p) = \frac{\%\text{ CHANGE DEMAND}}{\%\text{ CHANGE PRICE}} \Rightarrow \mathcal{E}(p) \cdot (\%\text{ CHANGE PRICE}) = \%\text{ CHANGE DEMAND}$$

$$\Rightarrow -\frac{15}{8} \cdot (-5)\% = +\frac{75}{8}\%$$

READ ONLINE NOTE FOR EXAMPLES & DEFINITIONS