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CUET · ECONOMICS · CLASS XI · CODE 309

Index Numbers

CUET unit: Statistics for Economics

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Snapshot

- An **index number** is a statistical device that summarises change in a group of related variables (prices, quantities, value) into a single comparable figure expressed as a percentage of a base period valued at **100**.
- The construction toolkit: **simple aggregative, weighted aggregative** (Laspeyre's with base-year weights; Paasche's with current-year weights), and the **method of averaging price relatives** (simple and weighted).
- The most important Indian index numbers are **CPI** (industrial workers, agricultural labourers, rural/urban/combined), **WPI, IIP, Agricultural Production Index** and the **SENSEX** — each with its own base, weights and uses.
- Index numbers feed real economic decisions: wage negotiation, real-wage and purchasing-power calculation, inflation measurement, and stock-market sentiment.
- Frequently tested in CUET through factual recall of weights/bases, formulas (Laspeyre vs Paasche), CPI/WPI distinctions, and small numerical applications.
- Dated grid of base years: CPI-IW (2001), CPI-AL & CPI-RL (1986-87), CPI Rural/Urban/Combined (2012), WPI (2011-12), IIP (2011-12), SENSEX (1978-79).

Detailed Notes

2.1 Core concepts

- An **index number** is a statistical device for measuring changes in the magnitude of a group of related variables; it represents the general trend of diverging ratios from which it is calculated and is a measure of the **average change** in a group of related variables over two different situations (NCERT §2, p. 92).
- Index numbers are **conventionally expressed in percentage**; the value in the **base period** is set at **100** and any other period's index is in proportion to it — an index of 250 means the value is two-and-a-half times the base (NCERT §2, p. 92).
- **Price index numbers** measure and permit comparison of prices of certain goods, while **quantity index numbers** measure changes in the physical volume of production, construction or employment; price indices are more widely used but a production index is also an important indicator of output (NCERT §2, p. 92).

- An index can be computed by the **aggregative method** or the **method of averaging relatives** (NCERT §3, p. 92).
- **Simple aggregative price index**: $P_{01} = (\Sigma P_1 \div \Sigma P_0) \times 100$. It is **unweighted** and of limited use because units of measurement of different commodities are not the same and the relative importance of items is not reflected (NCERT §3, p. 92).
- **Weighted aggregative price index**: $P_{01} = (\Sigma P_1 q \div \Sigma P_0 q) \times 100$. A well-specified basket is taken and its worth in each year computed, so the change is purely due to price change (NCERT §3, p. 93).
- **Laspeyre's price index** uses **base-period quantities (q_0)** as weights; it answers — if ₹100 was spent on the base-period basket, how much is needed in the current period for the same basket (NCERT §3, p. 93).
- **Paasche's price index** uses **current-period quantities (q_1)** as weights; it answers — if the current-period basket had been consumed in the base period at ₹100, how much is needed in the current period for the same basket (NCERT §3, pp. 93–94).
- **Method of averaging relatives** (simple): $P_{01} = (1/n) \times \Sigma (P_1/P_0) \times 100$; the ratio $(P_1/P_0) \times 100$ is the **price relative** (NCERT §3, p. 94).
- **Weighted price relatives index**: $P_{01} = \Sigma W_i \times (P_{1i}/P_{0i} \times 100) \div \Sigma W_i$; weights are usually the **proportion of expenditure** on each item in total expenditure in the base period (or current period); base-period weights are generally preferred for convenience and comparability (NCERT §3, p. 94).
- **Consumer Price Index (CPI)**, also called the **cost-of-living index**, measures the average change in **retail prices** of a fixed basket. CPI for industrial workers (2001 = 100) of 277 in Dec 2014 means ₹100 of 2001 spending would need ₹277 to buy the same basket — what matters is the capability to buy it (NCERT §4, p. 95).
- The government compiles several CPIs — **CPI-IW (base 2001 = 100)**, **CPI for Agricultural Labourers (1986-87 = 100)**, **CPI for Rural Labourers (1986-87 = 100)**, **All-India Rural, Urban and Combined CPIs (2012 = 100)**; the **RBI uses the All-India Combined CPI** as the main measure of consumer-price change (NCERT §4, p. 96).
- **CPI (2012 = 100) major-group weights** (from CES 2011-12, NSS 68th Round): **Food and beverages 45.86**, Pan/tobacco/intoxicants 2.38, Clothing & footwear 6.53, Housing 10.07, Fuel & light 6.84, Miscellaneous 28.32 (NCERT §4, p. 96).
- **Consumer Food Price Index (CFPI)** equals the CPI 'Food and Beverages' group **excluding** alcoholic beverages and prepared meals/snacks/sweets (NCERT §4, p. 96).
- **Wholesale Price Index (WPI)** indicates the change in the **general price level**; unlike CPI it has **no reference consumer category** and **excludes services** (barber charges, repairing etc.) — only the prices of goods at the wholesale level are included (NCERT §4, pp. 96–97).

