5.E: Elasticity (Exercises)

5.1: Price Elasticity of Demand and Price Elasticity of Supply

Self-Check Questions

Q1

From the data shown in Table below about demand for smart phones, calculate the price elasticity of demand from: point (B) to point (C), point (D) to point (E), and point (G) to point (H). Classify the elasticity at each point as elastic, inelastic, or unit elastic.

<table>
<thead>
<tr>
<th>Points</th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>60</td>
<td>3,000</td>
</tr>
<tr>
<td>B</td>
<td>70</td>
<td>2,800</td>
</tr>
<tr>
<td>C</td>
<td>80</td>
<td>2,600</td>
</tr>
<tr>
<td>D</td>
<td>90</td>
<td>2,400</td>
</tr>
</tbody>
</table>
Points | P | Q
---|---|---
E | 100 | 2,200
F | 110 | 2,000
G | 120 | 1,800
H | 130 | 1,600

Q2

From the data shown in Table below about supply of alarm clocks, calculate the price elasticity of supply from: point \(J\) to point \(K\), point \(L\) to point \(M\), and point \(N\) to point \(P\). Classify the elasticity at each point as elastic, inelastic, or unit elastic.

<table>
<thead>
<tr>
<th>Point</th>
<th>Price</th>
<th>Quantity Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>$8</td>
<td>50</td>
</tr>
<tr>
<td>K</td>
<td>$9</td>
<td>70</td>
</tr>
<tr>
<td>L</td>
<td>$10</td>
<td>80</td>
</tr>
<tr>
<td>M</td>
<td>$11</td>
<td>88</td>
</tr>
<tr>
<td>N</td>
<td>$12</td>
<td>95</td>
</tr>
<tr>
<td>P</td>
<td>$13</td>
<td>100</td>
</tr>
</tbody>
</table>

Review Questions

Q3

What is the formula for calculating elasticity?
Q4
What is the price elasticity of demand? Can you explain it in your own words?

Q5
What is the price elasticity of supply? Can you explain it in your own words?

Critical Thinking Questions

Q6
Transatlantic air travel in business class has an estimated elasticity of demand of \((0.40)\) less than transatlantic air travel in economy class, with an estimated price elasticity of \((0.62)\). Why do you think this is the case?

Q7
What is the relationship between price elasticity and position on the demand curve? For example, as you move up the demand curve to higher prices and lower quantities, what happens to the measured elasticity? How would you explain that?

Problems

Q8
The equation for a demand curve is \(P = 48 - 3Q\). What is the elasticity in moving from a quantity of \((5)\) to a quantity of \((6)\)?

Q9
The equation for a demand curve is \(P = \frac{2}{Q}\). What is the elasticity of demand as price falls from \((5)\) to \((4)\)? What is the elasticity of demand as the price falls from \((9)\) to \((8)\)? Would you expect these answers to be the same?

Q10
The equation for a supply curve is \(4P = Q\). What is the elasticity of supply as price rises from \((3)\) to \((4)\)? What is the elasticity of supply as the price rises from \((7)\) to \((8)\)? Would you expect these answers to be the same?
Q11

The equation for a supply curve is \(P = 3Q - 8\). What is the elasticity in moving from a price of \(4\) to a price of \(7\)?

Solution

S1

From point \(B\) to point \(C\), price rises from \($70\) to \($80\), and \(Q_d\) decreases from \(2,800\) to \(2,600\). So:

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{2600-2800}{(2600+2800)\div 2}\times 100 \quad \&= \frac{-200}{2700}\times 100 \\
&= -7.41 \\
\% \text{ change in price} &= \frac{80-70}{(80+70)\div 2}\times 100 \quad \&= \frac{10}{75}\times 100 \\
&= 13.33
\end{align*}
\]

\[
\begin{align*}
\text{Elasticity of Demand} &= \frac{-7.41\%}{13.33\%} \\
&= 0.56
\end{align*}
\]

The demand curve is inelastic in this area; that is, its elasticity value is less than one.

Answer from Point \(D\) to point \(E\):

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{2200-2400}{(2200+2400)\div 2}\times 100 \quad \&= \frac{-200}{2300}\times 100 \\
&= -8.7 \\
\% \text{ change in price} &= \frac{100-90}{(100+90)\div 2}\times 100 \quad \&= \frac{10}{95}\times 100 \\
&= 10.53
\end{align*}
\]

\[
\begin{align*}
\text{Elasticity of Demand} &= \frac{-8.7\%}{10.53\%} \\
&= 0.83
\end{align*}
\]

The demand curve is inelastic in this area; that is, its elasticity value is less than one.

