Elasticity and Its Application

Chapter 5

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Elasticity . . .

- ... is a measure of how much buyers and sellers respond to changes in market conditions

- ... allows us to analyze supply and demand with greater precision.
Price Elasticity of Demand

- Price elasticity of demand is the percentage change in quantity demanded given a percent change in the price.

- It is a measure of how much the quantity demanded of a good responds to a change in the price of that good.
Determinants of Price Elasticity of Demand

- *Necessities versus Luxuries*
- *Availability of Close Substitutes*
- *Definition of the Market*
- *Time Horizon*
Determinants of Price Elasticity of Demand

*Demand tends to be more elastic:*

- if the good is a luxury.
- the longer the time period.
- the larger the number of close substitutes.
- the more narrowly defined the market.
Computing the Price Elasticity of Demand

The price elasticity of demand is computed as the percentage change in the quantity demanded divided by the percentage change in price.

\[
\text{Price Elasticity of Demand} = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Price}}
\]
Computing the Price Elasticity of Demand

**Price elasticity of demand** = \( \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}} \)

**Example:** If the price of an ice cream cone increases from $2.00 to $2.20 and the amount you buy falls from 10 to 8 cones then your elasticity of demand would be calculated as:

\[
\frac{(10 - 8)}{10} \times 100 \times \frac{10}{(2.20 - 2.00)} \times 100 = \frac{20 \text{ percent}}{10 \text{ percent}} = 2
\]
Computing the Price Elasticity of Demand Using the Midpoint Formula

The midpoint formula is preferable when calculating the price elasticity of demand because it gives the same answer regardless of the direction of the change.

\[
\text{Price Elasticity of Demand} = \frac{(Q_2 - Q_1)/[(Q_2 + Q_1)/2]}{(P_2 - P_1)/[(P_2 + P_1)/2]}
\]
Computing the Price Elasticity of Demand

Price Elasticity of Demand = \( \frac{Q_2 - Q_1}{(Q_2 + Q_1)/2} \) \( \frac{P_2 - P_1}{(P_2 + P_1)/2} \)

Example: If the price of an ice cream cone increases from $2.00 to $2.20 and the amount you buy falls from 10 to 8 cones the your elasticity of demand, using the midpoint formula, would be calculated as:

\[
\frac{(10 - 8)}{(10 + 8)/2} \div \frac{(2.20 - 2.00)}{(2.00 + 2.20)/2} = 22 \text{ percent} \div 9.5 \text{ percent} = 2.32
\]
Ranges of Elasticity

**Inelastic Demand**
- Quantity demanded *does not respond* strongly to price changes.
- Price elasticity of demand is *less than* one.

**Elastic Demand**
- Quantity demanded *responds strongly* to changes in price.
- Price elasticity of demand is *greater than* one.
Computing the Price Elasticity of Demand

\[ E_D = \frac{(100-50)}{(4.00-5.00)} \left/ \frac{(100+50)}{2} \right/ \left/ \frac{(4.00+5.00)}{2} \right] \]

\[ = \frac{67\text{ percent}}{-22\text{ percent}} = -3 \]

Demand is price elastic
Ranges of Elasticity

- **Perfectly Inelastic**
  Quantity demanded does not respond to price changes.

- **Perfectly Elastic**
  Quantity demanded changes infinitely with any change in price.

- **Unit Elastic**
  Quantity demanded changes by the same percentage as the price.
A Variety of Demand Curves

Because the price elasticity of demand measures how much quantity demanded responds to the price, it is closely related to the slope of the demand curve.
Perfectly Inelastic Demand

- Elasticity equals 0

1. An increase in price...

2. ...leaves the quantity demanded unchanged.
Inelastic Demand
- Elasticity is less than 1

1. A 22% increase in price...

2. ...leads to a 11% decrease in quantity.
Unit Elastic Demand
- Elasticity equals 1