- WPI is now compiled with base **2011-12 = 100**; major-group weights — **Primary Articles 22.62, Fuel & Power 13.15, Manufactured Products 64.23**; "All Commodities" is the **Headline Inflation** rate; "WPI Food Index" 24.23 (NCERT §4, p. 97).
- **Index of Industrial Production (IIP)**, base **2011-12 = 100**, is unlike CPI/WPI in that it **measures quantities**; it is a **weighted arithmetic mean of quantity relatives** using Laspeyre's formula, with weights proportional to **value added** by manufacture in the base year — $IIP_{01} = (\sum q_{1i}W_i \div \sum W_i) \times 100$ (NCERT §4, pp. 97–98).
- IIP sectoral weights: **Mining 14.4, Manufacturing 77.6, Electricity 8.0**; the **Eight Core Industries** (coal, crude oil, natural gas, refinery products, fertilisers, steel, cement, electricity) have a combined weight of **40.27%** in IIP (NCERT §4, p. 98).
- **SENSEX** = Bombay Stock Exchange Sensitive Index, base **1978-79**, comprising **30 stocks across 13 sectors** of leading companies; a rising SENSEX indicates investor optimism about the economy (NCERT §4, pp. 98–99).
- **Issues in construction** of an index number: clarity of purpose; representative item selection; choice of a **normal (non-extreme), not-too-distant base year** that is **routinely updated**; choice of formula (Laspeyre vs Paasche differ only in weights used); reliability of data (NCERT §5, p. 99).
- **Economic uses**: CPI guides wage negotiation, income/price/rent/taxation policy; WPI eliminates the price effect on national income/capital formation and measures the **rate of inflation**; IIP gauges the industrial sector quantitatively; the Agricultural Production Index is a ready reckoner of agriculture; SENSEX guides stock-market investors (NCERT §6, pp. 99–100).
- **Real values: Purchasing power of money = $1 \div \text{cost-of-living index}$; Real wage = $(\text{Money wage} \div \text{Cost-of-living index}) \times 100$** . With CPI (1982 = 100) = 526 in Jan 2005, one rupee of 2005 is worth $100/526 \approx ₹0.19$ of 1982; ₹10,000 money wage equals ₹1,901 of 1982 purchasing power (NCERT §6, p. 100).
- **Why a single number for many prices**: an economy has thousands of commodities, each with its own price path; an index number compresses this vector of changes into one comparable scalar — enabling sentences like "prices rose 8% last year" that a non-statistician can understand (NCERT §1, p. 91).
- **Why express as percentage of 100**: setting the base to 100 makes any later value immediately readable — 110 = 10% rise, 90 = 10% fall, 250 = 2.5× the base. The "% of 100" convention removes the need to remember absolute base values (NCERT §2, p. 92).
- **Aggregative vs averaging-of-relatives — conceptual contrast**: the aggregative method sums prices (or quantities) directly across items and is sensitive to **units** of measurement (kg vs tonne, litre vs barrel); the relatives method first converts each item's price into a unit-free ratio P_1/P_0 and then averages — making it invariant to units, a major advantage (NCERT §3, pp. 92–94).

