

Elasticity

by
Geoffrey T Andron
Rev 10-8-06

Calculating impact of change in causal variables --elasticities

- Use a table relating the causal to the affected variable.
- Use a graph of the same.
- Use a math formula for the relationship
- Use slope arithmetic.
- Use elasticity arithmetic.

©2006 Geoffrey Teetor Andron

Definition of “Elasticity”

- The percentage change in the “affected” variable divided by the percentage change in the “causal” variable which led to the effect.

In symbols:

$$\frac{\% \text{ Change in Affected Variable}}{\% \text{ Change in Causal Variable}}$$

©1998 Geoffrey Teetor Andron

Why is elasticity an important and useful concept?

If you know an elasticity, it is very easy to calculate the real world effect from a specific change in that causal variable.

©1998 Geoffrey Teetor Andron

What are some of the different types of elasticities used by economists?

- Demand elasticities
 - Own price elasticities.
 - Cross price elasticities.
 - Income elasticities.
- Supply elasticities
 - Own price elasticities.
 - Input price elasticities.
 - Factor price elasticities.

©1998 Geoffrey Teetor Andron

Examples of Proper Elasticity Language (Slide 1 of 2) (“y” is the affected, and “x” the causal, variable)

- “The x elasticity of y”, example --“price elasticity of demand”
- “Y is very x elastic”, example --“demand is very price elastic”
- “Y is x inelastic”, example --“demand is income inelastic”

©2006 Geoffrey Teetor Andron

Examples of Proper Elasticity Language (Slide 2 of 2)
 (“y” is the affected, and “x” the causal, variable)

- “Y is unit elastic”, example --“supply is unit elastic”
- “The x elasticity of y is one”, example --“the cross price elasticity of demand is one”
- “The x elasticity of y is large (or small)”
- “The x elasticity of y is 2.4”, example --“the income elasticity of demand is 2.4”

©2006 Geoffrey Teetor Andron

Shortcomings of elasticities and their use in calculations:

Shortcoming I: There are two elasticities, one for increases in the causal variable and one for decreases! (The solution in the text? Calculate “arc elasticity”, which is a kind of average of the two. Don’t do this—It is sure to always get incorrect answer!)

Shortcoming II: Real world elasticities for large changes in causal variables are often different than elasticities for small changes. Solution: Use an appropriate elasticity!

©2006 Geoffrey Teetor Andron

Example of Shortcoming I (Slide 1 of 2)

“Increase elasticity” is different from “decrease elasticity”.

Affected variable (q)	1500	1000
Causal variable (p)	50	100

Impact of increase p from 50 up to 100:

The % change in q is

$$100 * ((1000 - 1500) / 1500) = -33.33\%$$

The % change in p is

$$100 * ((100 - 50) / 50) = 100\%$$

So: the elasticity is $-33.333\% / 100\% = -.3333$.

©2006 Geoffrey Teetor Andron

(Slide 2 of 2:) Now look at the “decrease elasticity” for the same example:

Affected variable (q)	1500	1000
Causal variable (p)	50	100

Impact of decrease p from 100 back to 50:

The % change in q is

$$100 * ((1500 - 1000) / 1000) = 50\%$$

The % change in p is

$$100 * ((50 - 100) / 100) = -50\%$$

So the elasticity is $50\% / -50\% = -1.00$

Conclusion: Different elasticity for increases than for decreases, -0.333 versus -1.00 .

©2006 Geoffrey Teetor Andron

Which elasticity should we use? Well, the textbook tells you, “Use neither one. Instead calculate an average of the two.”

--Sometimes called “arc elasticity”. See definition and examples on next three slides.

(BUT DON’T DO IT! IT’S GOOFY, because it guarantees wrong answer every time!)

©2006 Geoffrey Teetor Andron

Definition:

The Midpoint Formula:

change in affected variable
divided by

(sum of affected quantities/2)

DIVIDED BY

change in causal variable
 divided by

(sum of causals/2)

©2006 Geoffrey Teetor Andron

How does the textbook solution work for an increase?

Affected variable (q)	1500	1000
Causal variable (p)	50	100

For the increase:

The % change in q is

$$100 * ((1000 - 1500) / ((1000 + 1500) / 2)) = -40\%$$

The % change in p is

$$100 * ((100 - 50) / ((100 + 50) / 2)) = +66.66\%$$

So the elasticity is $-40\% / +66.66\% = -.600$

Trouble is, if you use this elasticity you get the wrong answer, since correct elasticity is $-.333!$

©2004 Geoffrey Teetor Andron

How does the textbook solution work for a decrease?

Affected variable (q)	1500	1000
Causal variable (p)	50	100

For the decrease:

The % change in q is

$$100 * ((1500 - 1000) / ((1000 + 1500) / 2)) = 40\%$$

The % change in p is

$$100 * ((50 - 100) / ((100 + 50) / 2)) = -66.66\%$$

So the elasticity is $40\% / -66.66\% = -.600$ --same as for an increase!

Only trouble is, if you use it you get the wrong answer, since the correct elasticity is $-1.00!$

©2006 Geoffrey Teetor Andron

What is the proper thing to do?

If the % change in the causal is small, say 20% or less, you get almost the same answer whatever you do. So:

--Use either increase, decrease or arc elasticity!

--But if the % change is large, use the "increase elasticity" for increases in causal variable, and the "decrease elasticity" for decreases in it.

©2006 Geoffrey Teetor Andron

Now let's take a look at some particular types of elasticities.

First,

"Own price elasticities of demand", also called "demand elasticities".

