Chapter 5: Elasticity and applications

Discussion section 4

September 2023

Outline

Elasticity captures an extremely intuitive concept:

How do you change your behavior in response to changing prices?

Let's refresh:

When does a consumer buy more of a good?

Elasticity

1. Its price is lower (law of demand)
2. Incomes are higher (for normal goods)
3. Price of substitutes is higher
4. Price of complements is lower

The *price elasticity of demand* will tell us just how big the change in demand is for these cases.

Elasticity of demand

A good may have *elastic* or *inelastic* demand.

What are some examples of inelastic goods?

Elastic goods?

Let's take a specific example: the Ford F-150. What factors will influence this product's elasticity of demand?

Elasticity of demand

What factors will influence a good's elasticity?

1. **Availability of close substitutes**: other kinds of trucks, cars, bikes, etc.
2. **Necessities vs. luxuries**: do you need it for work? For fun?
3. **Market definition**: Are we considering the market for Ford F150s? For pickup trucks? For motor vehicles?)
4. **Time horizon**: In the short run, maybe we need a pickup; in the long-run, maybe we retool our lives to accomadate a different car or no car at all

Elasticity of demand

We have a simple equation to find the price elasticity of demand:

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

Will this value be greater or less than 0? Why?

First, let's refresh the basics. If good A used to cost \$10, and now it costs \$14, what is the percentage change?

Elasticity of demand

If good A used to cost \$10, and now it costs \$14, what is the percentage change?

$$\frac{\text{Change in price}}{\text{Original price}} * 100\% = \frac{\$14 - \$10}{\$10} * 100\% = 40\%$$

In our elasticity formula, we do not need to worry about multiplying by 100%.

Calculating elasticity

Consider two points on a demand curve:

- Point A: price is $P_A = 12$ and quantity demanded is $Q_A = 60$
- Point B: $P_B = 8$ and $Q_B = 80$

Take our formula and calculate the price elasticity of demand:

1. Moving from point A to point B
2. Moving from point B to point A

Calculating elasticity

1. Moving from point A to point B: $P_e = \frac{1}{\frac{1}{3}} = 3$
2. Moving from point B to point A: $P_e = \frac{\frac{1}{2}}{\frac{1}{2}} = 1$

Two different values! What gives?

You have \$100, and lose 10%. Tomorrow, you gain back 10%. How much do you have?

What can we do about this?

Midpoint technique

Instead of taking the % change w.r.t. the original price, use an average of the two prices as your base, use an average of the two:

$$\text{Price elasticity of demand} = \frac{(Q_2 - Q_1)/[(Q_2 - Q_1)/2]}{(P_2 - P_1)/[(P_2 - P_1)/2]}$$

This is the formula we will use!

Calculating elasticity

Let's return to our example:

- $P_A = 12$ and $Q_A = 60$
- $P_B = 8$ and $Q_B = 80$

1. What is the new base price?
2. What is the new base quantity?
3. What is the % change for quantity?
4. What is the % change for price?

Then put it all together to get our new elasticity estimate.

Calculating elasticity

Whether we consider moving from A to B or from B to A, we get $P_e = 1\frac{2}{3}$.

Demand might be:

- Elastic
- Inelastic
- Unit elastic
- Perfectly elastic
- Perfectly inelastic

Group activity: draw a demand curve for each of these cases

Types of elasticity

Demand might be:

- Elastic: price change of $X\%$ $\rightarrow$ demand change greater than $X\%$
- Inelastic: price change of $X\%$ $\rightarrow$ demand change less than $X\%$
- Unit elastic: price change of $X\%$ $\rightarrow$ demand change of $X\%$
- Perfectly elastic: price change has no impact on demand
- Perfectly inelastic: small price change has enormous impact on demand

Total revenue

How do we know how much is spent on a good at the market equilibrium?

Total revenue = equilibrium price $\times$ equilibrium quantity

How does elasticity interact with revenue? Think about how revenue changes when the price doubles from P_A to $P_B = 2 * P_A$ when:

- Demand is elastic: quantity decreases by 75%
- Demand is inelastic: quantity decreases by 25%
- Demand is unit elastic

Elasticity

Say we have a linear demand curve:

- Quantity demanded is 0 when price is 100
- Quantity demanded is 12 when price is 4

1. Calculate the formula for the demand curve (slope and intercept) and draw graphically
2. Is the elasticity constant? Why or why not?
3. Pick a few example points, and use the midpoint formula to check the elasticity when:
    1. Price is close to 100
    2. Price is close to 0
    3. Price is around 50
4. How will total revenue vary as price moves from 0 to 100?

Different elasticities

We have focused on the *price elasticity of demand*, but there are others.

In general, we can find the *X elasticity of Y* as:

$$\text{X elasticity of Y} = \frac{\%\ \Delta \text{ of Y}}{\%\ \Delta \text{ of X}}$$

Some important elasticities:

- Income elasticity of demand
- Cross-price elasticity of demand

Different elasticities

Income elasticity of demand:

- Positive for normal goods, negative for inferior goods
- income elasticity of demand $= \dfrac{\%\ \Delta \text{ of demand}}{\%\ \Delta \text{ of income}}$

Cross-price elasticity of demand:

- Positive for substitutes, negative for complements
- CP elasticity of demand $= \dfrac{\%\ \Delta \text{ of demand for good 1}}{\%\ \Delta \text{ of price of good 2}}$

Supply elasticities

Firms will react to a change in price based on their *price elasticity of supply*.

The same ideas are in play. Firms may have supply that is:

- elastic
- inelastic
- unit elastic
- perfectly elastic
- perfectly inelastic

Let's draw a graph for each of these scenarios.

What is the formula for finding the price elasticity of supply?

Supply elasticities

Firms may have supply that is:

- elastic: an X% change in price $\rightarrow <$ X% change in supply
- inelastic: an X% change in price $\rightarrow >$ X% change in supply
- unit elastic: an X% change in price $\rightarrow$ X% change in supply
- perfectly elastic: any change in price $\rightarrow$ enormous change in supply
- perfectly inelastic: any change in price $\rightarrow$ no change in supply (perfectly vertical)

Of course our formula is:

$$\text{price elasticity of supply} = \frac{\%\ \Delta \text{ of supply}}{\%\ \Delta \text{ of price}}$$

Elasticity examples

Let's use some intuition, and choose three products for which we think:

1. Demand is inelastic
2. Demand is elastic
3. Supply is inelastic
4. Supply is elastic

Appliction

Let's think about the market for hotel rooms:

Price	Q_D **(Business)**	Q_D **(Vacation)**	Q_S **(Firms)**
\$150	2,100	1,000	2,300
\$200	2,000	800	2,400
\$250	1,900	600	2,500
\$300	1,800	400	2,600

Table: Market for airline tickets

Which group do you expect to be elastic? Inelastic? Why? Calculate the elasticities.

Appliction

Business people	Vacationers	Firms
0.17	0.78	0.15
0.23	1.29	0.18
0.3	2.2	0.22

Table: Elasticities for airline tickets

Was your intuition for the elasticities correct? When is this market in *equilibrium*?