ECON250: Intermediete Microeconomics

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1 Elasticities

Recall, a derivative tells us the instantaneous rate of change of one variable with respect to another.

Definition: The percent ratio of price and quantity is called the elasticity

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Using elasticity we can answer the question : What percent would quantity change if the price raised by one percent. Using the definition, we can derive the elasticity:

$E = \frac{\%\Delta Q}{\%\Delta} = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{X_2 - X_1}{X_1}} = \frac{(Q_2 - Q_1)(X_1)}{(Q_1)(X_2 - X_1)} = \frac{\Delta Q}{\Delta X}\frac{X}{Q}$

Now if we take the limit as $Q_1 \to Q_2$ and $X_1 \to X_2$ then we get the Price elasticity of X is $\boxed{\mathrm{E}_X^P = \frac{dQ}{dX}\frac{X}{Q}}$

Now we can looks at the different types of Elasticities

The own price elasticity of Demand is how much someones quantity consumed changes with respect to price.

$$\boxed{E_{own} = \frac{dQ_d}{dP_{own}}\frac{P_{own}}{Q_d}}$$

The cross price elasticity of demand is how much someones quantity demanded for good X changes with respect to a change in price of good Y.

$$\boxed{E_{cross} = \frac{dQ_d}{dP_{other}}\frac{P_{other}}{Q_d}}$$

The Income elasticity of demand is how much does quantity demanded change with respect to Income

$$\boxed{E_{income} = \frac{dQ_d}{dI}\frac{I}{Q_d}}$$

The supply elasticity is how much quantity supplied changes with respect to price.

$$\boxed{E^P = \frac{dQ_s}{dP}\frac{P}{Q_s}}$$

The price elasticity of demand will typically will be negative due to the downward sloping nature of the demand curve. Also note we have five cases for elasticty

Definition:

(i) if $|E| = 0 \implies$ Perfectly Inelastic

(ii) if $|E| \to \infty \implies$ Perfectly Elastic

(iii) if $|E| = 1 \implies$ Unitary Elastic

Generally,

$E \in (0, 1) \implies$ Inelastic

$E \notin (0, 1) \implies$ Elastic

Notice, when the demand curve is steeper, the elasticity is more inelastic and when it is more shallow, elasticity is elastic.

2 Utility Maximization

In economics we often want to know how people make decisions. Some examples of what people think while making decision are:

- How many?
- Preferences
- Budget

We combines these ideas in the the concept of utility maximization

Definition: How to maximize your quantity with respect to preference, budget, etc.

2.1 Consumer Preferences

Assumptions:

(I) Completeness(Rankability)

Consumers can compare across all sets of goods. Prefer one to another or be indifferent.

(II) Non-Satiation(Free Disposal)

More is weakly better than less. (Weakly better $\equiv$ Not worse) Since you can get ride of excess without cost
(III)Transitivity
If you prefer A to B and your prefer B to C then you prefer A to C
(IV) Preference for Balance
Like variety

Definition: A utility function is a relation between goods and being satisfied.

EX: Supposed Sam has a preference for chicken and rice given by the following utility function $U(C,R) = C^2R$. Given bundles $A = (2,2), B = (10,0), C = (4,1), D(3,1)$ How would Sam rank each bundle?
Soln: $U(A) = 8, U(B) = 0, U(C) = 16, U(D) = 9$
hence he prefers $C > D > A > B$

