1 Market Demand and Elasticity

1.1 Market Demand

Go from individual demand to the total demand in the market **market demand.**

There will be multiple consumer $P = \{a, b, c\}$

Consumers are labeled with letters.

Good are labeled with numbers.

$x_{1,a}$ comsumer a's demand for good 1.

$x_{2,a}$ consumer a's demand for good 2.

$x_{2,b}$ consumer b's demand for good 2.

Market demand, is the sum of individual consumer demands.

Market demand for good 1 :

$$X_1 = x_{1,a} + x_{1,b} + x_{1,c} + ...$$

Suppose the set of people in the market is P.

$$X_1 = \sum_{i \in P} x_{1,i}$$

$$X_2 = \sum_{i \in P} x_{2,i}$$

1.2 Example: Cobb Douglass

Suppose there are three consumers in a market with incomes $m_a = 10, m_b = 20, m_c = 30$.

They each have utility for x_1, x_2 of $U(x_1, x_2) = x_1 x_2$.

Each consumer's demand is $\frac{\frac{1}{2}m}{p_1}$.

$$x_{1,a} = \frac{\frac{1}{2}(10)}{p_1}, x_{2,a} = \frac{\frac{1}{2}(10)}{p_2}$$

$$x_{1,b} = \frac{\frac{1}{2}(20)}{p_1}, x_{2,b} = \frac{\frac{1}{2}(20)}{p_2}$$

$$x_{1,c} = \frac{\frac{1}{2}(30)}{p_1}, x_{2,c} = \frac{\frac{1}{2}(30)}{p_2}$$

$$X_1 = \frac{\frac{1}{2}(10)}{p_1} + \frac{\frac{1}{2}(20)}{p_1} + \frac{\frac{1}{2}(30)}{p_1} = \frac{\frac{1}{2}(10+20+30)}{p_1} = \frac{30}{p_1}$$

$$X_2 = \frac{\frac{1}{2}(10)}{p_2} + \frac{\frac{1}{2}(20)}{p_2} + \frac{\frac{1}{2}(30)}{p_2} = \frac{30}{p_2}$$

1.3 Example with Quasi-Linear Utility

Three consumers with utility: $U(x_1, x_2) = \ln(x_1) + x_2$

Incomes are $m_a = 10, m_b = 20, m_c = 30$

Tangency Condition:

$$MRS = -\frac{p_1}{p_2}$$

To find the MRS, we need the margial utilities (partial derivatives of the utility function).

$$Mu_1 = \frac{\partial(\ln(x_1) + x_2)}{\partial x_1}, Mu_2 = \frac{\partial(\ln(x_1) + x_2)}{\partial x_2}$$

$$Mu_1 = \frac{1}{x_1} + 0 = \frac{1}{x_1}, Mu_2 = 0 + 1 = 1$$

$$MRS = -\frac{\frac{1}{x_1}}{1} = -\frac{1}{x_1}$$

Tangency condition:

$$-\frac{1}{x_1} = -\frac{p_1}{p_2}$$

$$x_1 = \frac{p_2}{p_1}$$

To get x_2, use the budget constraint:

$$x_1 p_1 + x_2 p_2 = m$$

$$\left(\frac{p_2}{p_1}\right) p_1 + x_2 p_2 = m$$

$$p_2 + x_2 p_2 = m$$

$$p_2 (1 + x_2) = m$$

$$x_2 = \frac{m}{p_2} - 1$$

Three consumers with utility: $U(x_1, x_2) = \ln(x_1) + x_2$

Incomes are $m_a = 10, m_b = 20, m_c = 30$

Their demands are: $x_1 = \frac{p_2}{p_1}, x_2 = \frac{m}{p_2} - 1$.

Let's write down the individual consumer demands:

$$x_{1,a} = \frac{p_2}{p_1}, x_{1,b} = \frac{p_2}{p_1}, x_{1,c} = \frac{p_2}{p_1}$$

$$X_1 = \frac{p_2}{p_1} + \frac{p_2}{p_1} + \frac{p_2}{p_1} = 3\frac{p_2}{p_1}$$

$$x_{2,a} = \frac{10}{p_2} - 1, x_{2,b} = \frac{20}{p_2} - 1, x_{2,c} = \frac{30}{p_2} - 1$$

$$X_2 = \frac{10}{p_2} - 1 + \frac{20}{p_2} - 1 + \frac{30}{p_2} - 1 = \frac{10 + 20 + 30}{p_2} - 1 - 1 - 1$$

$$= \frac{60}{p_2} - 3$$

2 Elasticity

The of an elasticity is to measure relationships in terms of percent changes. Allows to make fair comparisons across markets where the pirces and demands might on be very different scales.

If the price of teslas goes up by 1% and demand goes down by 1%

and

If the price of eggs goes up by 1% and demand goes down by 1%

This is the same behavior even though the prices and demands are wildly different for these two markets.

2.1 Price Elasticity

How does demand change in percentage terms when price increases by 1%?

$\epsilon_{1,1}$ how does the demand for x_1 change in percentage terms when the price p_1 goes up by 1%.

$\epsilon_{1,2}$ how does the demand for x_1 change in percentage terms when the price p_2 goes up by 1%.

$\epsilon_{1,1} = -1$ if the price of good 1 goes up by 1% then demand **decreases by 1%.**

Elastic. $|\epsilon_{1,1}| > 1$**.** Demand is sensitive to changes in price. A 1% increase in price will lead to a more than 1% decrease in demand.

For example, $\epsilon_{1,1} = -50$ if the price of good 1 goes up by 1% then demand **decreases by** 50%**.**

Inelastic. $|\epsilon_{1,1}| < 1$**.** Demand is **not** sensitive to changes in price. A 1% increase in price will lead to less than 1% decrease in demand.

For example, $\epsilon_{1,1} = -0.1$ if the price of good 1 goes up by 1% then demand **decreases by** 0.1%**.**

2.2 Exampls of Each Type

Inelastic: Gas, Electricity, Medicine, Credit Card, Debt, Drugs

Elastic: Bud Light, Teslas, Red Apples

2.2.1 Income Elasticity

η how does demand for a good change in percentage terms when we increase income by 1%.

$\eta = 2$ if income goes up by 1%, demand goes up by 2%.

$\eta = -1$ if income goes up by 1%, demand goes **down** by 1%.

2.2.2 Interpreting Elasticities Examples

Suppose $\epsilon_{1,1} = -2$. The price of p_1 increases by 1%, what happens to their demand for x_1?

It goes down by 2%.

Suppose $\eta = 0.5$. Income increases by 1%, what happens to their demand for x_1?

Demand goes up $\frac{1}{2}$%.

Suppose $\epsilon_{1,1} = -0.5$. The price of p_1 increases by 1%, what happens to their demand for x_1?

Demand for x_1 goes down by $\frac{1}{2}$%.

$\epsilon_{1,2}$ is the **cross-price-elasticity** for good 1 when p_2 changes.

Suppose $\epsilon_{1,2} = 2$. The price of a good 2 increases by 1%, what happens to their demand for x_1?

The demand for good 1 goes up by 2%.