Lecture 4

# Elasticity

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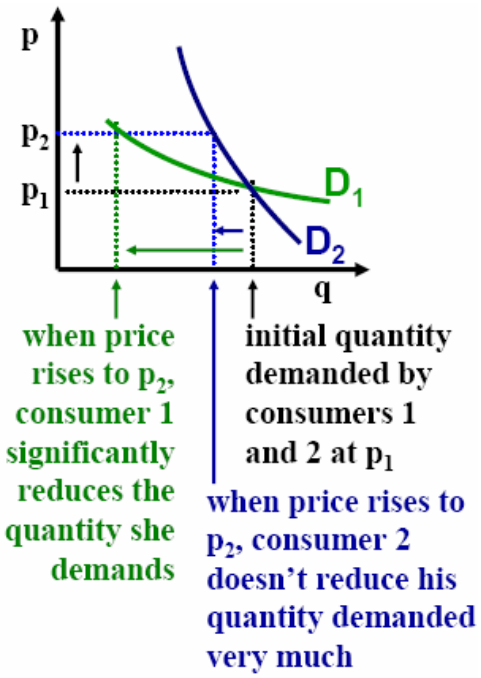
Principles of Microeconomics

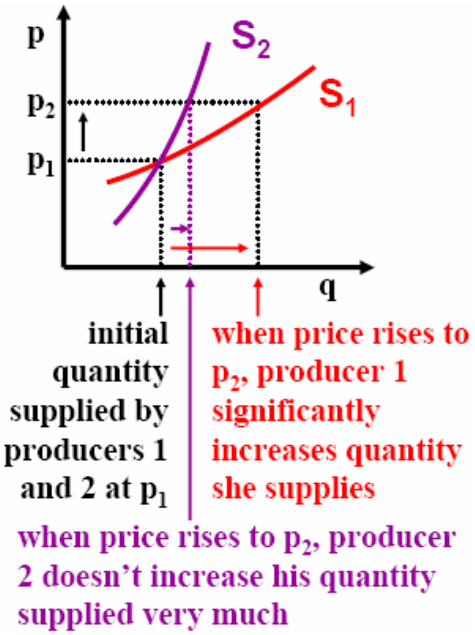
# Shape of the Demand Curve

- When prices change, change in quantity demanded depends on shape of demand curve
- Consumer 1 has a very elastic demand curve
- Consumer 2 has a very inelastic demand curve
- Elasticity often depends on the good in question:
  - Elastic: education, alcohol
  - Inelastic: gas, food, cigarettes, electricity



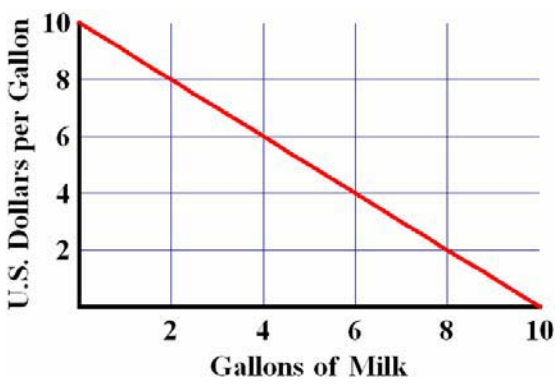
# Shape of the Supply Curve

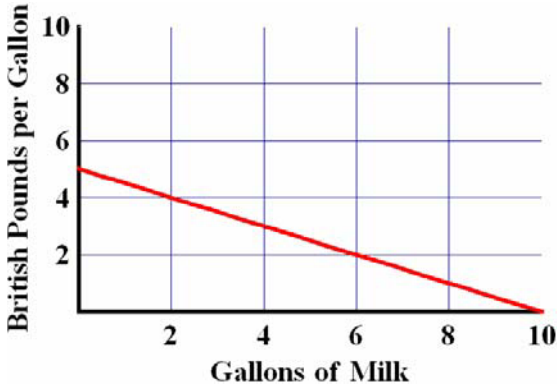
- When prices change, change in quantity supplied depends on shape of supply curve
- Producer 1 has a very elastic supply curve
- Producer 2 has a very inelastic supply curve
- Elasticity often depends on the good in question:
  - Elastic: soft drink vendors on a hot day at the beach
  - Inelastic: housing, labor




# slope can be misleading

- Slope can be misleading because it depends on the units of measurement
- For example, if the price of a British Pound is 2 U.S. Dollars per British Pound, then the demand curve for milk is twice as steep if measured in dollars instead of pounds