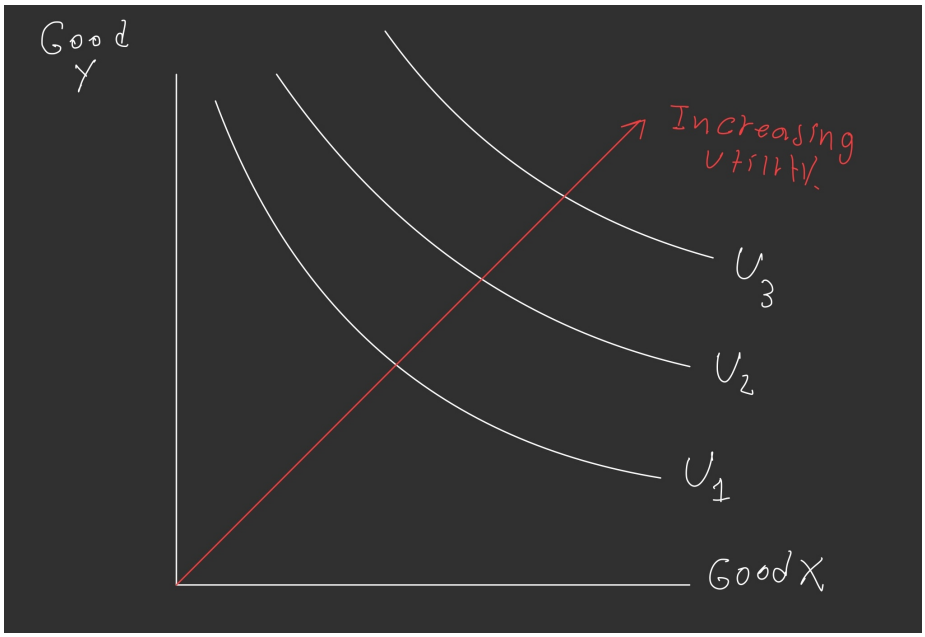
If U(A)=U(B) we say that someone is indifferent between A and B. Different utility functions represent different preferences. Moreover, utility is ordinal (Ordinal ranking). This means we can compare ranking but but not scale of happiniess. Meaning we can say $A < D$ but we cannot say you prefer D 2 times as much as A. You can compare across people but that is harder. i.e
if $U_1(x), U_2(x)$ represent 2 peoples utility function and if

$$U_1(A) < U_1(B) < U_1(C) < U_1(D)$$

$$U_2(A) < U_2(B) < U_2(C) < U_2(D)$$

we say that they have the same preferences but need not have $U_1(x) = U_2(x)$ if they have the same preference, they have the same shape and slope.

Definition: An indifference curve is a level curve where all bundles are indifferent.



Characteristics:

- Always Can be Drawn (Completeness)
- Higher Utility further from the origin (Non-Satiation)
- Downward Sloping, Likes both goods so to keep just as happy, if you take away some of one you need to make up for it by adding the other.
- Never cross. (Crossing violates transitivity and non-satiation)
- Curved away from origin (Matches a preference for balance)

Above picture is the standard indifference curve or the Imperfect substitute curve. Recall, the definition of Substitutes and Complements.
Definition: Given goods A and B,
if you buying good A $\iff$ you buying good B
then good A and good B are called complements.
Definition: Given goods A and B,
if you buying good A $\implies$ you do not buy good B
and
if you buying good B $\implies$ you do not buy good A
then good A and good B are substitutes.
So this means the indifference curves of complements look like L's and the indifference curves of substitutes are lines.
When given a Utility function to draw it we just draw the level curves of it. By completness you can choose any fixed U.

2.2 Marginal Utility and Budget Constraints

Definition:(Marginal Utility)
Additional utility a consumer receives from an additional good or service.

$$\boxed{MU_{x_1} = \frac{\partial U}{\partial x_1}}$$

$$\boxed{MU_{x_2} = \frac{\partial U}{\partial x_1}}$$

Notice, MU$\geq$0 by the non-satiation assumption.
$\frac{MU_{x_1}}{MU_{x_2}}$ = marginal rate of substitution of x_1 for x_2. The Marginal Rate of substitution tells us the rate at which a consumer is willing to trade off good x_1 for good x_2 and be equally well off.

Definition: (Budget Constraints)
All Combinations a consumer can buy when spending all their income.

It is quite simple to derive the formula for the one we will use in our class. We begin with the assumption that total expenditure is equal to total income. Then we trivially find that

$$I = P_X X + P_Y Y$$

A standard budget constrain will be just a line. With vertical intercept $\frac{I}{P_Y}$ and horizontal intercept $\frac{I}{P_X}$. Moreover, the slope of the budget constrain is the ratio of the price of good X and Y. Which is formally the market trade off between X and Y.

2.3 Methods of Solutions

Recall that budget constraints and the utility curves both have goods on their axes. So I guess a natural econ question is what if we plot them on the same graph. First, think intuitively what does it mean for use to find the most efficient point. It means that we are on our budget line and on the highest utility curve we can be on. By completeness, we know there are infinite number of utility curves. However most of them are either impossible with our budget or not fully utilizing the budget. So we choose the Utility curve with tangent line equal to the budget curve. Because at this point the Market trade off between the 2 goods is equal to our marginal rate of substitution. This is called the method of interior solutions.

