

UNIT 3

Theory of Consumer Behavior

(6 Hrs) — Applied Economics (CAEC353), BCA III/VI

⚠ Please Take Care — This May Contain Errors

These notes were prepared from the course syllabus and may contain errors, omissions or over-simplifications — including in numerical examples, diagrams, and Nepal-specific facts and figures (which change over time). Please take care: cross-check every formula, number and definition with your prescribed textbook, class notes and the official syllabus before relying on it for study or examination.

3.1 Concept of Utility: Cardinal vs Ordinal

Utility is the want-satisfying power of a commodity. It is subjective — it depends on the consumer, the time and the place. The theory of consumer behaviour explains how a rational consumer, with a limited income and given prices, allocates spending among goods to obtain **maximum satisfaction**. Two approaches exist:

Basis	Cardinal utility analysis	Ordinal utility analysis
Proponents	Marshall, Jevons, Walras, Menger	Hicks, Allen, Pareto, Slutsky
Measurability	Utility can be measured in numbers (utils).	Utility cannot be measured; only <i>ranked</i> (first, second, third preference).
Main tool	Marginal utility (MU)	Indifference curve and budget line
Equilibrium condition	$MU_x / P_x = MU_m$ (or $MU_x/P_x = MU_y/P_y$)	$MRS_{xy} = P_x / P_y$
Assumption on money	Constant marginal utility of money	No such assumption
Realism	Less realistic	More realistic and general

3.2 Cardinal Utility Analysis

3.2.1 Assumptions

- Consumer is **rational** and aims to maximise total utility.
- Utility is **cardinally measurable** in 'utils'.
- **Law of diminishing marginal utility** holds: as more units are consumed, MU falls.

- **Marginal utility of money is constant** (so price can be used as a measure of MU in money terms).
- Utility is **additive** and **independent** — the utility from one good does not depend on the quantity of another.
- Income, tastes and prices are **given**; consumption is of homogeneous units and continuous.

3.2.2 Total and Marginal Utility; Law of Diminishing Marginal Utility

Total utility (TU) is the sum of satisfaction from all units consumed; **marginal utility (MU)** is the addition to TU from consuming one more unit: $MU = \Delta TU / \Delta Q$, and $TU = \Sigma MU$. The **law of diminishing marginal utility** states that, other things remaining the same, as a consumer consumes more units of a good, the marginal utility from each successive unit falls.

Units of X	MU (utils)	TU (utils)
1	24	24
2	20	44
3	16	60
4	12	72
5	8	80
6	4	84
7	0	84 (maximum, MU = 0)
8	-4	80 (MU negative)

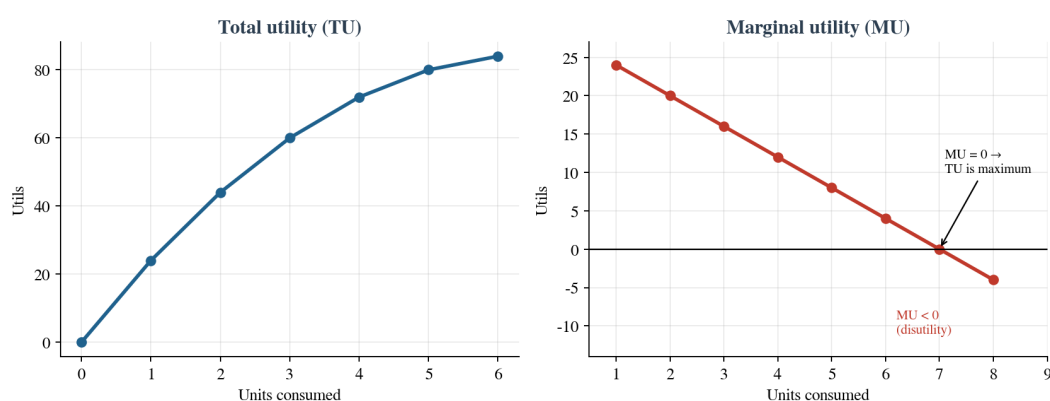


Figure 3.1 — TU rises at a diminishing rate; MU falls and TU is maximum when MU = 0

3.2.3 Consumer's Equilibrium

(a) **Single commodity:** A consumer buys a good up to the point where the marginal utility of the good (in money terms) equals its price: $MU_x / P_x = MU_m$. If the MU of money is constant and taken as 1, then $MU_x = P_x$. If $MU_x > P_x$ the consumer buys more; if $MU_x < P_x$ the consumer buys less.