- If we focus on a ratio of percentage changes, we can eliminate the confusion caused by differences in the units of measurement

# What is elasticity?

- it's a unit-free measure of responsiveness
- the **own price elasticity of demand** measures the ratio of a percentage change in quantity demanded of good X to a percentage change in the price of good X

$$\varepsilon = \frac{\%\text{-age } \Delta Q}{\%\text{-age } \Delta P} = \frac{\Delta Q/Q}{\Delta P/P} = \frac{\Delta Q}{\Delta P}.\frac{P}{Q}$$

- notice that the component $\frac{\Delta Q}{\Delta P}$ corresponds to the slope of a demand function such as: $Q_D = 10 - 2P$, in which case: $\frac{\Delta Q}{\Delta P} = -2$
- $\frac{\Delta Q}{\Delta P}$ is also the <u>inverse</u> of the slope of the demand curve (when we plot price on the vertical axis and quantity of the horizontal axis)
- the component $\frac{P}{Q}$ corresponds to the current price of the good and the quantity that consumers buy at that price

## Milk Example – Dollars vs. Pounds

- As illustrated in the graphs of British and American demand for milk, the demand relationships are:

$$Q_{D,\text{America}} = 10 - P_{\text{U.S Dollar}} \qquad Q_{D,\text{Britain}} = 10 - 2P_{\text{British Pound}}$$

- therefore:

$$\frac{\Delta Q_{D,\text{America}}}{\Delta P_{\text{U.S. Dollar}}} = -1 \qquad \frac{\Delta Q_{D,\text{Britain}}}{\Delta P_{\text{British Pound}}} = -2$$

- If $Q_{D,\text{America}} = Q_{D,\text{Britain}} = 6$, then:

$$P_{\text{U.S Dollar}} = 4 \quad \text{and} \quad P_{\text{British Pound}} = 2$$

- So the own-price elasticities of demand in each country must be:

$$\varepsilon_{\text{U.S.}} = \frac{\Delta Q_{D,\text{America}}}{\Delta P_{\text{U.S. Dollar}}}.\frac{P_{\text{U.S. Dollar}}}{Q_{D,\text{America}}} \qquad \varepsilon_{\text{Britain}} = \frac{\Delta Q_{D,\text{Britain}}}{\Delta P_{\text{British Pound}}}.\frac{P_{\text{British Pound}}}{Q_{D,\text{Britain}}}$$

$$\varepsilon_{\text{U.S.}} = -2/3 \qquad \varepsilon_{\text{Britain}} = -2/3$$

- How much less milk would be demanded in each country if the price rose 1% in each country? **0.67% less**

# Why elasticity is so useful

$\varepsilon_{U.S.} = -2/3$ $\varepsilon_{Britain} = -2/3$

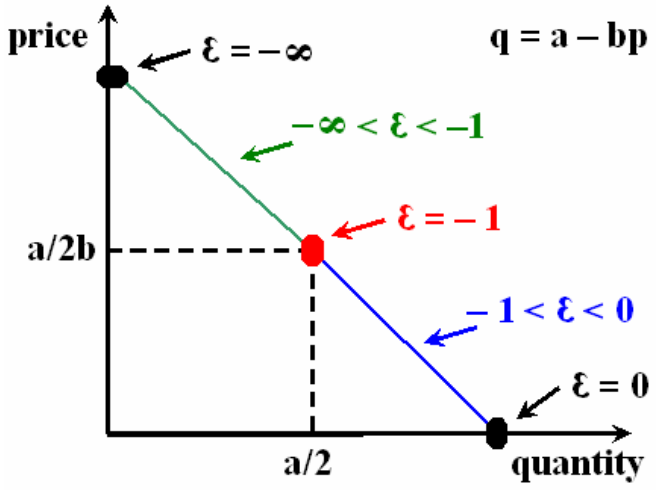
- **How much less milk would be demanded in each country if the price rose 1% in each country? 0.67% less**
- **Now this result may seem trivial, but that's the point!**
- **You want an easy way to make comparisons.**
- **You don't want to have to convert U.S. Dollars into British Pounds or gallons into liters, etc.**
- **So for example, if I told you that:**
  - own-price elasticity of demand for gasoline is –0.5 and
  - own-price elasticity of demand for restaurant meals is –2.3
- **which is more responsive to changes in price? The demand for gasoline or the demand for restaurant meals?**
- **the demand for restaurant meals** – because for a one percent increase in price, the quantity of restaurant meals demanded falls over four times more than the quantity of gasoline demanded does

