

# Elasticity

The *price elasticity of demand* measures the sensitivity of the quantity demanded to changes in the price.

Demand is *inelastic* if it does not respond much to price changes, and *elastic* if demand changes a lot when the price changes.

- Necessities tend to have inelastic demand.
- Luxuries tend to have elastic demand.
- Demand is elastic when there are close substitutes.
- Elasticity is greater when the market is defined more narrowly: food vs. ice cream.
- Elasticity is greater in the long run, as people are more free to adjust their behavior.

Price elasticity of demand =

$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

$$= \frac{\Delta Q}{\Delta P} \frac{P}{Q}$$

- We use this formula instead of the slope, because the slope is sensitive to the units of measurement of price and quantity.
- Mankiw adopts the convention of reporting the absolute value of the price elasticity.
- Elasticity depends on where we are on the demand curve. For a straight line demand curve, elasticity is highest when the price is high (and quantity is low).

- For the elasticity between two points, the formula can depend on whether we move from point A to point B, or point B to point A.

A: Price = \$4, Quantity = 120

B: Price = \$6, Quantity = 80

A to B: Elasticity =  $(40/2)(4/120) = 2/3$

B to A: Elasticity =  $(40/2)(6/80) = 1.5$

- The midpoint method: *Use the average of the two prices for P, and the average of the two quantities for Q.*

Elasticity =  $(40/2)(5/100) = 1$

- When we measure the elasticity at a single point (by considering a very small price change), all 3 computations give the same answer.

When economists refer to demand as *inelastic*, we mean a price elasticity of demand that is less than 1.

Demand is *elastic* when the price elasticity of demand is greater than one.

When the price elasticity of demand is one, we say that demand has *unit elasticity*.

# Total Revenue and the Price Elasticity of Demand

How does total revenue,  $P \times Q$ , change when we increase the price?

Revenue *increases* if demand is *inelastic*,

Revenue *decreases* if demand is *elastic*, and

Revenue stays the same if demand is *unit elastic*.

## Income Elasticity of Demand

Income elasticity of demand =

$$\frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

$$= \frac{\Delta Q}{\Delta I} \cdot \frac{I}{Q}$$

- For *normal goods*, the income elasticity of demand is positive.
- For *luxury goods*, the income elasticity of demand is greater than 1.
- For *inferior goods*, the income elasticity of demand is negative.

## The Price Elasticity of Supply

Price elasticity of supply =

Percentage change in quantity supplied  
Percentage change in price

$$= \frac{\Delta Q}{\Delta P} \frac{P}{Q}$$

- The price elasticity of supply is positive.
- The closer the industry (firm) is to full capacity, the lower the price elasticity of supply.
- The price elasticity of supply is greater in the long run, as firms are more free to adjust their behavior and adjust their capacities.

Here is a tough question.

Suppose you have two data points, of the price and quantity of potatoes sold in 2005 and 2006. When you use the elasticity formula, are you measuring the price elasticity of demand or the price elasticity of supply?

## **Applications of Elasticity**

1. On the Road with Elasticity.
2. Can Good News for Farming be Bad News for Farmers?

A new hybrid wheat seed that increases yields shifts the supply curve to the right. Because demand is inelastic, revenues fall.

Why adopt the innovation? Competition. It is better for each individual farmer to adopt it, because that farmer's revenues will be higher.

### 3. Drug Policy and Drug-related Crime.

The U.S. devotes billions of dollars to the war on drugs. How does this affect the equilibrium price and quantity of drugs? How does it affect the amount of burglaries and robberies by drug addicts to support their habits?

- Drug interdiction reduces the supply of drugs, which causes the new equilibrium to be at a higher price and lower quantity
- Because the demand for drugs is inelastic, this raises the total revenue received by drug dealers, and the total expenditure by addicts. Holding fixed the number of addicts, the increased expenditure is financed by increased drug-related crime.
- Better to try to reduce the demand for drugs (by education, for example), because price and quantity would fall, reducing crime.