(b) **Two or more commodities — Law of Equi-Marginal Utility:** With a fixed income, the consumer maximises total utility when the marginal utility of the last rupee spent on each good is equal:

$$MU_x / P_x = MU_y / P_y = \dots = MU_n / P_n = MU_m \text{ subject to } P_x \cdot X + P_y \cdot Y + \dots = M$$

Example 3.1 — Equilibrium with two goods

Income = Rs. 10, P_x = Rs. 2, P_y = Rs. 1. Marginal utilities (utils) are:

X (units 1–5): MU = 24, 20, 16, 12, 8 $\rightarrow MU_x/P_x = 12, 10, 8, 6, 4$

Y (units 1–6): MU = 14, 12, 10, 8, 6, 4 $\rightarrow MU_y/P_y = 14, 12, 10, 8, 6, 4$

Find the utility-maximising bundle and total utility.

Solution

Spend each rupee on the alternative with the highest MU per rupee until income is exhausted.

Ranking of MU per rupee: 14 (Y1), 12 (X1), 12 (Y2), 10 (X2), 10 (Y3), 8 (X3), 8 (Y4) ...

Spending: Y1 (Rs.1) + X1 (Rs.2) + Y2 (Rs.1) + X2 (Rs.2) + Y3 (Rs.1) + X3 (Rs.2) + Y4 (Rs.1) = Rs. 10 ✓.

Equilibrium bundle: **X = 3, Y = 4**. Check: $MU_x/P_x = 16/2 = 8$ and $MU_y/P_y = 8/1 = 8$ — equal ✓; expenditure = $3 \times 2 + 4 \times 1 = 10$ ✓.

Total utility = $(24+20+16) + (14+12+10+8) = 60 + 44 = \mathbf{104 \text{ utils}}$. The MU of money = 8 utils per rupee.

3.2.4 Derivation of the Demand Curve (Cardinal Approach)

With constant MU of money, the price the consumer is willing to pay for each unit equals its marginal utility in money terms ($MU_x \div MU_m$). As MU falls with more consumption, the price the consumer will pay falls — giving a **downward-sloping demand curve**. Thus the MU curve is the demand curve.

Example 3.2 — Deriving demand

$MU_x = 24, 20, 16, 12, 8$ utils for units 1–5, and MU of money = 4 utils per rupee. Derive the demand schedule.

Solution

Price = $MU_x \div MU_m$: unit 1 $\rightarrow 24/4 = \text{Rs. } 6$; unit 2 $\rightarrow \text{Rs. } 5$; unit 3 $\rightarrow \text{Rs. } 4$; unit 4 $\rightarrow \text{Rs. } 3$; unit 5 $\rightarrow \text{Rs. } 2$.

Demand schedule: $P = 6, 5, 4, 3, 2 \rightarrow Q_d = 1, 2, 3, 4, 5$ (price and quantity move in opposite directions — law of demand).

3.2.5 Criticisms

- Utility is a psychological feeling and **cannot be measured** in cardinal numbers.
- The assumption of **constant marginal utility of money** is unrealistic — it changes when income or prices change, especially for large purchases.
- Assumes utilities are **independent**, ignoring substitutes and complements.
- Cannot separate the **income and substitution effects** of a price change; cannot explain Giffen goods.
- Fails for **indivisible** goods (cars, houses) and for goods where MU rises at first.
- Assumes a perfectly rational, fully informed consumer.

3.3 Ordinal Utility Analysis (Indifference Curve Approach)

3.3.1 Concept and Assumptions

An **indifference curve (IC)** shows all combinations of two goods that give the consumer the **same level of satisfaction**, so the consumer is indifferent among them. A set of ICs is an **indifference map**. Assumptions: rationality; ordinal ranking; **completeness** and **transitivity** of preferences (if $A > B$ and $B > C$ then $A > C$); **non-satiation** (more is preferred); **diminishing MRS**; given income and prices.