Answer from Point \(G\) to point \(H\):

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{1600-1800}{1700}\times 100 \quad \&= \frac{-200}{1700}\times 100 \\
&= -11.76 \\
\% \text{ change in price} &= \frac{130-120}{125}\times 100 \quad \&= \frac{10}{125}\times 100 \\
&= 8.00
\end{align*}
\]

\[
\begin{align*}
\text{Elasticity of Demand} &= \frac{-11.76\%}{8.00\%} \\
&= -1.47
\end{align*}
\]

The demand curve is elastic in this interval.
From point \(J\) to point \(K\), price rises from \(\$8\) to \(\$9\), and quantity rises from \(50\) to \(70\). So:

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{70-50}{(70+50)\div 2}\times 100 \\
&= \frac{20}{60}\times 100 \\
&= 33.33 \\
\% \text{ change in price} &= \frac{\$9-\$8}{(\$9+\$8)\div 2}\times 100 \\
&= \frac{1}{8.5}\times 100 \\
&= 11.76 \\
\text{Elasticity of Supply} &= \frac{33.33\%}{11.76\%} \\
&= 2.83
\end{align*}
\]

The supply curve is elastic in this area; that is, its elasticity value is greater than one.

From point \(L\) to point \(M\), the price rises from \(\$10\) to \(\$11\), while \(Q_s\) rises from \(80\) to \(88\):

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{88-80}{(88+80)\div 2}\times 100 \\
&= \frac{8}{84}\times 100 \\
&= 9.52 \\
\% \text{ change in price} &= \frac{\$11-\$10}{(\$11+\$10)\div 2}\times 100 \\
&= \frac{1}{10.5}\times 100 \\
&= 9.52 \\
\text{Elasticity of Demand} &= \frac{9.52\%}{9.52\%} \\
&= 1.0
\end{align*}
\]

The supply curve has unitary elasticity in this area.

From point \(N\) to point \(P\), the price rises from \(\$12\) to \(\$13\), and \(Q_s\) rises from \(95\) to \(100\):

\[
\begin{align*}
\% \text{ change in quantity} &= \frac{100-95}{(100+95)\div 2}\times 100 \\
&= \frac{5}{97.5}\times 100 \\
&= 5.13 \\
\% \text{ change in price} &= \frac{\$13-\$12}{(\$13+\$12)\div 2}\times 100 \\
&= \frac{1}{12.5}\times 100 \\
&= 8.0 \\
\text{Elasticity of Supply} &= \frac{5.13\%}{8.0\%} \\
&= 0.64
\end{align*}
\]

The supply curve is inelastic in this region of the supply curve.

### 5.2: Polar Cases of Elasticity and Constant Elasticity

**Self-Check Questions**

https://socialsci.libretexts.org/Bookshelves/Economics/Book%3A_Microeconomics_(OpenStax)/05%3A_Elasticity/5.E%3A_Elasticity/5.2_Polar_Cases_of_Elasticity_and_Constant_Elasticity

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Q1

Why is the demand curve with constant unitary elasticity concave?

Q2

Why is the supply curve with constant unitary elasticity a straight line?

Review Questions

Q3

Describe the general appearance of a demand or a supply curve with zero elasticity.

Q4

Describe the general appearance of a demand or a supply curve with infinite elasticity.

Critical Thinking Questions

Q5

Can you think of an industry (or product) with near infinite elasticity of supply in the short term? That is, what is an industry that could increase Qs almost without limit in response to an increase in the price?

Problems

Q6

The supply of paintings by Leonardo Da Vinci, who painted the Mona Lisa and The Last Supper and died in 1519, is highly inelastic. Sketch a supply and demand diagram, paying attention to the appropriate elasticities, to illustrate that demand for these paintings will determine the price.
Q7

Say that a certain stadium for professional football has \((70,000)\) seats. What is the shape of the supply curve for tickets to football games at that stadium? Explain.

Q8

When someone’s kidneys fail, the person needs to have medical treatment with a dialysis machine (unless or until they receive a kidney transplant) or they will die. Sketch a supply and demand diagram, paying attention to the appropriate elasticities, to illustrate that the supply of such dialysis machines will primarily determine the price.

Solution

S1

The demand curve with constant unitary elasticity is concave because at high prices, a one percent decrease in price results in more than a one percent increase in quantity. As we move down the demand curve, price drops and the one percent decrease in price causes less than a one percent increase in quantity.

S2

The constant unitary elasticity is a straight line because the curve slopes upward and both price and quantity are increasing proportionally.

5.3: Elasticity and Pricing

Self-Check Questions

Q1

The federal government decides to require that automobile manufacturers install new anti-pollution equipment that costs \((2,000)\) per car. Under what conditions can carmakers pass almost all of this cost along to car buyers? Under what conditions can carmakers pass very little of this cost along to car buyers?
Q2

Suppose you are in charge of sales at a pharmaceutical company, and your firm has a new drug that causes bald men to grow hair. Assume that the company wants to earn as much revenue as possible from this drug. If the elasticity of demand for your company’s product at the current price is \(1.4\), would you advise the company to raise the price, lower the price, or to keep the price the same? What if the elasticity were \(0.6\)? What if it were 1? Explain your answer.

Review Questions

Q3

If demand is elastic, will shifts in supply have a larger effect on equilibrium quantity or on price?

