Topic 1: Consumer Behaviour

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Learning Objectives

- Consumer Preferences and Demand Curve.
- Luxury and Necessity; Complement and Substitute; Inferior and Normal
- Elasticity, revenue and elasticity.
- Consumer surplus.
- Measurement issues.

Why Consumer Behaviour?

- Demand and supply are two sides of the market.
- Unless and until firms have some idea about demand, they can not make their own decision (to supply)
- *"Is there a market for X"*? Here, "market" means sufficient consumer demand for good/service X.

Taste and Preferences

- We assume that consumer tastes and preferences are given.
- Assume that the consumer consumes only two goods: a and b (there can be more than two, but it is harder to draw).
- A consumers' preference is over various combinations of the goods $X_1 = (a_1, b_1)$, $X_2 = (a_2, b_2)$, $X_3 = (a_3, b_3)$.. so on and so forth
- Given any two bundles X_1 and X_2, only three possibilities are there: you either prefer X_1 to X_2, or you prefer X_2 to X_1 or you are indifferent.

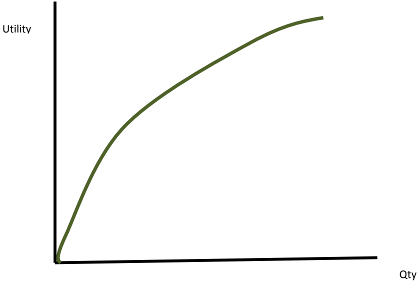
Utility Function

- Utility function is just a rule to associate a ranking number to each bundle. In this case, $u : \mathbb{R}^2 \longrightarrow \mathbb{R}$
- Suppose you prefer X_1 to X_2. Then, $u(a_1, b_1) > u(a_2, b_2)$
- If you are indifferent between X_2 and X_3, then $u(a_2, b_2) = u(a_3, b_3)$
- In other words, utility function helps you to order the bundles.

Marginal Utility

- Suppose one good is increased by a small amount. The effect on utility is called marginal utility. For example, the marginal utility of a is $\dfrac{\Delta u}{\Delta a}$. At the limit, we can replace it by the partial derivative $u_a = \dfrac{\partial u}{\partial a}$.
- Assumption: $u_a > 0$, $u_{aa} < 0$; similarly for b.
- Thus marginal utility is positive, i.e. as consumption increases, utility also increases
- But the rate at which consumption increases is diminishing.

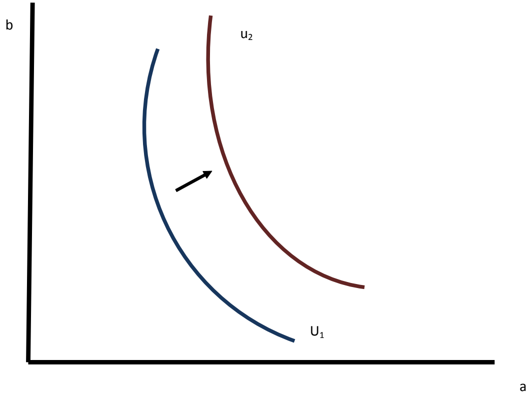
Law of Diminishing Marginal Utility



Indifference Curve

- An indifference curve is the locus of (a, b) such that, along the curve, $u(a, b)$ is a constant.
- In other words, it provides the bundles which you are indifferrent to
- Slope of indifference curve: *negative* (since lower amount of b nececitates higher amount of a as compensation and vice versa)
- Slope of the indifference curve: falls as we move to right (due to diminishing marginal utility).
- $$\begin{aligned} \frac{db}{da} &= -\frac{u_a}{u_b} \\ \frac{d^2 b}{da^2} &= -\frac{u_a u_{bb}^2 + u_b u_{aa}^2 - 2u_{ab} u_a u_b}{u_b^3} \end{aligned}$$
- Higher indifference curves mean higher utility.

Indifference Map



Other Utility Functions

- In general, we assume that the function $u()$ is C^2, i.e. continuous second derivatives exist.
- But suppose a is red pencil, b is blue pencil, and you are not concerned about the composition of the bundle, only the total number of pencils in a bundle matter.
- This is the case of *perfect substitutes*: $u(a, b) = a + b$
- Exercise: draw the indifference map.