3.3.2 Properties of Indifference Curves

- **Slope downward** from left to right — to keep utility constant, more of X requires less of Y.
- **Convex to the origin** — because the marginal rate of substitution diminishes.
- **Do not intersect** (nor are tangent) — intersection would violate transitivity.
- **Higher IC represents higher satisfaction** (more of at least one good).
- **Do not touch either axis** — the consumer buys some of both goods.

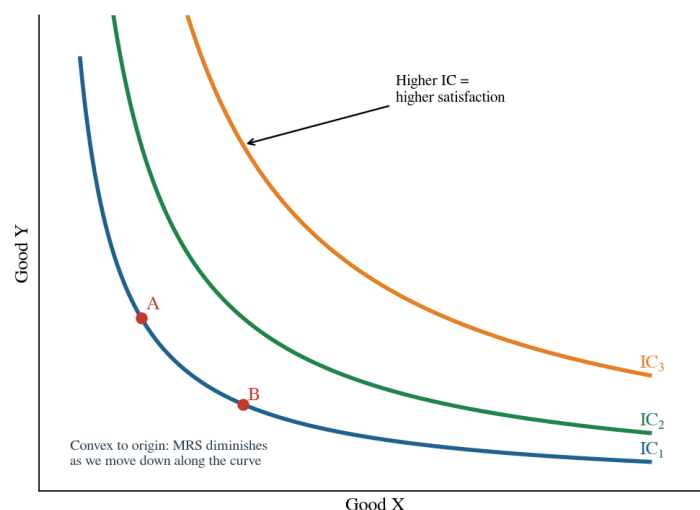


Figure 3.2 — An indifference map: A and B lie on the same IC (equal satisfaction)

3.3.3 Marginal Rate of Substitution (MRS)

MRS_{xy} is the amount of Y the consumer is willing to give up to get one more unit of X, keeping utility unchanged: $\text{MRS}_{xy} = -\Delta Y / \Delta X = \text{MU}_x / \text{MU}_y$ (the absolute slope of the IC). It **diminishes** as the consumer moves down the IC.

Combination	Good X	Good Y	MRS _{xy} ($\Delta Y / \Delta X$)
A	1	12	—
B	2	8	4 : 1
C	3	5	3 : 1
D	4	3	2 : 1
E	5	2	1 : 1

3.3.4 Price Line (Budget Line)

The budget line shows all combinations of X and Y that the consumer can buy with a given income and prices: $M = P_x \cdot X + P_y \cdot Y$. Intercepts: M/P_x on the X-axis and M/P_y on the Y-axis; **slope** = $-P_x/P_y$. A rise in income shifts it parallel outward; a change in P_x pivots it on the Y-intercept; a change in P_y pivots it on the X-intercept.

3.3.5 Consumer's Equilibrium

The consumer maximises satisfaction at the point where the budget line is **tangent** to the highest attainable indifference curve.

- **First-order condition:** slope of IC = slope of budget line $\rightarrow MRS_{xy} = MU_x/MU_y = P_x/P_y$.
- **Second-order condition:** IC must be **convex** to the origin at the point of tangency (MRS diminishing).

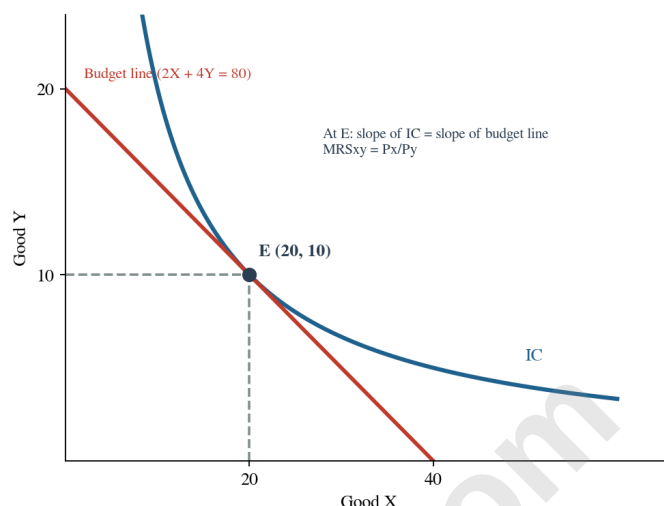


Figure 3.3 — Consumer's equilibrium at the tangency of budget line and IC

Example 3.3 — Equilibrium (numerical exercise)

