

Chapter 3: Elasticity

- Price elasticity
 - demand
 - supply
- Cross elasticity
- Income elasticity

Basic idea

- We know when P 

Qd 

Qs 

holding other factors constant

but how much?

- if price doubles
how much does Qd fall?
 - by 10%
 - by 50%
 - by 300%?
- price elasticity tells us

I. Price Elasticity of Demand

example

- mocha latte at Starbucks
- price rises from \$3 to \$5 per cup
- Qd falls from 15 to 5 cups per hr.



equation

$$\frac{\% \text{ change in } Q_d}{\% \text{ change in } P}$$

% change in Qd

$$\frac{\text{new } Q_d - \text{initial } Q_d}{\text{average } Q_d} \times 100$$



midpoint method

example

$$\frac{5 \text{ cups} - 15 \text{ cups}}{(5+15)/2 \text{ cups}} \times 100$$

$$\frac{-10 \text{ cups}}{10 \text{ cups}} \times 100 = -100\%$$

% change in P

$$\frac{\text{new P} - \text{initial P}}{\text{average P}} \times 100$$

↑

midpoint method

example

$$\frac{\$5 - \$3}{(\$5+\$3)/2} \times 100$$

$$\frac{\$2}{\$4} \times 100 = 50\%$$

demand elasticity

$$\frac{\% \text{ change in Qd}}{\% \text{ change in P}}$$

$$\frac{-100\%}{50\%} = -2$$

- If price of latte increases 1%,
Qd of latte decreases 2%

demand elasticity

- a unit-free measure
 - compare all goods & services
- changes for different points
on the demand curve

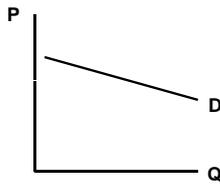
if price elasticity of demand
(absolute value)

- = 1
unit elastic
% change Qd = % change P
- > 1
elastic
% change Qd > % change P
sensitive to P changes

- < 1
inelastic
% change Qd < % change P
not sensitive to P changes

elastic demand
(>1)

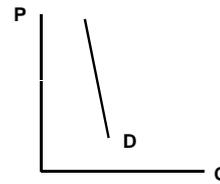
- flatter curve



small change in P
big change in Qd

inelastic demand
(<1)

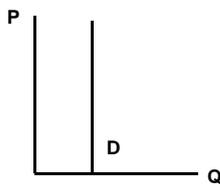
- steep curve



big change in P
small change in Qd

perfectly inelastic demand

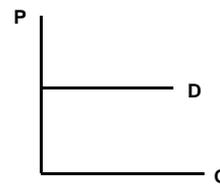
- vertical line



change in P
no change in Qd

perfectly elastic demand

- horizontal line



any change in P
Qd falls to zero

effect on total revenue

- total revenue (TR)
= $P \times Q$
- if demand is elastic,
 - TR falls as price rises
- if demand is inelastic,
 - TR rises as price rises

example: cup of latte

- initial $P = \$3$, $Q_d = 15$.
 $TR = \$3 \times 15 = \45
- new $P = \$5$, $Q_d = 5$
 $TR = \$5 \times 5 = \25
- demand for latte is elastic
TR falls as P rises

what makes demand elastic or inelastic?

1. is it a luxury or necessity
 - if luxury, demand is elastic
 - if necessity, demand is inelastic

example

- mocha latte at Starbucks is a luxury
- a liver transplant is not



2. definition of good

- latte at Starbucks,
narrow definition = many substitutes
(other brands of coffee, tea)
demand is elastic
- coffee in general,
broad definition = fewer substitutes
demand is less elastic

3. time since price change

- short time
no time to adjust,
demand is inelastic
- long time
time to adjust,
demand is elastic

example

- Price of gas per gallon
- the day price rises
 - demand inelastic
- years later
 - demand much more elastic
 - as carpool or buy smaller car



factors 1-3

all get at same issue:

- can consumers substitute a cheaper good easily?
 - if yes, demand is elastic
 - if no, demand is inelastic

4. Is item large part of your budget?

- if yes, then demand elastic
(forced to change behavior)
- if no, then demand inelastic
(no need to change behavior)

example

- soap
 - if price doubles, will you buy less?
- rent
 - if rent doubles?
 - stay on campus?
 - more roommates?