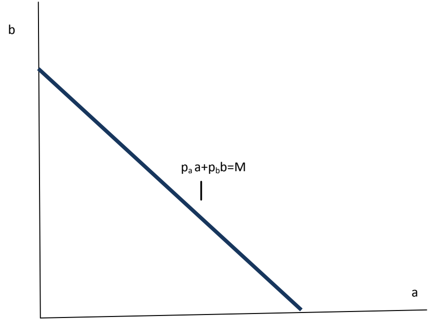
Another Example

- Generally, you wear one left shoe and one right shoe, i.e. bundle is $X_1 = (1, 1)$
- Now suppose I give you 5 left shoes and one right shoe, i.e. $X_2 = (1, 5)$. Similarly, consider $X_3 = (5, 1)$
- Among X_1, X_2, X_3, which one do you prefer (and why?)
- From the above information, draw the indifference curve.
- See if the following utility function makes any sense: $u(a, b) = \min(a, b)$
- This is the case of *perfect complements*.

Consumers' Budget

- Consumer takes the prices and income as given. Suppose prices are p_a,p_b and income is M.
- Consumers' budget constraint: total expenditure can not exceed total income (we are not allowing the consumer to borrow)
- $p_a a + p_b b \leq M$
- Budget set $BS = \{(a, b) | p_a a + p_b b \leq M\}$
- Budget line $B = \{(a, b) | p_a a + p_b b = M\}$
- Slope of the budget line $\dfrac{db}{da} = -\dfrac{p_a}{p_b}$
- Intercepts are $\left[\dfrac{M}{p_a}, \dfrac{M}{p_b}\right]$

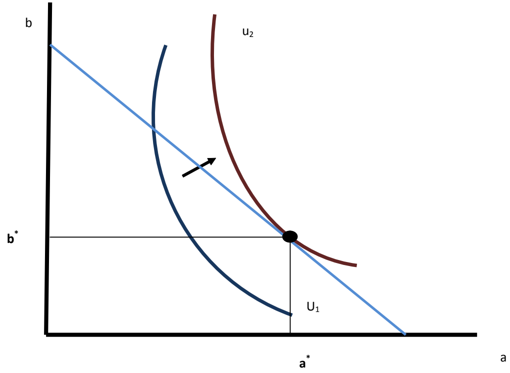
Budget Line



Consumer Behaviour

- Given prices, income and their preferences, people want to achieve the maximum utility as possible.
- This means that the indifference curves and the budget line must be *tangent* to each other.

Consumers Equilibrium:Diagram



Consumers Equilibrium:Mathematics

- Max $u(a, b)$ such that $p_a a + p_b b = M$
- Form the Lagrangean $L = u(a, b) + \lambda (M - p_a a - p_b b)$
  First order conditions are
  $u_a = \lambda p_a$
  $u_b = \lambda p_b$
  $M - p_a a - p_b b = 0$
- Solving these, we can express $a = D^a(p_a, p_b, M)$, $b = D^b(p_a, p_b, M)$: these functions are known as demand functions.
- Thus, demand depends on (i) taste and preferences (ii) price of the good, (iii) price of other goods and (iv) income.

Demand

- The relationship between equilibrium quantity and own price, keeping other factors constant is known as demand curve.
- The slope of the demand curve is negative, $\frac{\partial D}{\partial p_a} < 0$. As own prices change, we have a movement along the same demand curve ("Law" of Demand)
- Change in other factors lead to a *shift* of the demand curve.
- If $\dfrac{\partial a}{\partial M} > 0$, the good is normal (demand shifts to right if M increases), if $\dfrac{\partial a}{\partial M} < 0$, the good is inferior ((demand shifts to leftif M increases)
- If $\dfrac{\partial a}{\partial p_b} > 0$ then a and b are substitutes (petrol and diesel), if $\dfrac{\partial a}{\partial p_b} < 0$,then a and b are complements (petrol cars and petrol)

From Individual to Market Demand

- Market demand is obtained by *horizontally* summing up individual demand curves.