A consumer with utility $U = X \cdot Y$ has income Rs. 80. $P_x = \text{Rs. } 2$ and $P_y = \text{Rs. } 4$. Find the equilibrium quantities and maximum utility.

Solution

$MU_x = Y$ and $MU_y = X$, so $MRS_{xy} = MU_x/MU_y = Y/X$.

Equilibrium: $Y/X = P_x/P_y = 2/4 = 1/2 \rightarrow X = 2Y$.

Budget: $2X + 4Y = 80 \rightarrow 2(2Y) + 4Y = 80 \rightarrow 8Y = 80 \rightarrow Y = 10, X = 20$.

Maximum utility $U = 20 \times 10 = 200$ (Figure 3.3).

3.4 Price Effect, Income Effect and Substitution Effect

3.4.1 Price Effect and Price-Consumption Curve (PCC)

The **price effect** is the change in consumer's equilibrium quantity when the price of a good changes, income and the other price constant. Keeping M and P_y fixed and lowering P_x , the budget line pivots outward on the Y -axis intercept, giving new tangency points E_1, E_2, E_3 . Joining them gives the **price-consumption curve (PCC)**.

3.4.2 Derivation of the Demand Curve from the PCC

Each point on the PCC shows the quantity of X bought at a given price of X. Plotting (price of X, quantity of X) pairs gives the **demand curve**. From the numerical example ($U = XY$, $M = 80$, $P_Y = 4$): demand for X is $X = M/(2P_X) = 40/P_X$. At $P_X = 2$, $X = 20$; at $P_X = 1$, $X = 40$; at $P_X = 0.5$, $X = 80$.

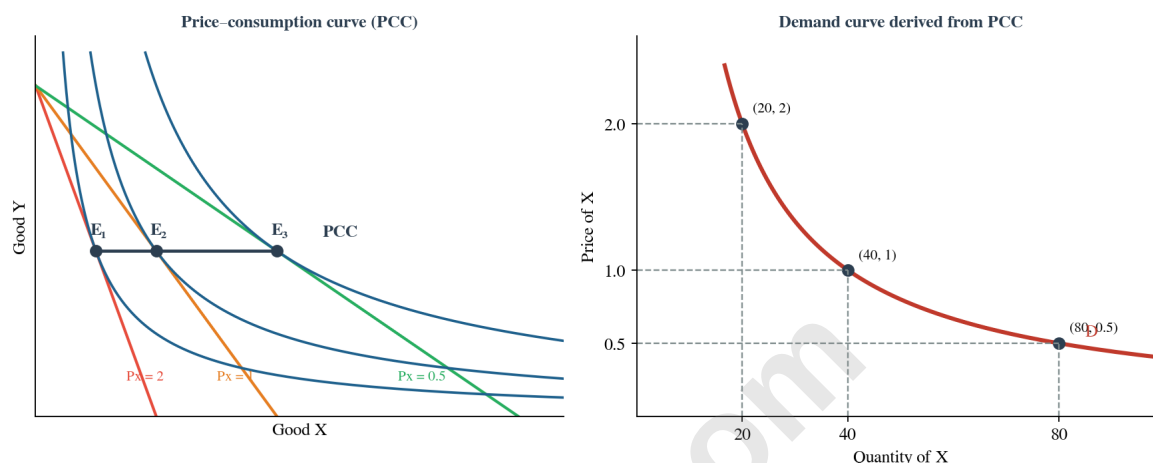


Figure 3.4 — PCC (left) and the demand curve derived from it (right)

Note: For a Cobb-Douglas utility function the PCC is horizontal (the quantity of Y stays unchanged, as here); for a normal good with elastic demand the PCC slopes downward and with inelastic demand it slopes upward.