1. A 22% increase in price...

2. ...leads to a 22% decrease in quantity.
Elastic Demand
- Elasticity is greater than 1

1. A 22% increase in price...

2. ...leads to a 67% decrease in quantity.
Perfectly Elastic Demand
- Elasticity equals infinity

1. At any price above $4, quantity demanded is zero.
2. At exactly $4, consumers will buy any quantity.
3. At a price below $4, quantity demanded is infinite.
Elasticity and Total Revenue

- **Total revenue** is the amount paid by buyers and received by sellers of a good.
- Computed as the price of the good times the quantity sold.

\[ TR = P \times Q \]
Elasticity and Total Revenue

\[ P \times Q = $400 \]  
(total revenue)
Elasticity and Total Revenue

With an inelastic demand curve, an increase in price leads to a decrease in quantity that is proportionately smaller. Thus, total revenue increases.
Elasticity and Total Revenue: Inelastic Demand

An increase in price from $1 to $3...

...leads to an increase in total revenue from $100 to $240

Price

$1

$3

0

100

Demand

Quantity

Revenue = $100

Revenue = $240

Price

0

80

Demand

Quantity

Revenue

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Elasticity and Total Revenue

With an elastic demand curve, an increase in the price leads to a decrease in quantity demanded that is proportionately larger. Thus, total revenue decreases.
Elasticity and Total Revenue: Elastic Demand

An increase in price from $4 to $5...

...leads to a decrease in total revenue from $200 to $100
## Computing the Elasticity of a Linear Demand Curve

<table>
<thead>
<tr>
<th>Price</th>
<th>Quantity</th>
<th>Total Revenue (Price x Quantity)</th>
<th>Percent Change in Price</th>
<th>Percent Change in Quantity</th>
<th>Elasticity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>14</td>
<td>$0</td>
<td>200%</td>
<td>15%</td>
<td>0.1</td>
<td>Inelastic</td>
</tr>
<tr>
<td>1</td>
<td>12</td>
<td>12</td>
<td>67</td>
<td>18</td>
<td>0.3</td>
<td>Inelastic</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>20</td>
<td>40</td>
<td>22</td>
<td>0.6</td>
<td>Inelastic</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>24</td>
<td>29</td>
<td>29</td>
<td>1</td>
<td>Unit elastic</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>24</td>
<td>22</td>
<td>40</td>
<td>1.8</td>
<td>Elastic</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>20</td>
<td>18</td>
<td>67</td>
<td>3.7</td>
<td>Elastic</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>12</td>
<td>15</td>
<td>200</td>
<td>13</td>
<td>Elastic</td>
</tr>
</tbody>
</table>

| 7     | 0        | 0                                | 0                       | 0                         | 0          | Inelastic   |
Income Elasticity of Demand

- **Income elasticity of demand** measures how much the quantity demanded of a good responds to a change in consumers’ income.
- It is computed as the percentage change in the quantity demanded divided by the percentage change in income.
Computing Income Elasticity

Income Elasticity of Demand = \frac{\text{Percentage Change in Quantity Demanded}}{\text{Percentage Change in Income}}
Income Elasticity  
- Types of Goods -

- Normal Goods
- Inferior Goods

Higher income *raises* the quantity demanded for *normal goods* but *lowers* the quantity demanded for *inferior goods.*
Income Elasticity
- Types of Goods -

- Goods consumers regard as necessities tend to be *income inelastic*. Examples include food, fuel, clothing, utilities, and medical services.

- Goods consumers regard as luxuries tend to be *income elastic*. Examples include sports cars, furs, and expensive foods.
Price Elasticity of Supply

- Price elasticity of supply is the percentage change in quantity supplied resulting from a percent change in price.
- It is a measure of how much the quantity supplied of a good responds to a change in the price of that good.
Ranges of Elasticity

- **Perfectly Elastic**
  \[ E_S = \infty \]

- **Relatively Elastic**
  \[ E_S > 1 \]

- **Unit Elastic**
  \[ E_S = 1 \]
Ranges of Elasticity

- Relatively Inelastic
  \[ E_s < 1 \]

- Perfectly Inelastic
  \[ E_s = 0 \]
Perfectly Inelastic Supply
- Elasticity equals 0

1. An increase in price...

2. ...leaves the quantity supplied unchanged.
Inelastic Supply
- Elasticity is less than 1

1. A 22% increase in price...

2. ...leads to a 10% increase in quantity.

