

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.
- 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.)
 - 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

- 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.
- 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. 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.)

Price elasticity in short run is 0.2
in Long run is 0.7 ,

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{percentage change in price}}$$

∴ in short run price elasticity = 0.2 ↖ the midpoint method

$$0.2 = \frac{\% \text{ change in quantity demanded}}{\$ (2.20 - 1.8) \div \left(\frac{1.8 + 2.2}{2} \right) \left\} \frac{0.4}{2}}$$

$$\therefore \text{percentage change in quantity demanded} = \frac{(0.2)(0.4)}{2}$$

∴ so percentage change in demand = 0.04 (4%)
which mean demand will decrease by 4% in the short run

∴ in long run price elasticity = 0.7

$$0.7 = \frac{\% \text{ change in quantity demanded}}{\frac{0.4}{2}}$$

$$\therefore \text{Percent change in quantity demanded} = \frac{(0.7)(0.4)}{2} = 0.14 (14\%)$$

∴ so percent change in quantity demand will decrease 14%
in the long run

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

Elasticity is depend on time horizon because there is a possibility that substitute for oil might come in anytime and people might prefer that over heating oil. Thus, they respond more easily to change in the price of heating oil in the long run than in the short run.

7 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.

i) If the income is 20,000, then the price of pizza rises from \$8 to \$10, and the quantity demand decrease from 40 to 32. By Midpoint method, the price elasticity of demand is calculated as follow

$$\text{Price elastic demand} = \frac{\frac{Q_2 - Q_1}{\left(\frac{Q_2 + Q_1}{2}\right)}}{\frac{P_2 - P_1}{\left(\frac{P_2 + P_1}{2}\right)}}, \quad \begin{array}{l} Q_1 = 40 \quad P_1 = 8 \\ Q_2 = 32 \quad P_2 = 10 \end{array}$$

$$\begin{aligned} \therefore \text{price elasticity of demand} \\ \text{at income } \$20,000 \text{ is } -1 &= \frac{\frac{32 - 40}{\left(\frac{32 + 40}{2}\right)}}{\frac{10 - 8}{\left(\frac{10 + 8}{2}\right)}} = \frac{\frac{-8}{76}}{\frac{2}{9}} = \frac{-0.222}{0.222} = -1 \quad \times \end{aligned}$$

ii) If the income is 24,000 price of pizz rises \$8 to \$10, and quantity demand decreas from 50 to 45

$$\text{Price elastic demand} = \frac{\frac{Q_2 - Q_1}{\left(\frac{Q_2 + Q_1}{2}\right)}}{\frac{P_2 - P_1}{\left(\frac{P_2 + P_1}{2}\right)}}, \quad \begin{array}{l} Q_1 = 50 \quad P_1 = 8 \\ Q_2 = 45 \quad P_2 = 10 \end{array}$$

$$= \frac{\frac{45 - 50}{\frac{45 + 50}{2}}}{\frac{10 - 8}{\frac{10 + 8}{2}}} = \frac{\frac{-5}{97.5}}{\frac{2}{9}} = \frac{-0.105}{0.222} = -0.472 \quad \times$$

\therefore Price elasticity of demand
at income \$24000 is -0.472

$$\text{income elasticity of demand} = \frac{\text{Percentage change in quantity demand}}{\text{Percentage change in income}}$$

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.

i) if income raise from \$20,000 to \$24,000, when pizza at price \$12 the quantity demand will be 24 and 30

$$Q_1 = 24, \quad Q_2 = 30$$

$$y_1 = \$20,000, \quad y_2 = \$24,000$$

$$\text{income elasticity of demand} = \frac{Q_2 - Q_1}{\frac{Q_2 + Q_1}{2}} \div \frac{y_2 - y_1}{\frac{y_2 + y_1}{2}}$$

$$\begin{aligned} \therefore \text{income elasticity of demand} &= \frac{30 - 24}{\frac{30 + 24}{2}} \div \frac{24,000 - 20,000}{\frac{24,000 + 20,000}{2}} \\ \text{at price } \$12 &\text{ is } 1.222 \\ &= \frac{6}{27} \div \frac{4}{22} = \frac{6}{27} \times \frac{22}{4} = 1.222 \end{aligned}$$

ii) when the pizza at price 16, the quantity of demand will be 8 with income 20,000 and 12 with income 24,000

$$Q_1 = 8, \quad y_1 = 20,000$$

$$Q_2 = 12, \quad y_2 = 24,000$$

$$\text{income elasticity of demand} = \frac{Q_2 - Q_1}{\frac{Q_2 + Q_1}{2}} \div \frac{y_2 - y_1}{\frac{y_2 + y_1}{2}}$$

$$\begin{aligned} \therefore \text{income elasticity of demand} &= \frac{12 - 8}{\frac{12 + 8}{2}} \div \frac{24,000 - 20,000}{\frac{24,000 + 20,000}{2}} \\ \text{at price } \$16 &\text{ is } 2.2 \\ &= \frac{4}{10} \div \frac{4}{22} = \frac{4}{10} \times \frac{22}{4} = 2.2 \end{aligned}$$