II. Price Elasticity of Supply

$$\frac{\% \text{ change in } Q_s}{\% \text{ change in } P}$$

example

- bunch of roses
- P = \$40/bunch, Qs = 6 (million bunches)
- P = \$60, Qs = 15



% change Qs

$$\frac{15 - 6}{(6+15)/2} \times 100$$

$$\frac{9}{10.5} \times 100 = 86\%$$

% change P

$$\frac{60 - 40}{(60+40)/2} \times 100$$

$$\frac{20}{50} \times 100 = 40\%$$

supply elasticity

$$\frac{\% \text{ change in } Q_s}{\% \text{ change in } P}$$

$$\frac{86\%}{40\%} = 2.15$$

- if price rises 1%,
Qs rises 2.15%
- unit-free measure
- depends on points chosen
on the supply curve

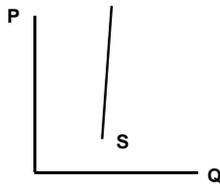
if price elasticity of supply

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elastic
% change Qs > % change P
sensitive to P changes

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% change Qs < % change P
not sensitive to P changes

inelastic supply

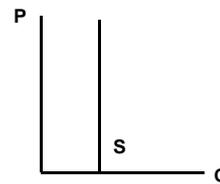
- steep curve



big change in P
small change in Qs

perfectly inelastic supply

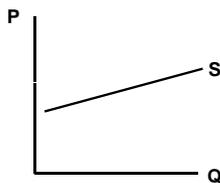
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change in P
no change in Qs

elastic supply

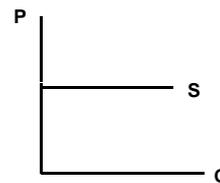
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small change in P
big change in Qs

perfectly elastic supply

- horizontal line



any change in P
Qs falls to zero

what makes supply elastic or inelastic?

1. production possibilities
Can you make more easily?
NO
then supply is inelastic
YES
then supply is elastic

example

- oceanfront property
 - can't make more
 - inelastic supply
- salt
 - almost an infinite amount
 - elastic supply



2. time since price change

- it takes time to produce
- if a short time,
supply is inelastic
- if a long time
supply is elastic

example

- hotel rooms
 - takes time to build
 - supply inelastic in short-run,
elastic in long-run

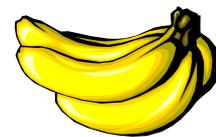


3. Can you store it easily/cheaply?

- if yes, then elastic
- if no, then inelastic

example

- bananas
 - storage time limited
 - supply inelastic



III. Income Elasticity of Demand

- impact of income changes on demand
- size of shift
in the demand curve
when income changes

equation

$$\frac{\% \text{ change in } Q_d}{\% \text{ change in income}}$$

- > 0 normal good
- < 0 inferior good

example: jewelry

- income increases 10%
- Qd jewelry increases 35%

income elasticity

$$\frac{\% \text{ change in Qd jewelry}}{\% \text{ change in income}}$$

$$\frac{35\%}{10\%} = 3.5$$

IV. Cross Elasticity of Demand

- impact of price change of substitutes or complements
- size of shift in demand curve when price of a related good changes

equation

$$\frac{\% \text{ change in Qd}}{\% \text{ change in P of related good}}$$

cross elasticity

- > 0 for substitutes
- < 0 for complements

example: Peanut butter



- what happens to Qd of PB, when price of jelly rises?
- PB & jelly are complements

price jelly = \$3 jar, Qd PB = 2 jars per month

price jelly = \$4 jar, Qd PB = 1 jar per month

% change in Qd PB

$$\frac{1 \text{ jar} - 2 \text{ jars}}{1.5 \text{ jars}} \times 100 = -66.7\%$$

% change in P of jelly

$$\frac{\$4 - \$3}{\$3.5} \times 100 = 28.6\%$$

cross price elasticity of PB

- with respect to price of jelly

$$\frac{\% \text{ change in Qd PB}}{\% \text{ change in P jelly}}$$

$$\frac{-66.7\%}{28.6\%} = -2.33$$

example: Peanut butter



- what happens to Qd of PB, when price of butter rises?
- PB & butter are substitutes

P butter = \$1 stick, Qd PB = 2 jars per month

P butter = \$3 stick, Qd PB = 2.2 jars per mo.

% change in Qd PB

$$\frac{2.2 \text{ jar} - 2 \text{ jars}}{2.1 \text{ jars}} \times 100 = 9.5\%$$

% change in P of butter

$$\frac{\$3 - \$1}{\$2} \times 100 = 100\%$$

cross price elasticity of PB

- with respect to price of butter

$$\frac{\% \text{ change in Qd PB}}{\% \text{ change in P butter}}$$

$$\frac{9.5\%}{100\%} = .095$$

summary

- law of demand & supply
 - direction of change in Qd/Qs when P changes
- price elasticity
 - how large are these Qd/Qs changes?
- cross/income elasticity
 - size of shift in demand curve