Example

Suppose market for tea. Person 1 has demand curve $q = 8 - 2p$ and person 2 has demand curve $q = 30 - 6p$. Then the market demand is $q = 30 - 6p$ if $4 \leq p \leq 5$ and $q = 38 - 8p$ if $p < 4$.

Note that, this implies the demand curve to have a kink at $p = 4$.

- However, if there are many consumers. these kinks will smooth out.
- In what follows, we will work essentially with market demand curve.

Elasticity

- We have established that $Q_1 = D(p_1, p_2, M)$
- A key question is, if one of the factors change, how would it affect the demand? How responsive is the demand to the parameters? (Comparative Statics in Economics)
- Suppose p_1 changes from p_1^0 to p_1^1. As a result, consumption increases from Q_1^0 to Q_1^1.
- One way to figure out the sensitivity is simply to find the slope= $\frac{Q_1^1.-Q_1^0}{p_1^1-p_1^0}$
- But the slope is not unit free. To make it unit free, we divide the numerator by quantity and the denominator by price. The result is known as "own price elasticity of demand".
- Simply speaking, this is proportional change in qty demanded divided by proportional change in price.

Definitions

- Arc elasticity

$$\epsilon = -\frac{\frac{\Delta Q}{\bar{Q}}}{\frac{\Delta p}{\bar{p}}}$$

, where $\bar{p}$, $\bar{Q}$ are average price and quantity.

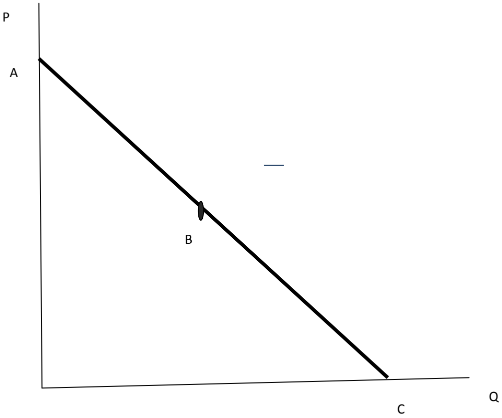
- Point elasticity: if the changes are small enough to allow us to apply calculus, then

$$\epsilon = -\frac{p}{Q}\frac{dQ}{dp} = -\frac{d\left(\ln Q\right)}{d\left(\ln p\right)}$$

Typology of Demand Curve

- Infinite elastic: horizontal
- Perfectly inelastic: vertical
- Steeper demand curve: more inelastic
- Flatter demand curve: more elastic.
- Elasticity depends on availability of substitutes, time frame etc.
- Usually, along a demand curve, elasticity changes.

Point Elasticity Along A Linear Demand Curve



- $\epsilon = \dfrac{AB}{BC}$

Income Elasticity

- Income elasticity: $\epsilon_{1M} = \frac{M}{Q_1}\frac{dQ_1}{dM}$
- Positive for normal goods, negative for inferior goods.
- If $\epsilon_{1M} < 1$, then the good is "necessity", if $\epsilon_{1M} > 1$, then it is luxury.

Cross Price Elasticity

- Cross price elasticity: $\epsilon_{12} = \frac{p_2}{Q_1}\frac{dQ_1}{dp_2}$
- Positive for substitutes, negative for complements.
- If $\epsilon_{12} < 0$, then the goods are "complements" (such as cars with petrol engine and petrol), if $\epsilon_{12} > 0$, then goods are substitutes (such as petrol and diesel).

Own Price and Revenue

- An application of Own Price Elasticity.
- From a firm's perspective, the elasticity of demand is a critical piece of information, since it determines the change in revenue that results from a given change in price
- Revenue $R = p * q$
- $\frac{dR}{dp} .= q + p\frac{dq}{dp} = q\left(1 + \frac{p}{q}\frac{dq}{dp}\right) = q\left(1 - |\epsilon|\right)$
- Thus, if demand is *inelastic*, then charging higher prices will lead to higher revenue.
- If demand is *elastic*, higher prices lead to lower revenue.
- Related: which good to tax?

Estimation

- An important issue is estimating the demand curve..
- Strategy: compile data on consumption , own price, price of other goods, income, other relevant varables.
- $c = \alpha + \beta\,(ownprice) + \gamma\,(otherprice) + \delta\,(income) + others$
- $\ln c = \alpha' + \beta' \ln\,(ownprice) + \gamma' \ln\,(otherprice) + \delta' \ln\,(income) + others$
- Difference between these two estimation strategy?