- **Laspeyre upward-bias intuition:** Laspeyre keeps the base-period basket fixed; consumers, in reality, substitute away from goods whose prices have risen most, so the fixed basket overstates the cost-of-living increase. **Paasche has the opposite (downward) bias**, using the current basket that already reflects substitution. The true index lies between them, motivating Fisher's "ideal" index $(\sqrt{L \times P})$ — not in NCERT but a natural extension (NCERT §3, pp. 93–94).
- **CPI-IW worked illustration (Table 7.4-style):** five items — Food, Fuel, Cloth, Rent, Misc — with weights W and price relatives R . $\Sigma WR / \Sigma W = 9786.85 / 100 = 97.86$ → CPI of 97.86 (just below the base 100) suggests prices fell marginally; if instead $\Sigma WR = 12500$, $\text{CPI} = 125$, signalling a 25% rise (NCERT §3, p. 95).
- **CPI-IW is used to determine Dearness Allowance (DA)** for Central Government employees — a real-world payoff that makes the index politically salient. The CPI-IW base shift from 2001 to 2016 (recent) changed many DA calculations (NCERT §6, p. 99, contextual).
- **WPI inflation = Headline Inflation in India:** WPI is the **most-quoted inflation measure** in older RBI documents (the headline rate); but since 2014 the RBI's Monetary Policy Committee uses CPI-Combined as the **inflation-targeting** anchor ($4\% \pm 2\%$) — a contemporary CUET fact often appearing in current-affairs hybrids (NCERT §4, pp. 96–97).
- **IIP's role in business cycle dating:** a sustained fall in IIP for two or more consecutive quarters is a warning of industrial recession; conversely, a rising IIP signals expansion. CUET sometimes pairs an IIP table with a "which sector contributed most" question (NCERT §4, pp. 97–98).
- **Use-based IIP classification weights (Table 7.6, p. 98):** Primary 34.1, Capital Goods 8.2, Intermediate 17.2, Infrastructure/Construction 12.3, Consumer Durables 12.8, Consumer Non-durables 15.3. The weights sum to 100 (within rounding) — a quick CUET check.
- **SENSEX historical perspective:** launched in 1986 with the **1978-79 financial-year base = 100**, SENSEX is widely treated as a barometer of investor sentiment about Indian listed companies. A SENSEX of, say, 60000 means the basket is worth $600\times$ its 1978-79 value — a graphic illustration of compounded capital-market returns (NCERT §4, pp. 98–99).
- **Index-number formulas — quick reference:** simple aggregative ignores quantity; Laspeyre fixes q_0 ; Paasche fixes q_1 ; simple average of relatives uses $(1/n) \Sigma (P_1/P_0) \times 100$; weighted relatives use expenditure shares as weights — five formulas, each with a one-line difference (NCERT §3, pp. 92–94).
- **Issues in construction (NCERT §5):** a good index must (i) have a clear purpose, (ii) include items representative of that purpose, (iii) use a **normal, non-extreme base year** that is updated periodically as consumer patterns shift, (iv) employ a formula suited to the data, and (v) rest on reliable underlying data (NCERT §5, p. 99).

Each of these can become an MCQ on "which of the following is NOT an issue in index construction".

- **Real wage worked example:** a worker earns ₹20000/month in 2024 when CPI = 280 (base 2012). Real wage in 2012 prices = $(20000/280) \times 100 = ₹7142.86$ — i.e., the 2024 nominal salary commands the same basket as ₹7143 would have done in 2012, exposing how much inflation has eroded purchasing power.
- **Quantity vs price index — applications:** agriculture and industry are measured by **quantity** indices (output, value-added) because the policy interest is in physical production; consumer welfare and wage bargaining are measured by **price** indices because what matters there is purchasing power; both belong to the same statistical family (NCERT §2, p. 92).

2.2 Definitions to memorise

| Term | Definition | Page |
|--------------------------------------|--|-------|
| Index number | Statistical device for measuring average change in a group of related variables between two situations | 92 |
| Base period | Period with which comparison is made; value set to 100 | 92 |
| Price relative | Ratio $(P_1/P_0) \times 100$ of current to base-period price | 94 |
| Simple aggregative index | $(\sum P_1/\sum P_0) \times 100$ with no weighting | 92 |
| Weighted aggregative index | $(\sum P_1q/\sum P_0q) \times 100$ with quantity weights | 93 |
| Laspeyre's price index | Uses base-period quantities (q_0) as weights | 93 |
| Paasche's price index | Uses current-period quantities (q_1) as weights | 93–94 |
| Consumer Price Index (CPI) | Cost-of-living index — average change in retail prices of a fixed basket | 95 |
| Wholesale Price Index (WPI) | Change in general price level at wholesale stage; excludes services | 96–97 |
| Index of Industrial Production (IIP) | Weighted arithmetic mean of quantity relatives using Laspeyre's formula | 97 |
| Headline Inflation | "All Commodities" inflation rate from WPI | 97 |
| CFPI | Consumer Food Price Index — CPI Food & Beverages minus alcohol and prepared meals | 96 |
| SENSEX | BSE Sensitive Index, base 1978-79, of 30 stocks across 13 sectors | 98 |
| Purchasing power of money | $100 \div \text{cost-of-living index}$ | 100 |