©1998 Geoffrey Teetor Andron

The Own Price Elasticity of Demand is:

% change in quantity demanded

divided by

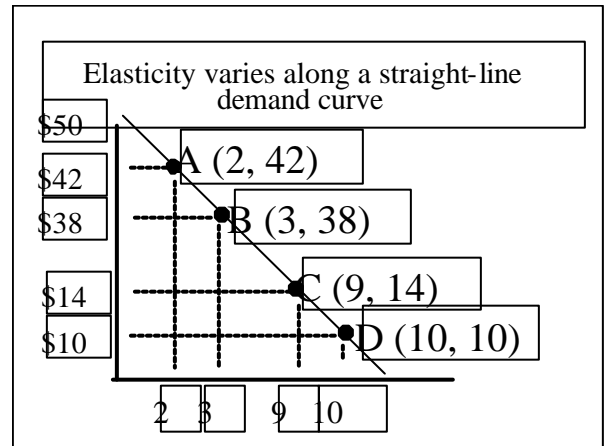
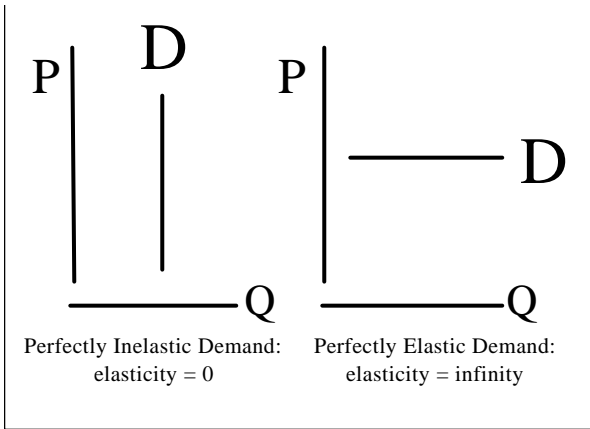
% change in price:

$$E^D = \% \blacktriangle Q^D / \% \blacktriangle P$$

©1998 Geoffrey Teetor Andron

Own price demand elasticities are negative, but when talking about them we economists they are positive. We do this for convenience.

©2006 Geoffrey Teetor Andron



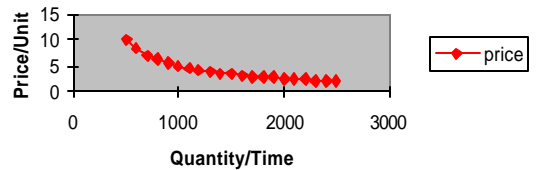
What does a demand curve look like which has:

- 1) A unit price elasticity?
- 2) A price elasticity greater than one?
- 3) A price elasticity less than one?

©2004 Geoffrey Teetor Andron

“Unit Elastic” Demand (Revenue Doesn’t Change)

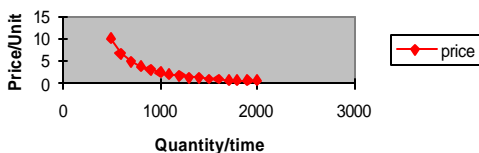
"Unit" Own Price Elasticity of Demand



©1998 Geoffrey Teetor Andron

“Elastic” Demand (Revenue Changes With Price)

"Elastic" Own Price Elasticity of Demand



©1998 Geoffrey Teetor Andron

What determines the price Elasticity of Demand?

Number and closeness of substitutes

Consumers’ budgets

Time

©1998 Geoffrey Teetor Andron

What is Income Elasticity of Demand?

- The percentage change in the quantity demanded caused by a percent change in total money income.

©2006 Geoffrey Teetor Andron

Economists classify goods by size and sign of the income elasticity of demand:

- Negative income elasticity—called an “inferior good”
- Positive income elasticity—called a “normal good”
- Income elasticity positive **and also** equal to one or less--called a “necessity”
- Income elasticity positive **and also** larger than one--called a “luxury good”

©2006 Geoffrey Teetor Andron

What is Cross Price Elasticity of Demand?

- The percentage change in the quantity demanded of one commodity resulting from a 1 percent change in price of another commodity.

©1998 Geoffrey Teetor Andron

Cross Price Elasticities of Demand

If the cross price elasticity is negative, the goods are *complements* (steak & steak sauce)

If the cross price elasticity is positive, the goods are *substitutes* (butter & margarine)

©2006 Geoffrey Teetor Andron

New Topic: Supply Elasticities. Definition of the “Own Price Elasticity of Supply”:

The percentage change in the quantity supplied of a good or service caused by a percentage change in its price. Next slide gives definition in symbols.

©2006 Geoffrey Teetor Andron

Price Elasticity of Supply equals:

% change in quantity supplied
DIVIDED BY

% change in price

$$E^S = \% \frac{\Delta Q^S}{\Delta P}$$

©1998 Geoffrey Teetor Andron

Summary Elasticity Concepts to Know About:

What is elasticity? Definition.

Once you know the elasticity, how to use it in a calculation.

- Two difficulties with using elasticities in problems and how to overcome them.

Different types of elasticity.

- Demand elasticities
 - Own price
 - Income
 - Cross Price
- Supply elasticity

©2004 Geoffrey Teetor Andron

Summary continued..

Language used to refer to elasticities.

Detailed look at own price elasticities of demand.

- Definitions elastic, unit elastic and inelastic and how changes in total revenue depend on own price elasticity of demand.
- Elasticity of vertical and horizontal demand curves.

©2004 Geoffrey Teetor Andron

Summary continued..

- Along a textbook, downward sloping, straight line demand curve, demand is elastic at high prices and inelastic at low prices.

Income elasticities and cross price elasticities of demand.

Own price elasticity of supply.

©2004 Geoffrey Teetor Andron