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1. A 22% increase in price...

2. ...leads to a 22% increase in quantity.
Elastic Supply
- Elasticity is greater than 1

1. A 22% increase in price...
2. ...leads to a 67% increase in quantity.
Perfectly Elastic Supply
- Elasticity equals infinity

1. At any price above $4, quantity supplied is infinite.

2. At exactly $4, producers will supply any quantity.

3. At a price below $4, quantity supplied is zero.
Determinants of Elasticity of Supply

◆ Ability of sellers to change the amount of the good they produce.
  ◆ Beach-front land is inelastic.
  ◆ Books, cars, or manufactured goods are elastic.

◆ Time period.
  ◆ Supply is more elastic in the long run.
Computing the Price Elasticity of Supply

The price elasticity of supply is computed as the percentage change in the quantity supplied divided by the percentage change in price.

\[
\text{Elasticity of Supply} = \frac{\text{Percentage Change in Quantity Supplied}}{\text{Percentage Change in Price}}
\]
Application of Elasticity

- Can good news for farming be bad news for farmers?
- What happens to wheat farmers and the market for wheat when university agronomists discover a new wheat hybrid that is more productive than existing varieties?
Application of Elasticity

- Examine whether the supply or demand curve shifts.
- Determine the direction of the shift of the curve.
- Use the supply-and-demand diagram to see how the market equilibrium changes.
An Increase in Supply in the Market for Wheat

Price of Wheat

Demand

$3

0 100

Quantity of Wheat

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3. ...and a proportionately smaller increase in quantity sold. As a result, revenue falls from $300 to $220.

1. When demand is inelastic, an increase in supply...

2. ...leads to a large fall in price...
Compute Elasticity

\[
E_D = \frac{100 - 110}{3.00 - 2.00} \approx \frac{(100 + 110)/2}{(3.00 + 2.00)/2}
\]

\[
= \frac{-0.095}{0.4} \approx -0.24
\]
Compute Elasticity

\[ E_D = \frac{100 - 110}{3.00 - 2.00} \div \left( \frac{(100 + 110)/2}{(3.00 + 2.00)/2} \right) \]

\[ = \frac{-0.095}{0.4} \approx -0.24 \]

*Demand is inelastic*
Summary

- Price elasticity of demand measures how much the quantity demanded responds to changes in the price.
- If a demand curve is elastic, total revenue falls when the price rises.
- If it is inelastic, total revenue rises as the price rises.
Summary

- The price elasticity of supply measures how much the quantity supplied responds to changes in the price.
- In most markets, supply is more elastic in the long run than in the short run.
Graphical Review
Computing the Price Elasticity of Demand

Demand is price elastic

\[ E_D = \frac{\frac{(100-50)}{(4.00-5.00)}}{\frac{(100+50)/2}{(4.00+5.00)/2}} \]

= 67% increase

= -22% decrease

\[ = -3 \]
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- Elasticity equals 0

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$P \times Q = $400

(total revenue)
Elasticity and Total Revenue: Inelastic Demand

An increase in price from $1 to $3...

…leads to an increase in total revenue from $100 to $240
Elastic Demand

An increase in price from $4 to $5...

...leads to a decrease in total revenue from $200 to $100

Revenue = $200

Revenue = $100
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- Elasticity equals 0

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Inelastic Supply
- Elasticity is less than 1

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Price of Wheat

$3

0 100

Quantity of Wheat

Demand
An Increase in Supply in the Market for Wheat

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