| Term | Definition | Page |
|---------------------------|--|------|
| Real wage | $(\text{Money wage} \div \text{CPI}) \times 100$ | 100 |
| Cost-of-living index | Alternative name for CPI | 95 |
| Eight Core Industries | Coal, crude oil, natural gas, refinery products, fertilisers, steel, cement, electricity | 98 |
| Quantity index | Index that measures change in physical volume | 92 |
| Price index | Index that measures change in prices | 92 |
| Value-added weight (IIP) | Weight assigned to each industry proportional to its value added in the base year | 97 |
| Inflation | General rise in price level, measured by WPI in India | 99 |
| Money wage | Wage stated in current rupees, not adjusted for prices | 100 |
| Real wage | Wage adjusted for changes in cost of living | 100 |
| Basket of goods | Representative set of items used to compute an index | 93 |
| Cost-of-living adjustment | Wage revision based on changes in CPI | 99 |

2.3 Diagrams / processes to remember

- **Table 7.1 (p. 92):** four-commodity price data demonstrating the simple aggregative method.
- **Table 7.2 (p. 93):** base- and current-period prices and quantities of four commodities used to compute Laspeyre's (135.3) and Paasche's (132.1) indices.
- **Table 7.3 (p. 94):** weighted price relatives example — weighted index 156 vs unweighted 149, illustrating the impact of weighting.
- **Table 7.4 (p. 95):** CPI construction through a five-item basket (Food, Fuel, Cloth, Rent, Misc.) showing $\Sigma WR = 9786.85$ and $CPI = 97.86$.
- **CPI (2012=100) weight chart (p. 96):** Food & beverages 45.86, Misc. 28.32, Housing 10.07, Fuel & light 6.84, Clothing & footwear 6.53, Pan/tobacco/intoxicants 2.38.
- **WPI (2011-12=100) major-group weights (p. 97):** Primary Articles 22.62, Fuel & Power 13.15, Manufactured Products 64.23, WPI Food Index 24.23.
- **Tables 7.5 & 7.6 (p. 98):** IIP weight pattern — Mining 14.4, Manufacturing 77.6, Electricity 8.0; use-based — Primary 34.1, Consumer Non-durables 15.3, Consumer Durables 12.8, Intermediate 17.2, Infrastructure/Construction 12.3, Capital 8.2.
- **Index construction flow:** select purpose → choose items → choose base period → collect prices/quantities → select formula (aggregative vs relatives; weighted vs unweighted) → compute → interpret as percentage of 100.
- **Worked Laspeyre vs Paasche numerical (Table 7.2 logic):** four commodities with base-period prices $p_0 = 4, 6, 5, 2$ and quantities $q_0 = 10, 5, 8, 15$; current-period

prices $p_1 = 6, 8, 5, 3$ and quantities $q_1 = 5, 10, 8, 12$. $\sum p_0q_0 = 40 + 30 + 40 + 30 = 140$. $\sum p_1q_0 = 60 + 40 + 40 + 45 = 185$. Laspeyre = $(185/140) \times 100 = 132.14$. $\sum p_0q_1 = 20 + 60 + 40 + 24 = 144$. $\sum p_1q_1 = 30 + 80 + 40 + 36 = 186$. Paasche = $(186/144) \times 100 = 129.17$. Both $> 100 \Rightarrow$ prices have risen on average; Laspeyre slightly higher than Paasche, consistent with Laspeyre's known upward bias.

- **Worked weighted-relatives example:** three commodities with weights $W = 50, 30, 20$ ($\Sigma = 100$) and price relatives $R = P_1/P_0 \times 100 = 120, 140, 160$. $\Sigma WR = 50 \times 120 + 30 \times 140 + 20 \times 160 = 6000 + 4200 + 3200 = 13400$. Weighted index = $13400/100 = 134$ — i.e., a 34% rise in the weighted basket cost.
- **Worked CPI-based real-wage problem:** money wage = ₹15000, CPI (base year) = 250. Real wage = $(15000/250) \times 100 = ₹6000$ in base-year prices — students should be able to do this calculation in seconds for a CUET MCQ.
- **Worked purchasing-power example:** if CPI rises from 100 to 200 over a decade, the purchasing power of ₹1 halves — $100/200 = 0.5$ — meaning the rupee buys only half what it did a decade ago, a vivid one-line summary of long-run inflation.
- **Cross-check identity:** when weights are expenditures (P_0q_0), the weighted-relatives method exactly equals Laspeyre's aggregative formula — proving that aggregative and relatives families coincide when consistently weighted. A subtle but high-yield NCERT identity (NCERT §3, p. 94, implicit).

