Elasticity

- Lecture 10 outline: Read Chapter 7 and the reading for today.
  - Announcements: homework, exam, others
- Definition of **elasticity**
  - **price elasticity of demand**
  - **income elasticity of demand and**
  - **price elasticity of supply**
- Factors that influence the size of elasticities
- How elasticity affects the incidence of a tax, and who bears its burden?

The Midterm

- We just got grade sheets last night (in giant pdf files). We'll get them to your TAs late today. They'll have them at your section this week.
  - For those who did well, keep pushing. Students typically find the material gets more difficult.
  - For those who did poorly, you can drop the low midterm. But you need to figure out what is keeping you from learning the material.
- Provisional curve
  - 91-100 A; 83-90 A/B; 77-82 B; 68-76 B/C; 59-67 C; 40-58 D; 0-39 F

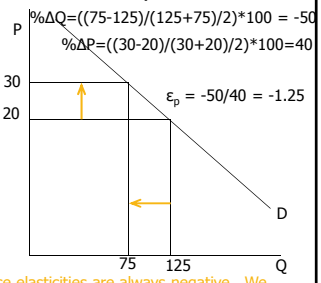
Defining and Measuring an Elasticity

- Elasticities are always defined as a "percentage change in this" over a "percentage change in that."
- The price elasticity of demand, therefore, is the percentage change in the quantity demanded over the percentage change in the price, moving along the demand curve.

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

Elasticity: Simple Examples

- Calculate a percentage change.
  - My GPA rose to 3.4 from 3.0 because of my good work in Economics.
- Your percentage change in GPA is
  - ((3.4-3.0)/((3.4+3.0)/2))*100 or 12.5 percent.
- Price elasticity of demand



Since demand curve slope downward, price elasticities are always negative. We take the absolute value, so $\varepsilon_p = 1.25$

We Will Use the "Midpoint Method" to Calculate Elasticities

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

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

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

Calculating an Elasticity: The World Demand for Oil

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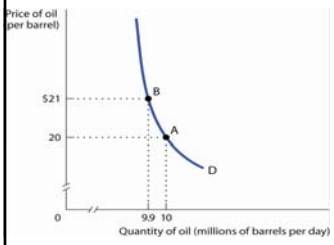

- % change in price is
  - ($1/$20.5)*100=4.878
- % change in Q is
  - -(0.1/9.95)*100=-1.005
- The elasticity is
  - -1.005/4.878 = -0.206
- Price elasticity of demand is always a negative number – again, we typically drop the negative, taking the absolute value.

What Determines the Magnitude of Elasticities?

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- The availability of close substitutes.
  - The price elasticity of demand will tend to be large if there are close substitutes.
- Whether the good is a necessity or a luxury.
  - The price elasticity of demand tends to be low if the good is a necessity.
- Time
  - The "long-run" price elasticity of demand is often higher than the "short-run" elasticity.
- Elasticities have the very useful "unit-free" property, by making use of percentage changes.

Some Estimated Price Elasticities of Demand

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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	

Three Demand Curves with Constant Elasticity…

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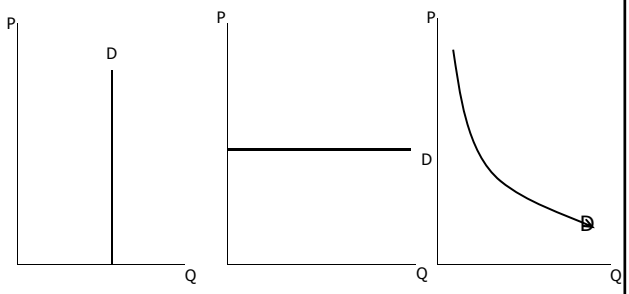

E_p=0; shoelaces?

E_p=∞; pink tennis balls?

E_p=1; product with unit-elastic demand.

Conventions with Describing the Price Elasticity of Demand

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- Demand is ***elastic*** if the price elasticity of demand is greater than 1: $\varepsilon_p > 1$
- Demand is ***inelastic*** if the price elasticity of demand is less than 1: $\varepsilon_p < 1$
- Demand is ***unit elastic*** if the price elasticity of demand is exactly 1: $\varepsilon_p = 1$

Two Examples

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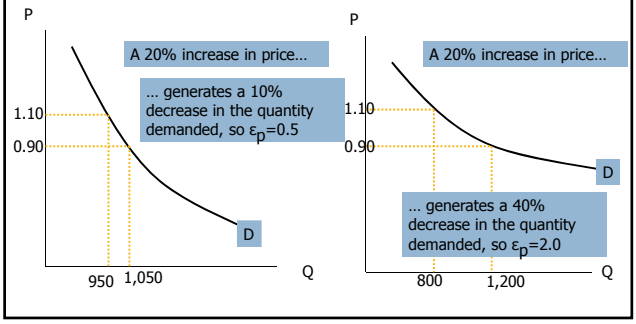
- Inelastic demand
- Elastic demand



Why Am I Paying So Much Attention to Price Elasticities?

