Worksheet 7 – Calculating Price Elasticity

In economics, we use price elasticity to measure consumers' and producers' sensitivity to changes in the price of a good. In the coming weeks, we will find out how this is a useful tool for understanding the effects of trade and regulation.

We use the following formula to measure elasticity for a large change in price:

\[ \epsilon_d = \frac{\% \Delta Q}{\% \Delta P} = \frac{\Delta Q}{Q} \frac{Q}{\Delta P} = \frac{(Q_2 - Q_1)}{Q_1} \frac{Q_1}{(P_2 - P_1)} = P_1 \epsilon_s = P_1 \frac{(Q_2 - Q_1)}{(P_2 - P_1)} \]

P_1 and Q_1 are the original values, and P_2 and Q_2 are the new values (This is just many ways of saying the same thing. You only need one of these formulas)

Elasticity depends on which way you're moving.

The elasticity you measure when you decrease a price will be different from the elasticity when you increase it back to where it came from. Use the demand curve below to answer the following questions:

![Demand Curve](image)

Calculate the elasticity for a decrease in price from $9/hour to $3/hour:

1. What is the change in price? \( P_2 - P_1 = \) ____________

2. What is the Quantity Demanded at $9/hour (the original value)? \( Q_1 = \) ____________

3. What is the Quantity Demanded at $3/hour? \( Q_2 = \) ____________

4. What is the change in Quantity Demanded? \( Q_2 - Q_1 = \) ____________
\[ \epsilon_d \text{ or } \epsilon_s = \frac{\% \Delta Q}{\% \Delta P} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q} = \frac{(Q_2 - Q_1)/Q_1}{(P_2 - P_1)/P_1} = \frac{P_1}{Q_1} \times \frac{(Q_2 - Q_1)}{(P_2 - P_1)} \]

5. Using those numbers and the formula above, calculate the elasticity. Use a calculator if you want.

6. If the elasticity is greater than 1, then the demand is elastic. If the elasticity is less than 1, then the demand is inelastic. If the elasticity is equal to 1, then the demand is unit elastic.

Is the demand for this good elastic, inelastic or unit elastic? _______________

Now, calculate the elasticity for an increase in price from $3/hour to $9/hour:

7. What is the change in price? $P_2 - P_1 = \text{______________}$

8. What is the Quantity Demanded at $9/hour (the original value)? $Q_1 = \text{______________}$

9. What is the Quantity Demanded at $3/hour? $Q_2 = \text{______________}$

10. What is the change in Quantity Demanded? $Q_2 - Q_1 = \text{______________}$

11. Using those numbers and the formula above, calculate the elasticity. Use a calculator if you want.

12. If the elasticity is greater than 1, then the demand is elastic. If the elasticity is less than 1, then the demand is inelastic. If the elasticity is equal to 1, then the demand is unit elastic.

Is the demand for this good elastic, inelastic or unit elastic? ________________
Arc Elasticity – The “Midpoint Method”

We can avoid the problem of two different elasticities by using the “midpoint method” to calculate what’s called the arc elasticity. This just gives us the average elasticity over a range of prices. We use the following formula:

\[ \epsilon_d \text{ or } \epsilon_s = \frac{\% \Delta Q}{\% \Delta P} = \frac{\Delta Q/Q_{\text{average}}}{\Delta P/P_{\text{average}}} = \]

\[ \frac{(Q_2 - Q_1)/(Q_1 + Q_2)}{2} = \frac{(P_1 + P_2)/(P_1 + P_2)}{2} \times \frac{(Q_2 - Q_1)}{(Q_1 + Q_2)} \times \frac{(P_2 - P_1)}{(P_1 - P)} \]

(Notice how the 2’s get cancelled out in the last step)

Now you can calculate the arc elasticity for an increase in price from $3/hour to $9/hour:

13. What is the sum of the prices? \( P_1 + P_2 = \) ______________

14. What is the sum of the quantities? \( Q_1 + Q_2 = \) ______________

15. Using those numbers you just found, the numbers you got earlier, and the formula above, calculate the arc elasticity. Use a calculator if you want.

16. On average, is the demand elastic, inelastic, or unit elastic along this range of prices?