H.W. #5

HW#5 Due September 22, 2020

Mankiw Page 107

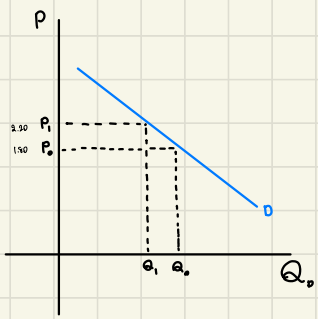
3. Suppose the price elasticity of demand for heating oil is 0.2 in the short run and 0.7 in the long run.
   a. If the price of heating oil rises from $1.80 to $2.20 per gallon, what happens to the quantity of heating oil demanded in the short run? In the long run? (Use the midpoint method in your calculations.)
   b. Why might this elasticity depend on the time horizon?

short run: $\eta_D = 0.2$

long run: $\eta_D = 0.7$

a) $P_0 = 1.80$ $ per gallon

$P_1 = 2.20$ $ per gallon



a.) Calculate by midpoint method

average price: $\frac{P_0+P_1}{2} = \frac{1.80+2.20}{2} = 2$

average quantity: $\frac{Q_0+Q_1}{2}$

In short run; $\eta_D = 0.2 = \frac{\frac{Q_1-Q_0}{\frac{Q_1+Q_0}{2}}}{\frac{P_1-P_0}{\frac{P_1+P_0}{2}}} = \frac{\frac{X}{0.4}}{\frac{4}{2}} = \frac{X}{0.2}$ (X)

$X = 0.04$

∴ The rate of change of quantity demanded calculated by midpoint method is 0.04

In long run; $\eta_D = 0.7 = \frac{X}{0.2}$ (refer to)

$X = 0.14$

∴ The rate of change of quantity demanded calculated by midpoint method is 0.14

b.) At a moment of time in short run, consumers have less time to find the substitute for the heating oil so they have no choices to choose this heating oil at that price. This means the elasticity of demand for heating oil is quite low (more inelastic)

Yet in long run, consumers have more time to seek for the substitute.

That means in long run the elasticity of demand for heating oil is more than in short run (less inelastic)

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.

a.(i.) Income: 20,000 $

$P_1 = 10\$ \quad Q_1 = 40$ pizzas

$P_0 = 8\$ \quad Q_0 = 32$ pizzas

Calculate price elasticity by using midpoint method.

$$\eta_D = \frac{\frac{Q_1-Q_0}{Q_1+Q_0}}{\frac{P_1-P_0}{P_1+P_0}} = \frac{\frac{32-40}{32+40}}{\frac{10-8}{10+8}} = \frac{\frac{-8}{72}}{\frac{2}{18}} = \frac{-8}{36} \div \frac{2}{9} = \frac{-8}{36} \times \frac{9}{2} = \frac{-4}{4} = -1$$

∴ price elasticity of demand is $|\eta_D| = |-1| = 1$ ⇒ unit elastic

a.(ii) Income = 24,000 $

$P_1 = 10\$ \quad Q_1 = 45$ pizzas

$P_0 = 8\$ \quad Q_0 = 50$ pizzas

Calculate price elasticity by using midpoint method.

$$\eta_D = \frac{\frac{Q_1-Q_0}{Q_1+Q_0}}{\frac{P_1-P_0}{P_1+P_0}} = \frac{\frac{45-50}{45+50}}{\frac{10-8}{10+8}} = \frac{\frac{-5}{95}}{\frac{2}{18}} = \frac{-5}{95} \times \frac{18}{2} = \frac{-9}{19} = -0.47$$

∴ price elasticity of demand is $|\eta_D| = |-0.47| = 0.47$ ⇒ inelastic

b.(i) From the fomula of income elasticity of demand.

$$\eta_i = \frac{\%\Delta Q}{\%\Delta I} \quad P = 12\$ \quad Q_{24k} = 30 \text{ pizzas} \quad Q_{20k} = 24 \text{ pizzas}$$

$$= \frac{\frac{Q_1-Q_0}{Q_0} \times 100}{\frac{I_1-I_0}{I_0} \times 100} = \frac{30-24}{24} \times \frac{20000}{24k-20k}$$

$$= \frac{1}{4} \times \frac{5}{4} = 1.25$$

∴ Income elasticity of demand if the price is 12 $ is 1.25 ⇒ elastic

b.(ii) $\eta_i = \frac{\%\Delta Q}{\%\Delta I}$ $P = 16\$$ $Q_{24k} = 12$ pizzas $Q_{20k} = 8$ pizzas

$$= \frac{\frac{Q_1-Q_0}{Q_0} \times 100}{\frac{I_1-I_0}{I_0} \times 100} = \frac{12-8}{8} \times \frac{20000}{24k-20k}$$

$$= \frac{1}{2} \times \frac{5}{2} = 2.5$$

∴ Income elasticity of demand if the price is 16 $ is 2.5 ⇒ elastic