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- It affects total revenue (TR = P*Q)
  - If demand is elastic, a 1 percent price cut increases the quantity sold by more than 1 percent, and total revenue increases.
  - If demand is inelastic, a 1 percent price cut increases the quantity sold by less than 1 percent, and total revenue decreases.
  - If demand is unit elastic, total revenues are unaffected by price changes.
- Dairy farmers (generally), for example, oppose adoption of Bovine Growth Hormone (BGH). Milk demand is inelastic.

Elasticity and Total Revenue

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- After increasing price there is a "price effect…"
  - Each unit sold sells at a higher price, which tends to raise total revenue.
- But there is also a "quantity effect…"
  - After a price increase, fewer units are sold, which tends to lower total revenue.
- The overall effect of a price change on total revenue, as noted earlier, depends on the elasticity of demand.

Price Changes and Total Revenue

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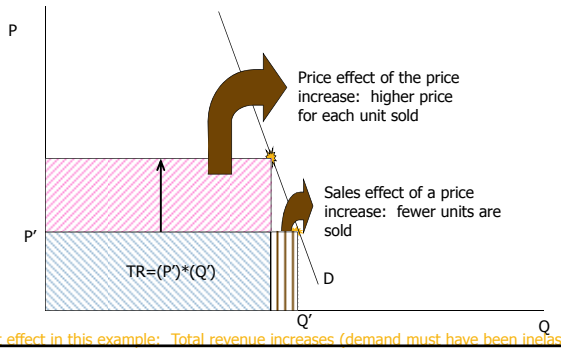

Net effect in this example: Total revenue increases (demand must have been inelastic)

The Price Elasticity of Demand Changes Along the Demand Curve

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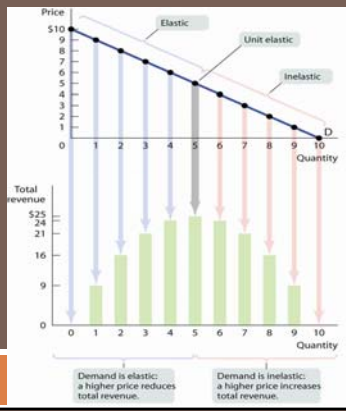

Demand Schedule and Total Revenue for a Linear Demand Curve

Price	Quantity demanded	Total revenue
$0	10	$0
1	9	9
2	8	16
3	7	21
4	6	24
5	5	25
6	4	24
7	3	21
8	2	16
9	1	9
10	0	0

The Elasticity Changes Along a Linear Demand Curve!

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$$\varepsilon_p \equiv \frac{\frac{\Delta Q}{(Q^1+Q^2)/2}}{\frac{\Delta P}{(P^1+P^2)/2}} = \frac{\Delta Q}{\Delta P} * \frac{(P^1+P^2)}{(Q^1+Q^2)} = \frac{1}{\text{Slope}} * \frac{(P^1+P^2)}{(Q^1+Q^2)}$$

Since the slope is constant along a linear demand curve, the elasticity must change as the price and quantity change along the demand curve.

Other Elasticities

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- Remember the elasticity definition
  - Percentage change in this over the percentage change in that.
- Cross price elasticity of demand

$$\varepsilon_{AB} = \frac{\%\Delta Q_A}{\%\Delta P_B}$$

  - If $\varepsilon_{AB}>0$, the goods are substitutes
  - If $\varepsilon_{AB}<0$, the goods are complements

Other Elasticities, continued

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- Remember the elasticity definition
  - Percentage change in this over the percentage change in that.
- Income elasticity of demand

$$\varepsilon_Y = \frac{\%\Delta Q_D}{\%\Delta Y}$$

  - If $\varepsilon_Y>0$, the good is a normal good
  - If $\varepsilon_Y<0$, the good is an inferior good
    - If $\varepsilon_Y>1$, the good is sometimes called a "luxury good"

Other Elasticities, part 3

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- Remember the elasticity definition
  - Percentage change in this over the percentage change in that.
- 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.

