Elasticity

The notion of elasticity

- The critical question: how responsive is the quantity demanded to changes in price?
The notion of elasticity

- The critical question: how responsive is the quantity demanded to changes in price?
- And how do we measure that?

A Definition, Sort of

- We represent that by the price elasticity of demand

\[ \eta \]

the ratio of the percentage change in quantity demanded to the percent change in price

An Illustration

\[ Q = 100 - 2P \]

\[
\begin{align*}
Q &= 100 - 2(20) = 60 \\
Q &= 100 - 2(18) = 64
\end{align*}
\]

New v. Old

But which is the new price and which is the old price? And does it make a difference?

Yes, let's do the calculation assuming the price goes from 20 to 18 and then from 18 to 20?
Going from 20 to 18

\[ \eta = \frac{\text{Percent Change in Quantity}}{\text{Percent Change in Price}} \]

\[ \frac{\text{New Price} - \text{Old Price}}{\text{Old Price}} = \frac{18 - 20}{20} = \frac{-2}{20} = -10\% \]

\[ \frac{\text{New Quantity} - \text{Old Quantity}}{\text{Old Quantity}} = \frac{64 - 60}{60} = \frac{4}{60} = 6.7\% \]

Going from 20 to 18

\[ \eta = \frac{6.7\%}{-10\%} = -0.67 \]

\[ \frac{\text{New Price} - \text{Old Price}}{\text{Old Price}} = \frac{18 - 20}{20} = \frac{-2}{20} = -10\% \]

\[ \frac{\text{New Quantity} - \text{Old Quantity}}{\text{Old Quantity}} = \frac{64 - 60}{60} = \frac{4}{60} = 6.7\% \]

Going from 18 to 20

\[ \eta = \frac{\text{Percent Change in Quantity}}{\text{Percent Change in Price}} \]

\[ \frac{\text{New Price} - \text{Old Price}}{\text{Old Price}} = \frac{20 - 18}{18} = \frac{2}{18} = 11.1\% \]

\[ \frac{\text{New Quantity} - \text{Old Quantity}}{\text{Old Quantity}} = \frac{60 - 64}{64} = \frac{-4}{64} = -6.25\% \]
Going from 18 to 20

\[ \eta = \frac{-6.25\%}{11.1\%} = -0.563 \]

\[
\begin{array}{c|c}
\text{NewPrice} & \text{OldPrice} \\
\hline
20 & 18 \\
\hline
\end{array}
\]

\[
\begin{array}{c|c}
\text{NewQuantity} & \text{OldQuantity} \\
\hline
60 & 64 \\
\hline
\end{array}
\]

So what is it?

\[ \eta = \frac{6.7\%}{-10\%} = -0.67 \quad \eta = \frac{-6.25\%}{11.1\%} = -0.563 \]

Two computational methods

• Point Elasticity of Demand
• Arc Elasticity of Demand

Point Elasticity of Demand

• Defined by

\[ \eta = \frac{\text{Slope}}{\frac{\text{Price}}{\text{Quantity}}} \]

where Slope is the slope of the demand function

In the case of a linear demand function

\[ Q = a - bP \]

The slope is \(-b\)

Computing the Point Elasticity

\[ \eta = \frac{\text{Slope}}{\frac{\text{Price}}{\text{Quantity}}} \]

Elasticity

Computing the Point Elasticity

\[ \eta = \frac{\text{Slope}}{\text{Price} - \text{Quantity}} \]

Slope = -2

Computing at Q = 60

\[ \eta = \frac{\text{Slope}}{\text{Price} - \text{Quantity}} \]

Slope = -2

\[ \eta = \frac{-2 \times 20}{60} = -0.67 \]

Computing at Q = 64

\[ \eta = \frac{\text{Slope}}{\text{Price} - \text{Quantity}} \]

Slope = -2

\[ \eta = \frac{-2 \times 18}{64} = -0.5625 \]

A Problem

Compute the point price elasticity of demand at

\( P = 25 \) and \( P = 35 \)

When \( P = 25 \), \( \eta = -1 \)

When \( P = 35 \), \( \eta = -2.333 \)

A Problem

\[ \eta = \frac{\text{Slope}}{\text{Price} - \text{Quantity}} \]

Slope = -2

Compute the point price elasticity of demand at

\( P = 25 \) and \( P = 35 \)

For a straight line demand curve \( \eta \) will vary over the demand curve
Elasticity along the Demand Function

\[ \eta = \frac{\text{Slope} \cdot \text{Price}}{\text{Quantity}} \]

- When the curve hits the price axis, \( \eta = -\infty \)
- When the curve hits the quantity axis, \( \eta = 0 \)
- At the midpoint, \( \eta = -1 \)

Next Lecture

- Arc Elasticity
- Extensions

End

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