# Now let's say you're selling cream cheese …

- **If there are many other companies selling cream cheese, then how responsive will the demand for your cream cheese be to the price?**
  - **very responsive**
  - **you'd face a very elastic demand** – since small changes in the price of your cream cheese would induce consumers to buy your competitors' cream cheese
- **If you raised your price, your revenue would fall dramatically.**
- **Now let's say you have few competitors in the cream cheese industry and a large group of people are cream cheese addicts.**
  - **demand for your cream cheese would not be very responsive to price**
  - **you'd face a very inelastic demand**
- **If you raised your price, the quantity of cream cheese that you sell would fall, but your revenue would not. Instead your revenue would increase due to the higher selling price and weak demand response.**

**NB: I have only mentioned revenue, not profit! Profit is the difference between your total revenue and your total cost.**

# Own-Price Elasticity of Linear Demand




| $-\infty < \varepsilon < -1$ | $\varepsilon = -1$ | $-1 < \varepsilon < 0$ |
|---|---|---|
| **Elastic Demand:** 1% price increase reduces quantity demanded by more than 1% | **Unit Elastic Demand:** 1% price increase reduces quantity demanded by 1% | **Inelastic Demand:** 1% price increase reduces quantity demanded by less than 1% |

# … but what about butter?

- So you're still selling cream cheese, but now the price of butter (a substitute for cream cheese) goes up
- What's going to happen to demand for your cream cheese?
- Since the goods are substitutes, an increase in the price of butter will increase the demand for cream cheese.
- The **cross-price elasticity of demand** for cream cheese with respect to a change in the price of butter is:

$$e_{c.\,cheese,\ butter} = \frac{\Delta Q_{c.\,cheese}}{\Delta P_{butter}} \cdot \frac{P_{butter}}{Q_{c.\,cheese}}$$

- this elasticity will be positive since $\Delta P_{butter} > 0 \Rightarrow \Delta Q_{c.\,cheese} > 0$
- so let's say: $e_{c.\,cheese,\ butter} = 0.5$, then a one percent increase in the price of butter causes a 0.5 percent increase in the demand for cream cheese

# … and what about bagels?

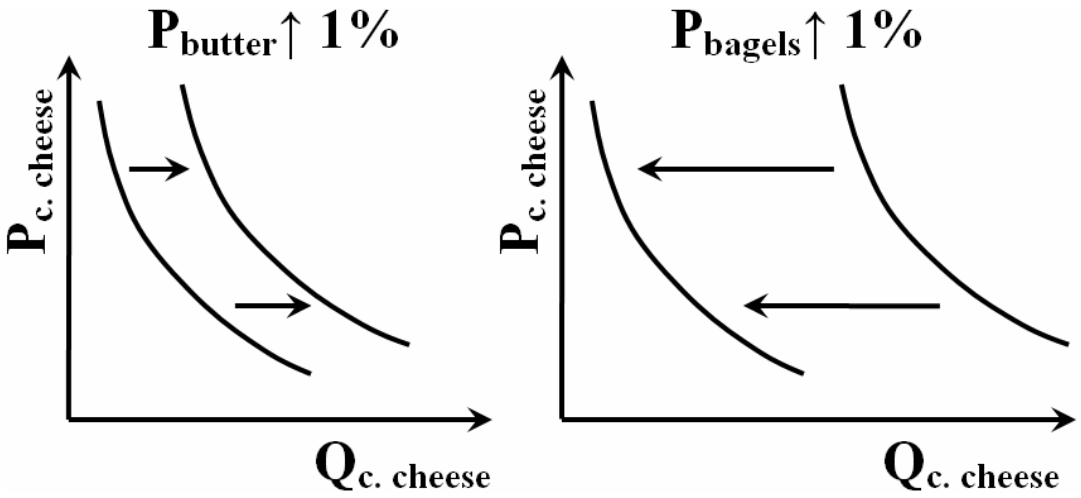
- **So you're still selling cream cheese, but now the price of bagels** (a complement to cream cheese) **goes up**
- **What's going to happen to demand for your cream cheese?**
- **Since the goods are complements, an increase in the price of bagels will decrease the demand for cream cheese.**
- **The cross-price elasticity of demand for cream cheese with respect to a change in the price of bagels is:**

$$e_{\text{c. cheese, bagels}} = \frac{\Delta Q_{\text{c. cheese}}}{\Delta P_{\text{bagels}}} \cdot \frac{P_{\text{bagels}}}{Q_{\text{c. cheese}}}$$

