Elasticity

February 1, 2007

Reading: Chapter 5

Elasticity

a. Definition
b. Measurement
c. Interpretation
d. Other demand elasticities
e. Price elasticity of supply
f. Applications

Definition

General

Y depends on *X*

How much does *Y* change when *X* changes? How responsive is *Y* to a change in *X*?

Suppose *X* changes from 8 to 10 which makes *Y* change from 30 to 34. $\Delta Y = 24 - 20 = 4$ and $\Delta X = 10 - 8 = 2$. Measure of response $\Delta Y / \Delta X = 4/2 = 2$

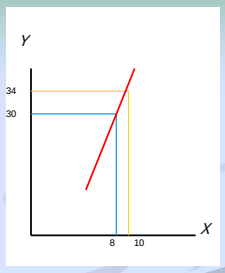
Measure affected by scale of measurement.

So responsiveness measured by elasticity:

% change in *Y* / % change in *X*

[(4/20) x 100]/[(2/8) x 100] = 20/25 = 4/5

Called *X* elasticity of *Y*.



Definition

Price elasticity of Demand

In microeconomics most common elasticity in price elasticity of demand or quantity demanded

The **price elasticity of demand** is the ratio of the percent change in the quantity demanded to the percent change in the price

Convention: put minus sign in front, to make it positive

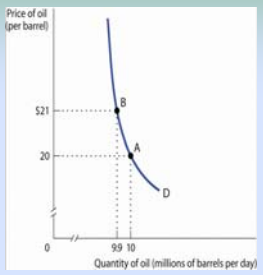
$$\text{Price elasticity of demand} = \frac{\%\text{ change in quantity demanded}}{\%\text{ change in price}}$$

Why study it? Examples of uses:

How to set price or quantity

Tax incidence

Measurement



% change in quantity demanded

-(0.1/10)x100 = 1%

% change in price

($1/$20)x100 = 5%

Price elasticity of demand

- (-1%)/5% = 0.2

Note minus sign

Using initial prices and quantities

Measurement

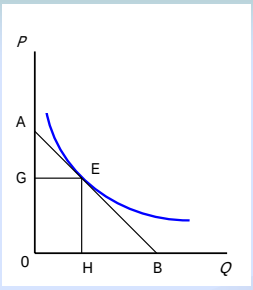
Using the Midpoint Method to Calculate Elasticities

$$\%\text{ change in } X = \frac{\text{Change in } X}{\text{Average value of } X} \times 100$$

$$\text{Average value of } X = \frac{\text{Starting value of } X + \text{final value of } X}{2}$$

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

Measurement
Graphical interpretation of point elasticity



Elasticity at point E
Elasticity = EB/AE

Elasticity
= $(\Delta Q/Q)/(\Delta P/P)$
= $(P/Q)(\Delta P/\Delta Q)$
= (0G/0H)(EH/HB)
= (0G/0H)(0G/HB)
= HB/0H
= EB/AE

Elasticity can change on a curve

Elasticity measured for a given price

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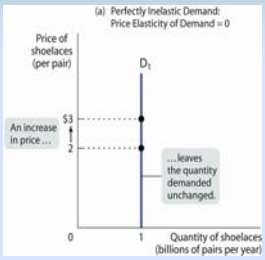
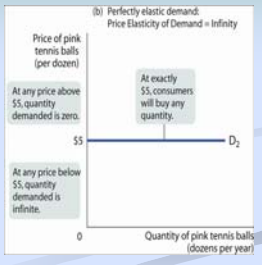
Interpretation
Different elasticity magnitudes





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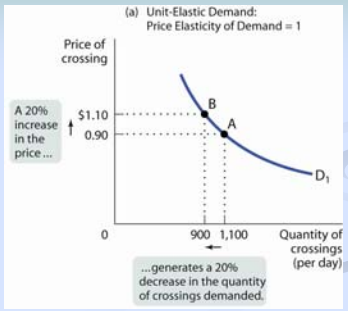
Interpretation
Different elasticity magnitudes, cont.



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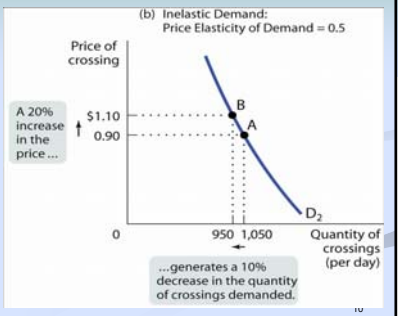
Interpretation
Different elasticity magnitudes, cont.

Inelastic demand:

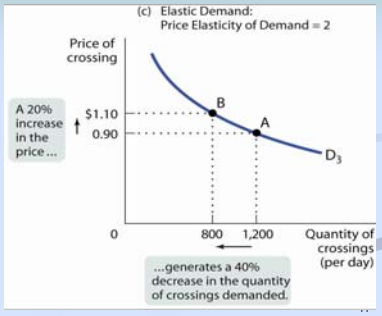
Price elasticity of demand < 1



Interpretation
Different elasticity magnitudes, cont.

