INDEX NUMBER

Use

Just as the arithmetic mean is used to represent a set of values, an index number is used to represent a set of values over two or more different periods or localities. Also when numbers are unwieldy (too large), we use index numbers instead of absolute numbers for analysis.

Definition

An index number is a ratio of two or more time periods are involved, one of which is the base time period. Ex. NSE, BSE, WPI, CPI etc.

Issues Involved

Selection of Data	→ Samples used should be representative of population. Use random sampling → Method of computation should be consistent to ensure comparison → Selection of commodities is challenging as their relative importance keeps on changing with time
Base Period	→ It should be normal and not affected by extraordinary events → Should be recent and not distant old
Selection of Weights	Due consideration should be given to the relative importance of each variable which relates to the purpose for which the index is to be used.
Use of Averages	GM is better measure of relatives but for most of the indices arithmetic mean is used because of its simplicity.
Choice of Variables	For Prices, whether retail or wholesale For Quantity, whether average for a period or end of the period
Selection of Formula	This will be covered below. There are multiple formulas.

Price Relative

Ratio of the price of single commodity in a given period to its price in another period.

Price Relative $= \frac{P_n}{P_0}$

To be expressed as Percentage $= \frac{P_n}{P_0} \times 100$

Methods/ Formulas for Index Numbers

Simple Aggregative Method	$\frac{\Sigma P_n}{\Sigma P_0} \times 100$	Refer: Page 19.5
Simple Average of Relatives	First calculate relatives for all commodities and then find average of all relative for each period. **Drawback:** It gives equal importance to each of the relatives	Refer: Page 19.5
Weighted Aggregative Index		

Laspeyres' Index	$\frac{\Sigma P_n Q_0}{\Sigma P_0 Q_0} \times 100$
Paasche's Index	$\frac{\Sigma P_n Q_n}{\Sigma P_0 Q_n} \times 100$
Marshall-Edgeworth Index	$\frac{\Sigma P_n (Q_0 + Q_n)}{\Sigma P_0 (Q_0 + Q_n)} \times 100$
Fisher's ideal Price Index	$\sqrt{\frac{\Sigma P_n Q_0}{\Sigma P_0 Q_0} \times \frac{\Sigma P_n Q_n}{\Sigma P_0 Q_n}} \times 100$ (GM of Laspeyres' and Paasche's)

	Weighted Average of Relative Method	$\frac{\sum \frac{P_n}{P_0} \times (P_0 Q_0)}{\Sigma P_0 Q_0} \times 100$	Page 19.7 Example
	Chain Index Numbers	**Chain Index** $= \frac{\text{Link relative of current year} \times \text{Chain Index of previous year}}{100}$	Page 19.8 Example
	Quantity Index Numbers	Though price indices are widely used to measure the economic strength, Quantity indices are used as indicators of the level of output in economy.	
	Value Indices	value index equals the total sum of the values of a given year divided by the sum of the values of the base year $\frac{\Sigma V_n}{\Sigma V_0} = \frac{\Sigma P_n Q_n}{\Sigma P_0 Q_0}$	
Limitations of Index Numbers	→ Chances of errors due to Sampling → It gives broad trend not real picture (as it is based on sample) → Due to many methods, at times it creates confusion		
Usefulness of Index Numbers	→ Framing suitable policies in economics and business → They reveal trends and tendencies in making important conclusions → They are used in time series analysis to study long-term trend, seasonal variations and cyclical developments → Index numbers are very useful in deflating (eg. Nominal wages into real)		
Deflated Value	$\text{Deflated Value} = \frac{\text{Current Value}}{\text{Price Index of the current year}}$		
Shifting Price Index	$\text{Shifted Price Index} = \frac{\text{Original Price Index}}{\text{Price Index of the year on which it has to be shifted}} \times 100$		
Splicing Two Index Series	Useful when there is new method of calculation or the inclusion of new commodity in index.		
Test of Adequacy	Unit Test	Formula should be independent of unit. All except simple aggregative index satisfy this test	
	Time Reversal Test	→ It is a test to determine whether a given method will work both ways in time, forward and backward. → Two indices should be reciprocals of each other → $P_{01} \times P_{10} = 1$ → Laspeyres' method and Paasche's method do not satisfy this test, but Fisher's Ideal Formula does	
	Factor Reversal Test	→ This holds when the product of price index and the quantity index should be equal to the corresponding value index → $P_{01} \times Q_{01} = V_{01}$ → Only Fisher's Index satisfies Factor Reversal test → Fisher's Index Number is ideal as it satisfies Unit, Time Reversal and Factor Reversal Test	
	Circular Test	→ This property therefore enables us to adjust the index values from period to period without referring each time to the original base. The test of this shift ability of base is called the circular test. → This test is not met by Laspeyres, or Paasche's or the Fisher's ideal index. → The simple geometric mean of price relatives and the weighted aggregative with fixed weights meet this test	