- **this elasticity will be negative since $\Delta P_{\text{bagels}} > 0 \Rightarrow \Delta Q_{\text{c. cheese}} < 0$**
- **so let's say: $e_{\text{c. cheese, bagels}} = -2$, then a one percent increase in the price of bagels causes a 2 percent decrease in the demand for cream cheese**

# So what will affect demand more?

- **What will affect demand for cream cheese more?**
  - a one percent increase in the price of butter
  - or a one percent increase in the price of bagels
- **if $e_{\text{c. cheese, butter}} = 0.5$ and $e_{\text{c. cheese, bagels}} = -2$, then:**



# … and what about the income of consumers?

- **So you're still selling cream cheese, but now the income of your consumers goes up (prices held constant)**
- **What's going to happen to demand for your cream cheese?**
- **Since your consumers now have more money to spend, an increase in the income of your consumers will probably increase the demand for cream cheese.**
- **The income elasticity of demand for cream cheese is:**

$$\eta_{c.\,cheese} = \frac{\Delta Q_{c.\,cheese}}{\Delta Income} \cdot \frac{Income}{Q_{c.\,cheese}}$$

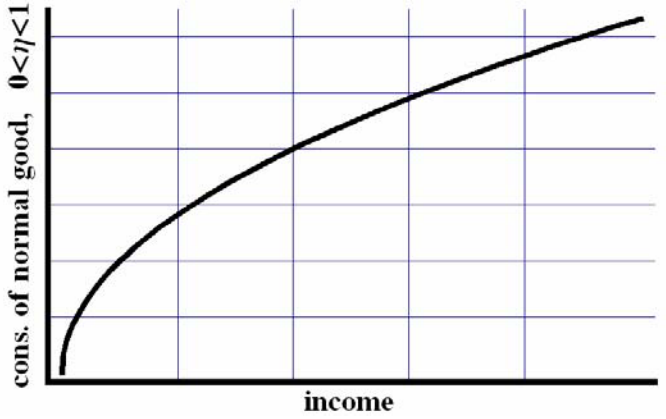
- **this elasticity will be positive since $\Delta Income > 0 \Rightarrow \Delta Q_{c.\,cheese} > 0$**
- **so let's say: $\eta_{c.\,cheese} = 0.75$, then a one percent increase in the income of consumers causes a 0.75 percent increase in the demand for cream cheese**

# Income Elasticities

- **Normal Goods can be broke down into:**
  - **Income-Inelastic Normal Goods → $0 < \eta < 1$**
    - when income increases by 1% (prices held constant)
    - demand for such goods increases less than 1%
  - **Unit-Elastic Normal Goods → $\eta = 1$**
    - when income increases by 1% (prices held constant)
    - demand for such goods increases by 1%
  - **Income-Elastic Normal Goods → $1 < \eta$**
    - when income increases by 1% (prices held constant)
    - demand for such goods increases more than 1%
    - these goods are also called: **Luxury Goods**
- **Inferior Goods → $\eta < 0$**
  - when income increases by 1% (prices held constant)
  - demand for such goods FALLS
- **However, no good can be inferior over all ranges of income, otherwise it would never be consumed at all.**

