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HW#5 Due February 25, 2021

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3. Suppose the price elasticity of demand for heating oil is 0.2 in the short run and 0.7 in the long run.

   a. If the price of heating oil rises from $1.80 to $2.20 per gallon, what happens to the quantity of heating oil demanded in the short run? In the long run? (Use the midpoint method in your calculations.)

   b. Why might this elasticity depend on the time horizon?

7. Suppose that your demand schedule for pizza is as follows:

Price	Quantity Demanded (income = $20,000)	Quantity Demanded (income = $24,000)
$8	40 pizzas	50 pizzas
10	32	45
12	24	30
14	16	20
16	8	12

   a. Use the midpoint method to calculate your price elasticity of demand as the price of pizza increases from $8 to $10 if (i) your income is $20,000 and (ii) your income is $24,000.

   b. Calculate your income elasticity of demand as your income increases from $20,000 to $24,000 if (i) the price is $12 and (ii) the price is $16.

(3) η_D in short run = 0.2

η_D in long run = 0.7

a.) When the price of heating oil rises from $1.80 to $2.20 per gallon,

$$\%\Delta P = \frac{P_1 - P_0}{\bar{P}} \cdot 100\%$$

$$= \frac{2.20 - 1.80}{\left(\frac{2.20 + 1.80}{2}\right)} \cdot 100\%$$

$$= \frac{0.4}{2} \cdot 100 = 20\%$$

η_D for short run = 0.2

$$0.2 = \frac{\%\Delta Q_D}{\%\Delta P}$$

$$0.2 = \frac{\%\Delta Q_D}{20\%}$$

$$4\% = \%\Delta Q_D$$

∴ Q_D will decrease 4% in short run.

η_D for long run. = 0.7

$$0.7 = \frac{\%\Delta Q_D}{\%\Delta P}$$

$$0.7 = \frac{\%\Delta Q_D}{20\%}$$

$$14\% = \%\Delta Q_D$$

∴ Q_D will decrease 14% in long run.

b.) The elasticity depends on the time horizon because there can be more substitutes as the time changes.

More substitutes lead to more elasticity.

(7) a.) When income is \$20,000, $P = -\frac{1}{4}Q_D + 18$ at (40,8) and (32,10)

When income is \$24,000, $P = -\frac{2}{5}Q_D + 28$ at (50,8) and (45,10)

Price elasticity of demand by midpoint method.

i.) When income is 20,000, $P = 8$ and $Q_D = 40$

$P = 10$ and $Q_D = 32$

$$\eta_D = \frac{1}{\text{slope}} \cdot \frac{\bar{P}}{\bar{Q}_D}$$

$$= \frac{1}{-\frac{1}{4}} \cdot \frac{(8+10)/2}{(40+32)/2}$$

$$= -4 \cdot \frac{18/2}{72/2}$$

$$= -4 \cdot \frac{1}{4}$$

$$= -1$$

ii) When income is 24,000, $P = 8$ and $Q_D = 50$

$P = 10$ and $Q_D = 45$

$$\eta_D = \frac{1}{\text{slope}} \cdot \frac{\bar{P}}{\bar{Q}_D}$$

$$= \frac{1}{-2/5} \cdot \frac{(8+10)/2}{(50+45)/2}$$

$$= -\frac{5}{2} \cdot \frac{18}{95}$$

$$= -\frac{9}{19} \approx -0.47$$

b.) Income elasticity of demand as income increases from \$20,000 to \$24,000

i.) The price is \$12, the income elasticity of demand is

$$\eta_I = \frac{\%\Delta Q_D}{\%\Delta I}$$

$$= \frac{\frac{20-24}{24} \cdot 100}{\frac{24000-20000}{20000} \cdot 100}$$

$$= \frac{\frac{6}{24}}{\frac{4000}{20000}} = \frac{5}{4} = 1.25$$

ii.) The price is \$16, the income elasticity of demand is

$$\eta_I = \frac{\%\Delta Q_D}{\%\Delta I}$$

$$= \frac{\frac{12-8}{8} \cdot 100}{\frac{24000-20000}{20000} \cdot 100}$$

$$= \frac{\frac{4}{8} \cdot 100}{\frac{4000}{20000} \cdot 100} = \frac{5}{2} = 2.5$$