Chapter 5
Elasticity of Demand and Supply

These slides supplement the textbook, but should not replace reading the textbook
What is total revenue?

Price multiplied by the quantity sold at that price

P \times Q
If you own a business and your raise price, will your total revenue go up or down?

That all depends on the price elasticity of demand for your product.
When price increases what two things happen?

- more money is made per unit
- fewer units are sold
What is price elasticity of demand?

A measure of the responsiveness of quantity demanded to a price change
How do I measure responsiveness?

You measure the percent change in quantity demanded when price changes.
How do I measure a percent change in quantity?

You take the difference between the two quantities and divide by the original number.
For example, if there is an increase from 3 units to 5, what is the percentage increase?

The percent increase is 67%
How do I know this?

The difference between the two numbers is 2 and the original number is 3.
So …

\[
\frac{2}{3} = 67\%
\]
If there is a decrease from 5 units to 3, what is the percent decrease?

$$\frac{2}{5} = 40\%$$
How do I calculate *price elasticity of demand*?

Price elasticity of demand = 

\[
\frac{\% \text{ change in quantity}}{\% \text{ change in price}}
\]
If NRCC raises tuition, what happens to total revenue?

- If demand is elastic - revenue goes down
- If demand is inelastic - revenue goes up
When price increases what two things happen?

- more money is made per unit
- fewer units are sold
If I increase my price from $1.00 to $1.10, how will this effect my revenue?

The answer depends upon the price elasticity of demand for your product.
When price increases and there is a net loss in revenue, the demand curve is price elastic, > 1
When price increases demand is elastic when …?

More money is lost because of the fewer units sold then the money gained because of the higher price
When price increases and there is a net gain in revenue, the demand curve is price inelastic, < 1
When price increases demand is inelastic when ...?

More money is gained because of the higher price then the money lost because of the fewer units sold
What do elastic demand curves look like?

Elastic demand curves are more horizontal than inelastic demand curves
What do inelastic demand curves look like?

Inelastic demand curves are more vertical than elastic demand curves.
Which of the above demand curves is oil and which ice cream?
Why is the demand curve for oil more inelastic?

- oil is a necessity
- oil has few substitutes
Why is the demand curve for ice cream more elastic?

- Ice cream is a luxury
- Ice cream has many substitutes
If tripling of the price triples the quantity of a good supplied, then price elasticity of supply is?

One
If a $1 increase in price leads to a 3-unit decrease in quantity demanded, then demand must be elastic?

False, the dollar increase is not given as a percent change.
What is unit-elastic demand?
The type of demand that exists when a percent change in price causes an equal (but of opposite sign) percent change in quantity demanded.
If total revenue does not change when price increases, the demand curve is unitary elastic, value equals -1
What determines the price elasticity of demand?

- substitutes
- consumers budgets
- time
- need
What do substitutes have to do with elasticity?

The more substitutes the more elastic is the demand.
How does the price elasticity of demand for running shoes compare to Nike running shoes?

The demand for running shoes is less elastic than the demand for Nike running shoes.
How does my budget effect demand?

The smaller the price of something is in relation to your budget, the more inelastic the demand.
What does time have to do with elasticity?

The more time to adjust to a price change the more elastic the demand.
Demand Becomes More Elastic Over Time

Price per unit

$1.25

$1.00

0 50 75 95 Quantity per period

$1.00

$1.25

W=week
M=month
Y=year

D_W
D_M
D_Y
What does need have to do with elasticity?

The greater the need the more inelastic the demand
How do I measure the price elasticity of demand for a good?

Price elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price.
Problem - when you move along a demand curve between two points, you will get different answers to elasticity depending if you are moving up or down the demand curve.
If you go from 3 to 5, the percentage change is $2/3$, but if you go from 5 to 3, the percentage change is $2/5$, so the elasticities are different!
The answer to this problem is to use the arc elasticity of demand formula which is …
change in quantity demanded
\[ \frac{\text{sum of quantities}}{2} \]
divided by
change in price
\[ \frac{\text{sum of prices}}{2} \]
Price elasticity equals the percentage in quantity demanded divided by the percent change in price (using the arc formula)

\[ E_D = \frac{q'_D - q_D}{(q'_D + q_D)/2} \div \frac{p' - p}{(p' + p)/2} \]
Mathematically, we invert the denominator and multiply, the 2’s cancel one another out, so formula becomes:

\[ E_D = \frac{q_D' - q_D}{(q_D' + q_D)} \times \frac{(p' + p)}{p' - p} \]
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>$20</td>
</tr>
<tr>
<td>200</td>
<td></td>
</tr>
<tr>
<td>240</td>
<td>$18</td>
</tr>
<tr>
<td>Oranges</td>
<td>$40</td>
</tr>
<tr>
<td>400</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>$70</td>
</tr>
</tbody>
</table>
What is the Price Elasticity of Demand for bananas?

\[
\frac{40}{220} \times \frac{19}{2} = \frac{760}{440}
\]
What is the Price Elasticity of Demand for oranges?

\[ \frac{120}{340} \times \frac{55}{30} = \frac{6,600}{10,200} \]
What is a linear demand curve?