Sometimes it is more optimal to buy all of one good and none of the other. To solve these systems, we look at how much the Marginal rate of substations is compared to the slope of the budget curve. To this we find the MSR and slope

of the budget line. If we should buy all of good X then our work would look like this:

$$\frac{MU_X}{MU_Y} \geq \frac{P_x}{P_y} \iff \frac{MU_x}{P_x} \geq \frac{MU_y}{Py}$$

This makes intuitive sense since on the right of the if and only if we see the utility per price of X is greater than the utility per price of Y, so of course we could choose the one where we get more utility per dollar spent. This method is called corner solutions because the point we buy at will be at the corner.

2.4 Engel Curve

Definition: An Engel Curve is a graph depicting the relationship and consumption.

We can classify goods by how they respond to changes in income.

- Normal Good: Consumption Increases when Income increases.
- Inferior Good: Consumption decreases when Income increases
- Neither: Neither an Inferior or normal good.

No good can be inferior at all points of Income since then it would be a normal good.
Result: At a fixed income we can find the relationship between the price of a good and the quantity consumed of a good. Notice, this is the demand curve for the good.
Method of Driving the demand curve:
Solve utility maximization problem in terms of income and prices.
Example: Suppose Daryl has utility over apples and bananas given by U(A,B)=AB. He has income I to spend on apples and bananas, the prices of apples and bananas are P_a and P_b.
(a) Solve for Daryl's optimal consumption of apples as a function of prices and income.
Solution:
Given $I = P_aA + P_bB, U(A,B) = AB$
$\implies MSR_{ab} = \frac{B}{A} \implies \frac{B}{A} = \frac{P_A}{P_B} \iff P_bB = P_aA \implies I = 2P_aA \iff A = \frac{I}{2P_a}$ similarly $\frac{I}{2P_b} = B$. Hence, we have the quantity demanded as a function of price i.e. a demand curve.

2.5 Income and Substitution Effects

Definition(s):
(i) Total Effect: Observed change from a price change.
(ii) Substitution Effects: Part of total change due to change in relative prices.
(iii) Income Effects: Part of total change due to a change in purchasing power.
Method: Given a Budget Curve tangent to Utility Curve$_1$ at bundle A and a

Budget Curve tangent to Utility Curve$_2$ at bundle B,
1) The total effect is the distance $A \mapsto B$
2) Draw a new Budget Curve parallel to the second Budget Curve and tangent to U_1. Let the point of tangency be called A'
3) The Substitution effect is the Distance $A \mapsto A'$
4) The Income effect is $A' \mapsto B$
Notes: Total Effect = Substitution Effects + Income Effects
You always substitute to cheaper good. For normal, inferior or neither goods we only look about the income effects. We ask, did our purchasing power go up or down. Then we ask what the cause was. If income effect is 0, it is neither normal nor inferior.

Suppose we have a good x whose price fell, We have 3 cases:
If X is a normal good then, substitution is positive, income is positive and total is positive.
If X is inferior then, substitution is positive , income is negative and total is positive.
A special case of an inferior good is called a Giffen good. It is an inferior good where price and quantity are positively related. Hence, Demand Slopes upward and incomes effects are very large.
If X is a Giffen good then, substitution is positive ,income is negative , total is negative.

2.6 Market Demand

Suppose we have two people, n_1 and n_2 in the market for some good X. If n_1's demand function is Q=500-2P and n_2's demand function is given by Q=800-4P. To find the market demand we need consider at what prices these people are buying and when are they not. We see that n_1 buys at P=250 but n_2 only buys at P=200 so for $200 \leq P \leq 250$ only n_1 is in the market. So market demand for $200 \leq P \leq 250$ is soley the demand function of n_1. However at $P \leq 200$ n_2 also enters in the market so we just add their inverse demand functions.
Proposition: Given n identical individual demand functions Q_{inv},
Market Demand $Q_m = \Sigma_{k=1}^{n} Q_{inv} = nQ_{inv}$

2.7 Labor Supply

What are examples Government assistance programs?
Social Security, Medicare, medicaid, Snap, unemployment, TANF, earned income tax credit, etc.
Over the Purpose is to provide government safety new. However, we are often concerned with what effects these social programs mave have.
Model: Labor Supply
We graph our typical indifference curves and budget constraint where the horizontal good is Leisure and vertical good is Income for other goods. We graph

leisure instead of hours worked because we want to put good people like so we abide by the typical shapes.
In questions we will get is to find the optimal bundle and see if it has the desired effect. i.e. if we give a big unemployment benfits we need to ensure it doesnt make everyone not work at all.