0.1 Elasticity

Suppose the price of a good changes from 1 to 2. Demand in market for apples changes from 100 to 50 and

In the market for dragonfruit, the price changes from 1 to 2 and demand changes from 10 to 5.

For apples we have increase of $1 in price and demand drops by 50.

For dragon fruit we have increase of $1 in price and demand drops by 5.

For apples we have increase of $1 in price and demand drops by 50.

For apples we have increase of 1000 yuan demand drops by 50.

$$\frac{\Delta x}{\Delta p} \rightarrow \frac{\%\Delta X}{\%\Delta p}$$

An eslasticity measures how something changes in percentage terms when something else changes by some percent.

0.2 Elasticities

$$\frac{\frac{100-50}{100}}{\frac{1-2}{1}} = -\frac{1}{2}$$

$$\frac{\frac{\Delta x}{x}}{\frac{\Delta p}{p}} = \frac{\Delta x}{\Delta p}\frac{p}{x} \rightarrow \frac{\partial x}{\partial p}\frac{p}{x}$$

An elasticity measures, for a one percent increase in s*omethinig* (price, income) what is the percent change in demand?

Price elasticity of demand:

$$\varepsilon_{i,i} = \frac{\partial x_i}{\partial p_i}\frac{p_i}{x_i}$$

0.3 Cobb Douglass Example

$$x_1 = \frac{\frac{1}{2}m}{p_1}$$

-1

$$\frac{\partial x_i}{\partial p_i}\frac{p_i}{x_i} = \frac{\partial\left(\frac{\frac{1}{2}m}{p_1}\right)}{\partial p_1}\frac{p_1}{\frac{\frac{1}{2}m}{p_1}} =$$

$$\frac{\partial\left(\frac{1}{2}mp_1^{-1}\right)}{\partial p_1}\frac{p_1}{\frac{\frac{1}{2}m}{p_1}} = -\frac{1}{2}mp_1^{-2}\frac{p_1}{\frac{\frac{1}{2}m}{p_1}} = -\frac{\frac{1}{2}m}{p_1^2}\frac{p_1^2}{\frac{1}{2}m} = -1$$

A 1% percent increase in price leads to a 1% decrease in demand.

Since the absolute value of elasticity is 1 we say the demand is **unit elastic**.

When the absolute value is small < 1 we say demand is **inelastic. Demand is insensitive to price.**

Examples of inelastic demand: Medicine. Illegal Drugs. Foods. Gas. Any goods which have few substitutes. Beer at a baseball game.

When the absolute value is large > 1 we say demand is **elastic. Demand is sensitive to price.** Goods that have many substitutes. Soft drinks.

0.4 Other Elasticities.

Price elasticity for good 1:

$$\varepsilon_{1,1}$$

For an ordinary good, the sign will be negative.

Cross-price elasticity for good 1 with respect to price 2:

$$\varepsilon_{1,2} = \frac{\partial x_1}{\partial p_2} \frac{p_2}{x_1}$$

With complements, the sign will be negative and with substitutes, the demand will be positive.

Calclate the price and cross-price elasticity for perfect complements good. $u = min \{x_1, x_2\}$

Demand for good 1 is: $x_1 = \frac{m}{p_1+p_2}$ $x_2 = \frac{m}{p_1+p_2}$

$$\varepsilon_{1,1} = \frac{\partial \left(\frac{m}{p_1+p_2} \right)}{\partial p_1} \frac{p_1}{\frac{m}{p_1+p_2}} = \frac{\partial \left(m \left(p_1 + p_2 \right)^{-1} \right)}{\partial p_1} \frac{p_1}{\frac{m}{p_1+p_2}} = m \left(-1 \right) \left(p_1 + p_2 \right)^{-2} \frac{p_1}{\frac{m}{p_1+p_2}}$$

$$= -\frac{m p_1 \left(p_1 + p_2 \right)}{\left(p_1 + p_2 \right)^2 m} = -\frac{p_1}{p_1 + p_2}$$

Since $p_1 + p_2 > p_1$, demand is always inelastic.

Suppose $p_1 = p_2 = 1$

$$\varepsilon_{1,1} = -\frac{1}{2}$$

$$\varepsilon_{1,2} = \frac{\partial \left(\frac{m}{p_1+p_2} \right)}{\partial p_2} \frac{p_2}{\frac{m}{p_1+p_2}} = -\frac{p_2}{p_1 + p_2}$$

$$\varepsilon_{1,2} = 0 \frac{p_2}{\frac{\frac{1}{2}m}{p_1}} = 0$$

Income elasticity: "How does demand change in percentage terms when income changes by 1%"

$$\eta_1 = \frac{\partial x_1}{\partial m} \frac{m}{x_1}$$

For cobb douglass. We expect this to be 1.

$$\frac{\partial \left(\frac{\frac{1}{2}m}{p_1} \right)}{\partial m} \frac{m}{\frac{\frac{1}{2}m}{p_1}} = \frac{\frac{1}{2}}{p_1} \frac{p_1 m}{\frac{1}{2}m} = 1$$

This is positive since cobb douglass demand is "normal" (not inferior).
$u = min \left\{ x_1, \frac{1}{2}x_2 \right\}$

$$\frac{\partial \left(\frac{m}{p_1+2p_2} \right)}{\partial m} \frac{m}{\frac{m}{p_1+2p_2}} = \frac{1}{p_1+2p_2} \frac{m}{\frac{m}{p_1+2p_2}}$$

$$= \frac{1}{p_1+2p_2} \frac{(p_1+2p_2)\, m}{m} = 1$$