A straight-line demand curve
Panel A: Demand and price elasticity

- **Elastic**
- **Unit elastic**
- **Inelastic**
How do price and total revenue relate?

- In the elastic range of a demand curve, price and total revenue move in opposite directions.
- In the inelastic range, price and total revenue move in the same direction.
What is a perfectly elastic demand curve?

A horizontal line reflecting a situation in which any price increase reduces quantity demanded to zero.
A Perfectly Elastic Demand Curve

\[ E_D = \infty \]
What is a perfectly inelastic demand curve?

A vertical line reflecting a situation in which price change has no effect on the quantity demanded.
A Perfectly Inelastic Demand Curve

\[ E_D = 0 \]

Price per unit

Quantity per period

0
What is unit elasticity of demand?

The type of demand that exists when price elasticity is the same everywhere along the curve, it has an elasticity of -1.0.
A Unit Elastic Demand Curve

$E_D = -1$

Price per unit

$10$

$6$

0 60 100 Quantity per period

$D''$
What is income elasticity of demand?

The percentage change in the quantity demanded resulting from a 1 percent change in total income.
What is a normal good?

Something that people will buy more of as their incomes increase
If a good is normal, then the income elasticity of demand for that good is?

Positive
What is an inferior good?

Something that people will by less of as their incomes increase
If a good is inferior, then the income elasticity of demand for that good is?

Negative
What is cross–price elasticity of demand?

The percent change in the demand of one good (at a given price) as a result of the percent change in the price of another good
If negative - complements (steak & steak sauce)

If positive - substitutes (butter & margarine)
If an increase in the price of peanut butter causes a decline in the demand for jelly, then ?

the goods are complements
If a decrease in the price of one good causes a decline in the demand for another good, then?

The goods are substitutes.
What are some examples of complementary goods?

- computers and software
- cars and gasoline
- CDs and playlists
What is price elasticity of supply?

A measure of the responsiveness of quantity supplied to a price change.
Price elasticity equals the percentage in quantity demanded divided by the percent change in price (using the arc formula)

\[ E_S = \frac{q_s' - q_s}{(q_s' + q_s)/2} \div \frac{p' - p}{(p' + p)/2} \]
What is a perfectly elastic supply curve?

A horizontal line reflecting a situation in which any price decrease reduces the quantity supplied to zero; the elasticity value is infinity.
Perfectly Elastic Supply

\[ E_s = \infty \]

Price per unit

Quantity per period
What is a perfectly inelastic supply curve?

A vertical line reflecting a situation in which a price change has no effect on the quantity supplied; the elasticity value is zero.
A Perfectly Inelastic Supply Curve

\[ E_s = 0 \]
What is unit-elastic supply?

A percent change in price causes an identical percent change in quantity supplied; the elasticity value is one.
How is unit-elastic supply depicted?

A supply curve that is a straight line through the origin
A Unit Elastic Supply Curve

Price per unit

$10

5

0

Quantity per period

0

10

20

S
What are the determinants of supply elasticity?

- Costs
- Time
Market Supply Becomes More Elastic Over Time

Price per unit

$12

$10

0 70 55 50 100

Quantity per period

S

S

S

W=week

M=month

Y=year
Effects of Different Demand Elasticities on Sales Tax Incidence

Panel A: Less elastic demand

<table>
<thead>
<tr>
<th>Price per pack</th>
<th>$2.30</th>
<th>$2.00</th>
<th>$1.90</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.40 tax</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Millions of packs per day

0 9 10
Effects of Different Demand Elasticities on Sales Tax Incidence

Panel B: More elastic demand

- Price per pack
  - $2.10
  - 2.00
  - 1.70

- Millions of packs per day
  - 0
  - 7
  - 10

- $0.40 tax

- $S_t$
- $S$

- $D'$
Effects of Different Supply Elasticities on Sales Tax Incidence

Panel A: More elastic supply

<table>
<thead>
<tr>
<th>Price per pack</th>
<th>Millions of packs per day</th>
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</thead>
<tbody>
<tr>
<td>$2.30</td>
<td>8</td>
</tr>
<tr>
<td>$2.00</td>
<td>10</td>
</tr>
<tr>
<td>$1.90</td>
<td></td>
</tr>
</tbody>
</table>

$0.40 tax
Effects of Different Supply Elasticities on Sales Tax Incidence

Panel B: Less elastic supply

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>$2.10</td>
<td>0</td>
</tr>
<tr>
<td>2.00</td>
<td>9</td>
</tr>
<tr>
<td>1.70</td>
<td>10</td>
</tr>
</tbody>
</table>

$0.40 tax

$S_t$
END