Q4

If demand is inelastic, will shifts in supply have a larger effect on equilibrium price or on quantity?

Q5

If supply is elastic, will shifts in demand have a larger effect on equilibrium quantity or on price?

Q6

If supply is inelastic, will shifts in demand have a larger effect on equilibrium price or on quantity?

Q7

Would you usually expect elasticity of demand or supply to be higher in the short run or in the long run? Why?

Q8

Under which circumstances does the tax burden fall entirely on consumers?

Critical Thinking Questions

https://socialsci.libretexts.org/Bookshelves/Economics/Book%3A_Microeconomics_(OpenStax)/05%3A_Elasticity/5.E%3A_Elasticity
Q9

Would you expect supply to play a more significant role in determining the price of a basic necessity like food or a luxury like perfume? Explain. *Hint:* Think about how the price elasticity of demand will differ between necessities and luxuries.

Q10

A city has built a bridge over a river and it decides to charge a toll to everyone who crosses. For one year, the city charges a variety of different tolls and records information on how many drivers cross the bridge. The city thus gathers information about elasticity of demand. If the city wishes to raise as much revenue as possible from the tolls, where will the city decide to charge a toll: in the inelastic portion of the demand curve, the elastic portion of the demand curve, or the unit elastic portion? Explain.

Q11

In a market where the supply curve is perfectly inelastic, how does an excise tax affect the price paid by consumers and the quantity bought and sold?

Problems

Q12

Assume that the supply of low-skilled workers is fairly elastic, but the employers' demand for such workers is fairly inelastic. If the policy goal is to expand employment for low-skilled workers, is it better to focus on policy tools to shift the supply of unskilled labor or on tools to shift the demand for unskilled labor? What if the policy goal is to raise wages for this group? Explain your answers with supply and demand diagrams.

Solution

S1

Carmakers can pass this cost along to consumers if the demand for these cars is inelastic. If the demand for these cars is elastic, then the manufacturer must pay for the equipment.
If the elasticity is \(1.4\) at current prices, you would advise the company to lower its price on the product, since a decrease in price will be offset by the increase in the amount of the drug sold. If the elasticity were \(0.6\), then you would advise the company to increase its price. Increases in price will offset the decrease in number of units sold, but increase your total revenue. If elasticity is 1, the total revenue is already maximized, and you would advise that the company maintain its current price level.

5.4: Elasticity in Areas Other Than Price

Self-Check Questions

Q1
What would the gasoline price elasticity of supply mean to UPS or FedEx?

Q2
The average annual income rises from \(\$25,000\) to \(\$38,000\), and the quantity of bread consumed in a year by the average person falls from \(30\) loaves to \(22\) loaves. What is the income elasticity of bread consumption? Is bread a normal or an inferior good?

Q3
Suppose the cross-price elasticity of apples with respect to the price of oranges is \(0.4\), and the price of oranges falls by \(3\%\). What will happen to the demand for apples?

Review Questions

Q4
What is the formula for the income elasticity of demand?
Q5
What is the formula for the cross-price elasticity of demand?

Q6
What is the formula for the wage elasticity of labor supply?

Q7
What is the formula for elasticity of savings with respect to interest rates?

Critical Thinking Questions

Q8
Normal goods are defined as having a positive income elasticity. We can divide normal goods into two types: Those whose income elasticity is less than one and those whose income elasticity is greater than one. Think about products that would fall into each category. Can you come up with a name for each category?

Q9
Suppose you could buy shoes one at a time, rather than in pairs. What do you predict the cross-price elasticity for left shoes and right shoes would be?

Solution

S1
The percentage change in quantity supplied as a result of a given percentage change in the price of gasoline.

S2

\[
\text{Percentage change in quantity demanded} \quad &= \quad \left(\frac{\text{change in quantity}}{\text{original quantity}}\right) \times 100
\]

\[
&= \frac{22 - 30}{(22 + 30)/2} \times 100
\]

\[
&= -8/26 \times 100
\]
\[
\begin{align*}
100 \ &= -30.77 \\
\text{Percentage change in income} \ &= \left(\frac{\text{change in income}}{\text{original income}}\right) \times 100 \ &= \left[\frac{38,000 - 25,000}{(38,000 + 25,000)/2}\right] \times 100 \ &= \frac{13}{31.5} \times 100 \ &= 41.27
\end{align*}
\]

In this example, bread is an inferior good because its consumption falls as income rises.

**S3**

The formula for cross-price elasticity is \((\% \text{ change in } Q_d \text{ for apples} / \% \text{ change in } P \text{ of oranges})\). Multiplying both sides by \((\% \text{ change in } P \text{ of oranges})\) yields:

\[
\% \text{ change in } Q_d \text{ for apples} = \text{cross-price elasticity} \times \% \text{ change in } P \text{ of oranges}
\]

\[
= 0.4 \times (-3\%) = -1.2\%
\]

or a \(-1.2\%) decrease in demand for apples.

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**Contributor**

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