3.4.3 Income Effect and Income-Consumption Curve (ICC)

The **income effect** is the change in quantity bought due to a change in the consumer's real income, prices constant. Raising income shifts the budget line **parallel outward**; joining the successive equilibrium points gives the **income-consumption curve (ICC)**. For normal goods the ICC slopes upward; if a good is inferior, the ICC bends backward (or downward) because the quantity of the inferior good falls as income rises. The income effect is positive for a normal good and negative for an inferior good.

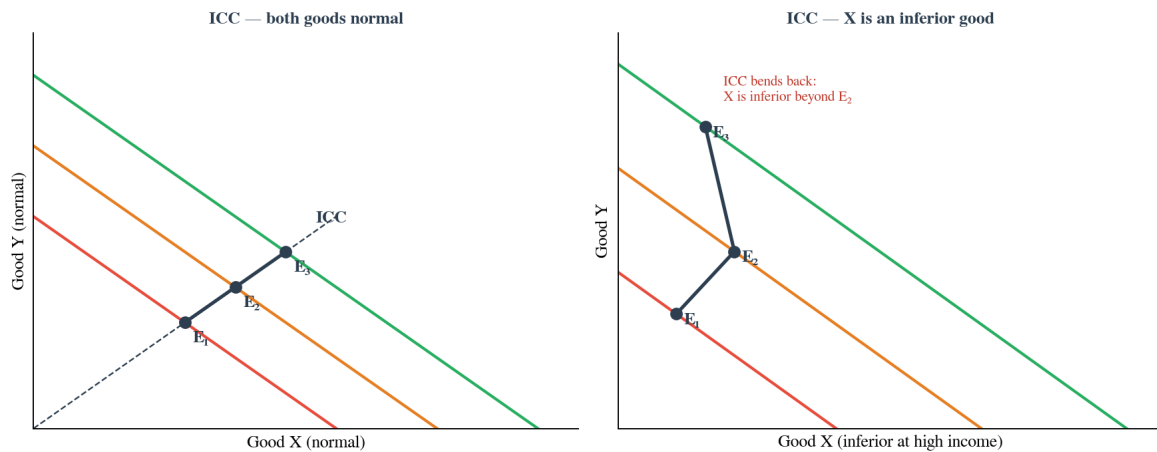


Figure 3.5 — Income-consumption curves for normal and inferior goods

3.4.4 Substitution Effect

The **substitution effect (SE)** is the change in quantity bought due only to the change in **relative prices**, with real income held constant; the consumer substitutes the relatively cheaper good for the dearer one. SE always works opposite to the price change — it is **always negative** — so a fall in P_x always raises the quantity of X through the SE.

3.4.5 Decomposition of the Price Effect (Hicksian Approach)

Price effect = Substitution effect + Income effect. In Hicks's method, real income is kept constant by keeping the consumer on the **original indifference curve**:

- Draw the original equilibrium A (budget line BL_1 tangent to IC_1) and the new equilibrium C after the price fall (BL_2 tangent to IC_2).
- Draw an **imaginary budget line BL' parallel to BL_2 and tangent to IC_1** at point B . Movement $A \rightarrow B$ is the **substitution effect** (utility unchanged).
- Movement $B \rightarrow C$ is the **income effect**: the consumer moves from IC_1 to IC_2 (higher real income).