Elastic demand:

Price elasticity of demand > 1



Interpretation
Some Estimated Price Elasticities of Demand

Problem with measuring price elasticity of demand:
quantity demanded depends on price as well as other variables

Good	Price elasticity	
Inelastic demand		
Eggs	0.1	Price elasticity of demand < 1
Beef	0.4	
Stationery	0.5	
Gasoline	0.5	
Elastic demand		
Housing	1.2	Price elasticity of demand > 1
Restaurant meals	2.3	
Airline travel	2.4	
Foreign travel	4.1	

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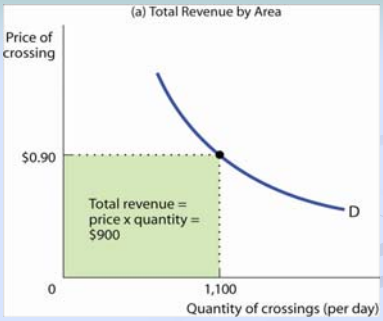
Interpretation
Elasticity and revenue



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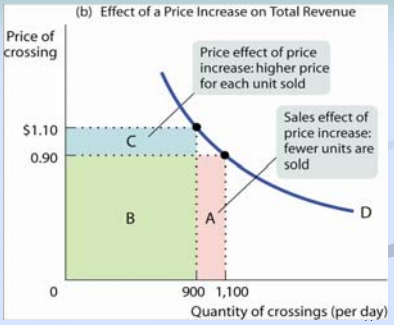
Interpretation
Elasticity and revenue, cont.

- ***A price effect:*** After a price increase, each unit sold sells at a higher price, which tends to raise revenue.
- ***A quantity or sales effect:*** After a price increase, fewer units are sold, which tends to lower revenue.



Interpretation
Elasticity and revenue, cont.

- If demand for a good is ***elastic,*** an increase in price reduces total revenue. (Quantity effect > Price effect).
- If demand for a good is ***inelastic***, a higher price increases total revenue. (Price effect > Quantity effect).
- If demand for a good is ***unit-elastic***, an increase in price does not change total revenue. (Quantity effect = Price effect).

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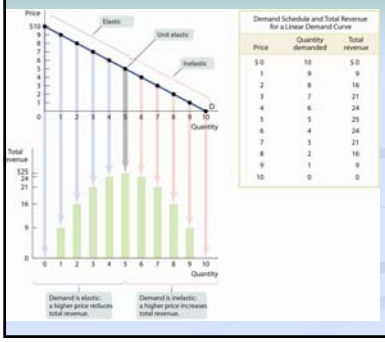
Interpretation
Linear demand curve



- Elasticity changes with price
- Less elastic as price falls
- Use point method
- Revenue rises and then falls as price falls
- Use rectangle to find revenue

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Interpretation
Factors Determining Price Elasticity of Demand

- **Whether Close Substitutes Are Available**
- **Whether the Good Is a Necessity or a Luxury**
- **Time for adjustment**

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Other Demand Elasticities

Cross-Price Elasticity

- Substitutes – negative elasticity
- Complement – positive elasticity

$$\frac{\%\ change\ in\ quantity\ of\ A\ demanded}{\%\ change\ in\ price\ of\ B}$$

Income elasticity of demand

- Normal Goods – positive elasticity
- Inferior Goods – negative elasticity

$$\frac{\%\ change\ in\ quantity\ demanded}{\%\ change\ in\ income}$$

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Price Elasticity of Supply

The **price elasticity of supply** is a measure of the responsiveness of the quantity of a good supplied to the price of that good.

$$\text{Price elasticity of supply} = \frac{\%\text{ change in quantity supplied}}{\%\text{ change in price}}$$

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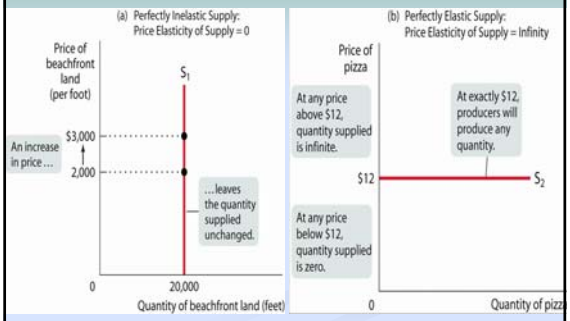
Price Elasticity of Supply



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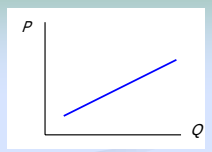
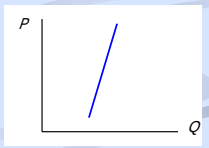
Price Elasticity of Supply

More elastic – flatter curve
Less elastic – steeper curve

Factors determining supply elasticity

- **The Availability of Inputs**
- **Time for adjustment**





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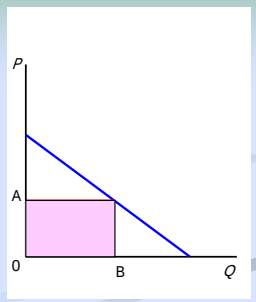
Application
Revenue maximization

- With linear demand curve revenue maximized by
  - setting price 0A
  - or quantity 0B
- Ticket price
- How much oil to pump



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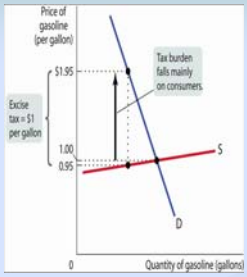
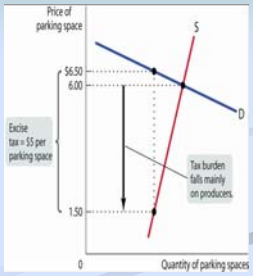
Applications
Tax incidence





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