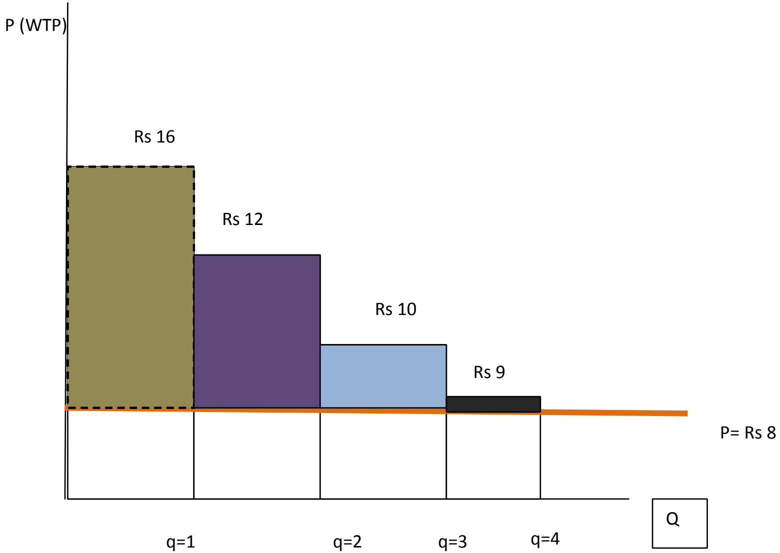
Consumers Surplus

- A typical demand curve information is at a price, what is the quantity demanded.
- But we can go the other way round as well: at a certain quantity, what is the maximum price that the consumer is willing to pay?
- This reflects the "value" of the good to the consumer.
- What is your willingness to pay?

A Thought Experiment

- Just before the exam, you want to put an allnighter. You desparately need some coffee. How much you are willing to pay for the first cup of coffee? For the second cup? For the third cup?
- For the first cup, you are really desparate, so probably something like Rs 16. for the second cup, since you do not need that much, may be 12 Rs, and then Rs 10 for the third cup, Rs 9 for fourth cup, Rs 7 for the sixth cup...
- Given that market price of coffee is Rs 8, you will buy 4 cups.
- The total willingness to pay $= (16 + 12 + 10 + 9) = 47$.: this is the total psychological benefit, or total willingness to pay for 4 cups of coffee.
- However, given the market price is Rs 8, you pay only Rs 32. Your consumer surplus $= 47 - 32 = 15$

Consumer Surplus: A Single Consumer



- Now suppose you are thinking not about an individual consumer, but the market demand curve as a whole.
- Even then, the area under the market demand curve is total value (interpret different consumers as having different willingness to pay).
- The area under the demand curve above the market price is consumer surplus.
- Let $Q = D(p)$ be the equation of the demand curve. Suppose $\bar{p}$ is the highest price (price at which qty demanded is zero). Then, for any price $p_{0,} CS = \int_{p_0}^{\bar{p}} D(p)\, dp$
- Of course, what is important is not CS per se, but the change in consumer surplus when price changes from p_0 to p_1. That expression is given by $\Delta CS = \int_{p_0}^{p_1} D(p)\, dp$
- Check that, if prices are going up, then change in consumers' surplus is negative.

Consumers' Surplus: Problem

- If more than one price change, then consumer surplus is ill defined.
- Suppose you consume two goods. Good 1 has demand curve $Q_1 = D_1(p_1, p_2)$ and good 2 has $Q_2 = D_2(p_1, p_2)$.
- Suppose both p_1 and p_2 change.
- You measure ΔCS_1 and ΔCS_2 and add these up.
- However, your measure will depend crucially on the order of change: do you change p_1 first or do you change p_2 first.
- This is a problem of *path dependence*.

Take Home Concepts

- Consumers' preferences, indifference curve.
- Budget line.
- Demand function: shift and movements.
- Own, cross price and income elasticities.
- Consumers' surplus.

Reference

- http://luiscabral.org//economics/books/iio2/c02.consumers.pdf