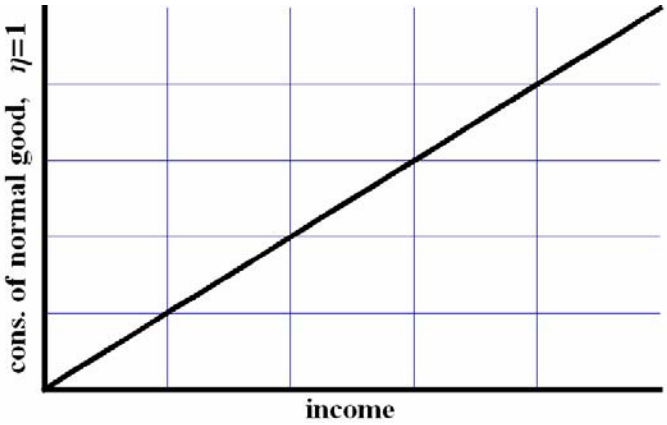
**Income-Inelastic Normal Good**

$0 < \eta < 1$



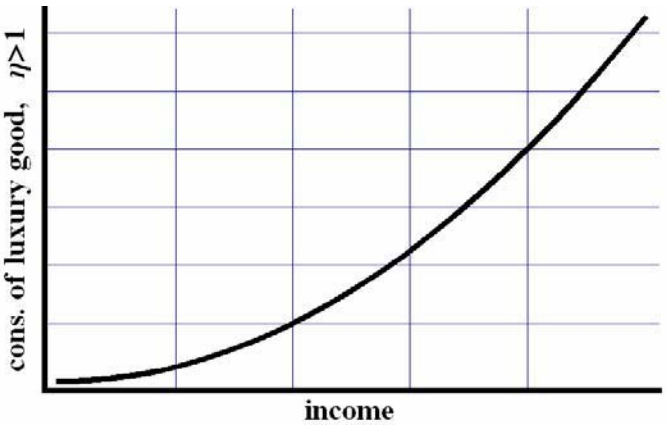

**Unit-Elastic Normal Good**

$\eta = 1$



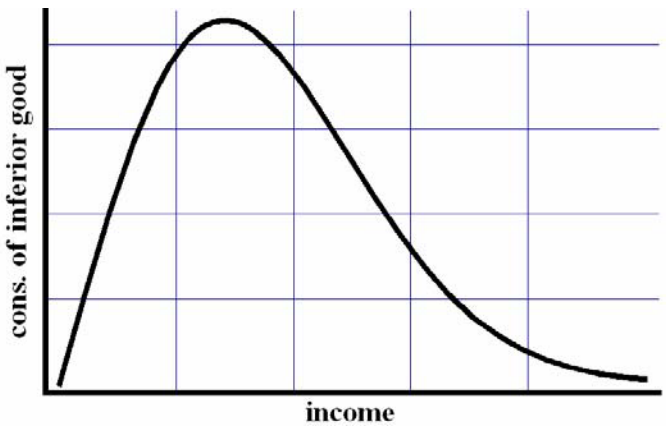

**Income-Elastic Normal Good**
$1 < \eta$

also called a
**Luxury Good**




**Inferior Good**
$\eta < 0$

As depicted, the income elasticity is initially positive, but becomes negative (inferior) after a certain income level is surpassed.



# Supply Elasticity

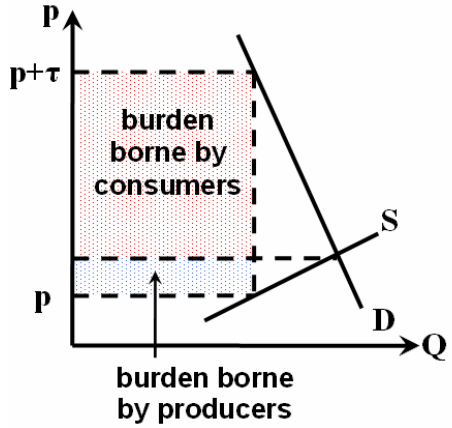
- **As alluded to at the beginning of the lecture, there's also an elasticity of supply.**

$$e_{supply} = \frac{\Delta Q_S}{\Delta P} \cdot \frac{P}{Q_S}$$

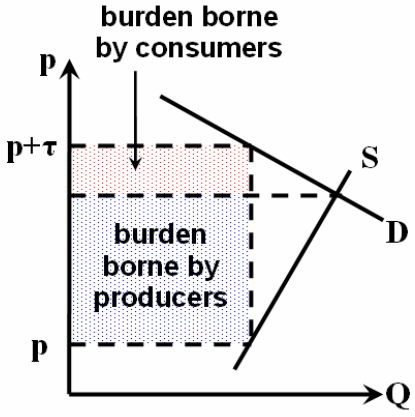
- **the component $\frac{\Delta Q}{\Delta P}$ corresponds to the slope of a supply function such as: $Q_S = 3 + 2P$, in which case: $\frac{\Delta Q}{\Delta P} = 2$**
- **$\frac{\Delta Q}{\Delta P}$ is also the <u>inverse</u> of the slope of the supply curve** (when we plot price on the vertical axis and quantity of the horizontal axis)
- **the component $\frac{P}{Q}$ corresponds to the current price of the good and the quantity that producers sell at that price.**

# Who Pays an Excise Tax?

- **Legislators may fuss and worry over who should pay an excise tax** (a tax on sales) – **the producer or the consumer**
- **But economists know that the true burden of the tax falls more heavily on the one who has a lower elasticity of supply/demand**




If the consumer's demand is very inelastic and the producer's supply is very elastic, then the consumer bears more of the tax burden.




If the consumer's demand is very elastic and the producer's supply is very inelastic, then the producer bears more of the tax burden.