$$\varepsilon_S = \frac{\%\Delta Q_S}{\%\Delta P}$$

Two Extreme Cases of the Price Elasticity of Supply

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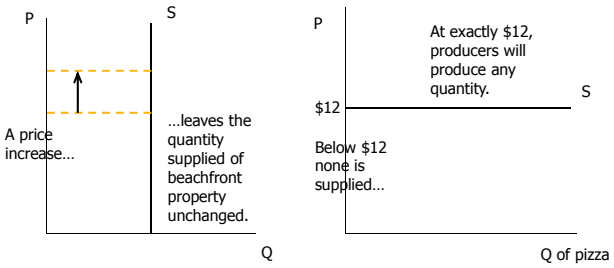
- Perfectly inelastic, $\varepsilon_S=0$
- Perfectly elastic, $\varepsilon_S=\infty$



Factors that Influence the Price Elasticity of Supply

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- The availability of inputs
  - When inputs are easily available, ε_S (the price elasticity of supply) will tend to be large (meaning supply is elastic). When the inputs are difficult to obtain, ε_S will tend to be small.
- Time
  - ε_S tend to be larger the longer the period of time that producers have to respond to a price change.
    - Long-run price elasticities are generally larger than short-run elasticities.

Elasticities and Tax Incidence: Excise Taxes Get Shifted to the Inelastic Factor

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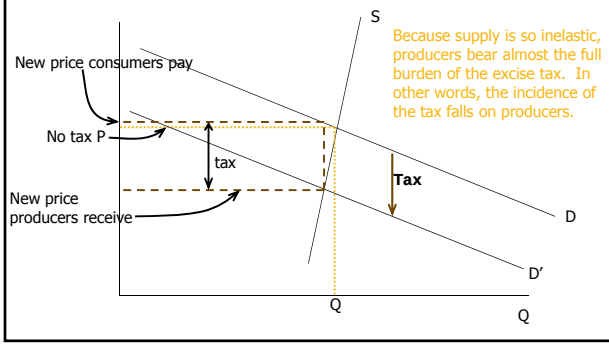

Because supply is so inelastic, producers bear almost the full burden of the excise tax. In other words, the incidence of the tax falls on producers.

Elasticities and Tax Incidence, Part 2

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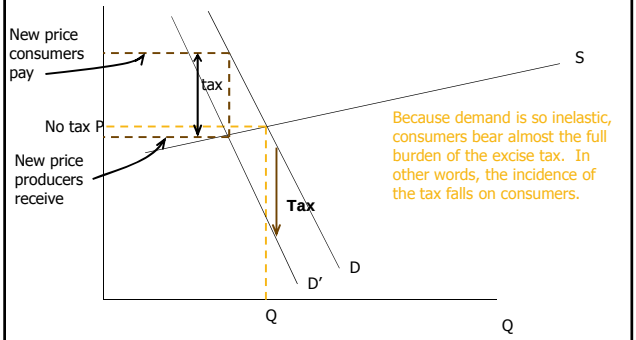

Because demand is so inelastic, consumers bear almost the full burden of the excise tax. In other words, the incidence of the tax falls on consumers.

Deadweight Loss is Affected by the Elasticity of Demand…

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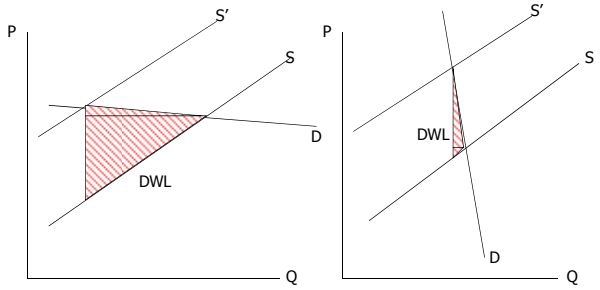

The DWL is clearly larger when demand is more elastic

Deadweight Loss is Affected by the Elasticity of Supply

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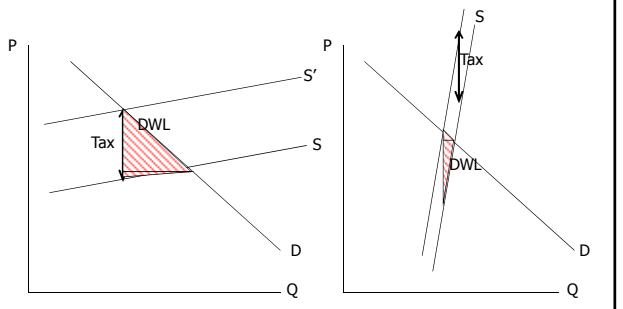

The DWL is clearly larger when supply (and/or demand) is more elastic