2.5 Key formulas

| Formula | Meaning | NCERT page |
|--|-----------------------------------|------------|
| $P_{01} = (\Sigma P_1 \div \Sigma P_0) \times 100$ | Simple aggregative price index | 92 |
| $P_{01}(L) = (\Sigma P_1q_0 \div \Sigma P_0q_0) \times 100$ | Laspeyre's price index | 93 |
| $P_{01}(P) = (\Sigma P_1q_1 \div \Sigma P_0q_1) \times 100$ | Paasche's price index | 94 |
| $P_{01} = (1/n) \times \Sigma (P_1/P_0) \times 100$ | Simple average of price relatives | 94 |
| $P_{01} = \Sigma W_i \times (P_{1i}/P_{0i} \times 100) \div \Sigma W_i$ | Weighted price relatives index | 94 |
| $IIP = (\Sigma q_{1i}W_i \div \Sigma W_i) \times 100$ | Index of Industrial Production | 97 |
| Purchasing power = $100 \div \text{CPI}$ | Value of money relative to base | 100 |
| Real wage = $(\text{Money wage} \div \text{CPI}) \times 100$ | Wage adjusted for inflation | 100 |
| Inflation rate (WPI) = $(\text{WPI}_{\text{current}} - \text{WPI}_{\text{previous}}) \div \text{WPI}_{\text{previous}} \times 100$ | Year-on-year price change | 97, 99 |

2.4 Common confusions / NTA trap points

- **Laspeyre vs Paasche weights:** Laspeyre uses **base-year (q_0)** quantities; Paasche uses **current-year (q_1)** quantities. NTA often swaps the two.
- **CPI vs WPI scope:** CPI tracks **retail** prices for a specific consumer category; WPI tracks **wholesale** prices, has **no consumer reference**, and **excludes services**. Inflation is generally measured by WPI.
- **Base years differ across indices** — CPI-IW: 2001=100; CPI-AL & CPI-RL: 1986-87=100; Rural/Urban/Combined CPI: 2012=100; WPI: 2011-12=100; IIP: 2011-12=100; SENSEX: 1978-79.
- **Largest weight in CPI (2012=100) is Food & beverages (45.86%)** — followed by Miscellaneous (28.32%).
- **IIP measures quantities, not prices**, and uses Laspeyre's formula on **quantity relatives** with **value-added** weights.
- **Eight Core Industries weight in IIP = 40.27%**, not equal to Manufacturing's 77.6%.
- An index of **150 means a 50% rise**, not a 150% rise.
- **CFPI excludes alcohol and prepared meals/snacks** from CPI Food & Beverages.
- **RBI uses the All-India Combined CPI** as its main consumer-price measure.
- **SENSEX comprises 30 stocks across 13 sectors**, not 50 or 100.
- **Real wage formula has CPI in the denominator**, not the numerator.
- **Headline Inflation refers to the WPI All-Commodities rate.**

Practice MCQs

Q1. An index number which accounts for the relative importance of the items is known as:

- A.** Simple aggregative index
- B.** Simple average of price relatives
- C.** Weighted index
- D.** Unweighted aggregative index

Q2. In Laspeyre's price index, the quantities used as weights belong to:

- A. The current period
- B. The base period
- C. An average of base and current periods
- D. A future projected period

Q3. Consider the following about WPI: I. It indicates the change in the general price level. II. It includes services such as barber charges and repairing. III. The 'All Commodities Inflation Rate' from WPI is called 'Headline Inflation'. IV. The current base year of WPI is 2011-12.

- A. I, II and III only
- B. I, III and IV only
- C. II and IV only
- D. I, II, III and IV

 **9 more MCQs + answer key**

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PYQ Alignment

This chapter is a near-certain source of CUET items because index numbers feed directly into macro topics in Paper 309: in 2023–25 CUET typically posed about 6–8 questions per year on definitions (CPI vs WPI, Laspeyre vs Paasche), recall of base years/weights, and small numerical applications such as computing a simple/weighted aggregative index or inferring purchasing power from a given CPI. Match-the-following on index names and bases, and assertion–reason on IIP being a quantity index, are particularly common NTA framings. See [previous CUET PYQs on this chapter](#).