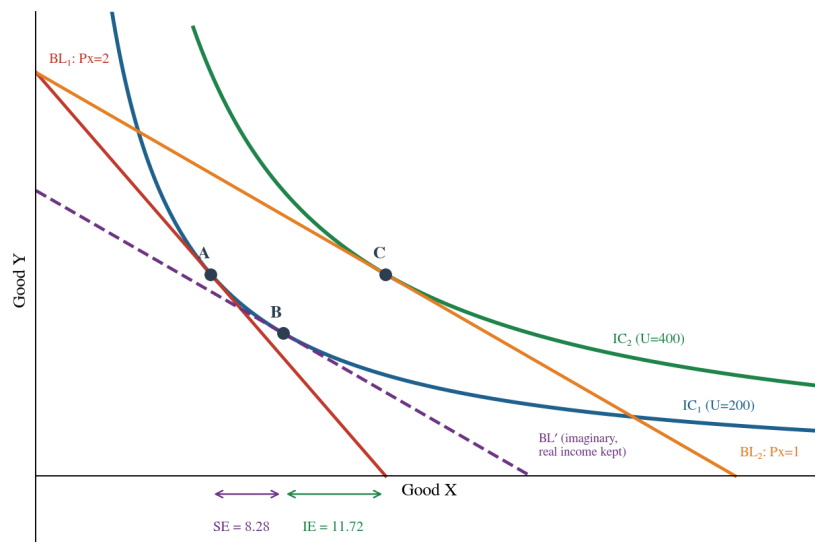


Figure 3.6 — Hicksian decomposition of the price effect ($U = XY$, P_x falls from Rs. 2 to Rs. 1)

Example 3.4 — Decomposing the price effect

Using $U = X \cdot Y$, $M = 80$, $P_y = 4$: P_x falls from Rs. 2 to Rs. 1. Find total, substitution and income effects on X.

Solution

Initial equilibrium A: $X = 20$, $Y = 10$, $U = 200$. New equilibrium C: $X = 80/(2 \times 1) = 40 \rightarrow$ **total price effect = $40 - 20 = +20$.**

Hicksian SE: keep $U = 200$ at new prices (1, 4). MRS: $Y/X = 1/4 \rightarrow X = 4Y$. $XY = 200 \rightarrow 4Y^2 = 200 \rightarrow Y \approx 7.07$, $X \approx 28.28$ (point B).

Substitution effect = $28.28 - 20 = +8.28$.

Income effect = $40 - 28.28 = +11.72$. Check: $8.28 + 11.72 = 20 \checkmark$.

Type of good	Substitution effect	Income effect	Net price effect / demand curve
Normal good	Negative (Q rises when P falls)	Negative (reinforces SE)	Total effect strong; downward-sloping demand
Inferior (non-Giffen)	Negative	Positive but smaller than SE	SE dominates; still downward-sloping demand
Giffen good	Negative	Positive and larger than SE	Income effect dominates; upward-sloping demand (rare)

Note: Sign convention: 'negative' here means the effect on quantity is opposite in direction to the change in price. Different textbooks use different sign conventions — check your class notes.

3.4.6 Derivation of the Demand Curve — Hicksian (Compensated) Approach

Ordinary (Marshallian) demand from the PCC includes both the substitution and income effects. The **Hicksian demand curve** is derived by removing the income effect: at each price, quantity is read from the tangency of an imaginary budget line with the **same** indifference curve (e.g., points A and B). It is thus a **compensated** demand curve, always downward-sloping, and it is steeper than the ordinary demand curve for a normal good. In the numerical example, holding $U = 200$ and $P_y = 4$, the tangency condition $Y/X = P_x/P_y$ gives Hicksian demand $X = \sqrt{(U \cdot P_y / P_x)} = \sqrt{(800 / P_x)}$, i.e., 20 at $P_x = 2$ and 28.28 at $P_x = 1$ (compared with 20 and 40 on the ordinary demand curve $X = 40/P_x$).

Key Takeaways — Unit 3

- ✓ Cardinal approach: utility measurable; diminishing MU; equilibrium where $MU_x/P_x = MU_y/P_y = MU_m$; demand curve derived from the MU curve.
- ✓ Criticisms of cardinal utility: immeasurable utility, constant MU_m , ignores income/substitution effect.
- ✓ Ordinal approach: IC is downward sloping, convex, non-intersecting; $MRS = MU_x/MU_y$ diminishes; budget line slope = $-P_x/P_y$.
- ✓ Consumer equilibrium: $MRS_{xy} = P_x/P_y$ with IC convex at the tangency.
- ✓ PCC → demand curve; ICC → Engel curve/income effect; price effect = substitution effect + income effect (Hicks).
- ✓ For Giffen goods the negative income effect outweighs the substitution effect, giving an upward-sloping demand curve.

— End of Unit 3 —

Reminder: these notes may contain errors — verify with your textbook and syllabus.