

# INDEX NUMBERS

PRESENTED BY-  
*Deepak Khandelwal*  
*Prakash Gupta*

# CONTENTS

- Introduction
- Definition
- Characteristics
- Uses
- Problems
- Classification
- Methods
- Value index numbers
- Chain index numbers.





# INTRODUCTION

- An index number measures the relative change in price, quantity, value, or some other item of interest from one time period to another.
- A simple index number measures the relative change in one or more than one variable.



# WHAT IS AN INDEX NUMBER

- 
- An index number measures how much a variable changes over time.

- 
- We calculate the index number by finding the ratio of the current value to a base value.



# DEFINITION

- “Index numbers are quantitative measures of growth of prices, production, inventory and other quantities of economic interest.”

•

**-Ronold**



# **CHARACTERISTICS OF INDEX NUMBERS**

- ❖ Index numbers are specialised averages.
- ❖ Index numbers measure the change in the level of a phenomenon.
- ❖ Index numbers measure the effect of changes over a period of time.



# USES OF INDEX NUMBERS

- To framing suitable policies.
- They reveal trends and tendencies.
- Index numbers are very useful in deflating.



# **PROBLEMS RELATED TO INDEX NUMBERS**

- Choice of the base period.
- Choice of an average.
- Choice of index.
- Selection of commodities.
- Data collection.





# CLASSIFICATION OF INDEX NUMBERS

Price Index

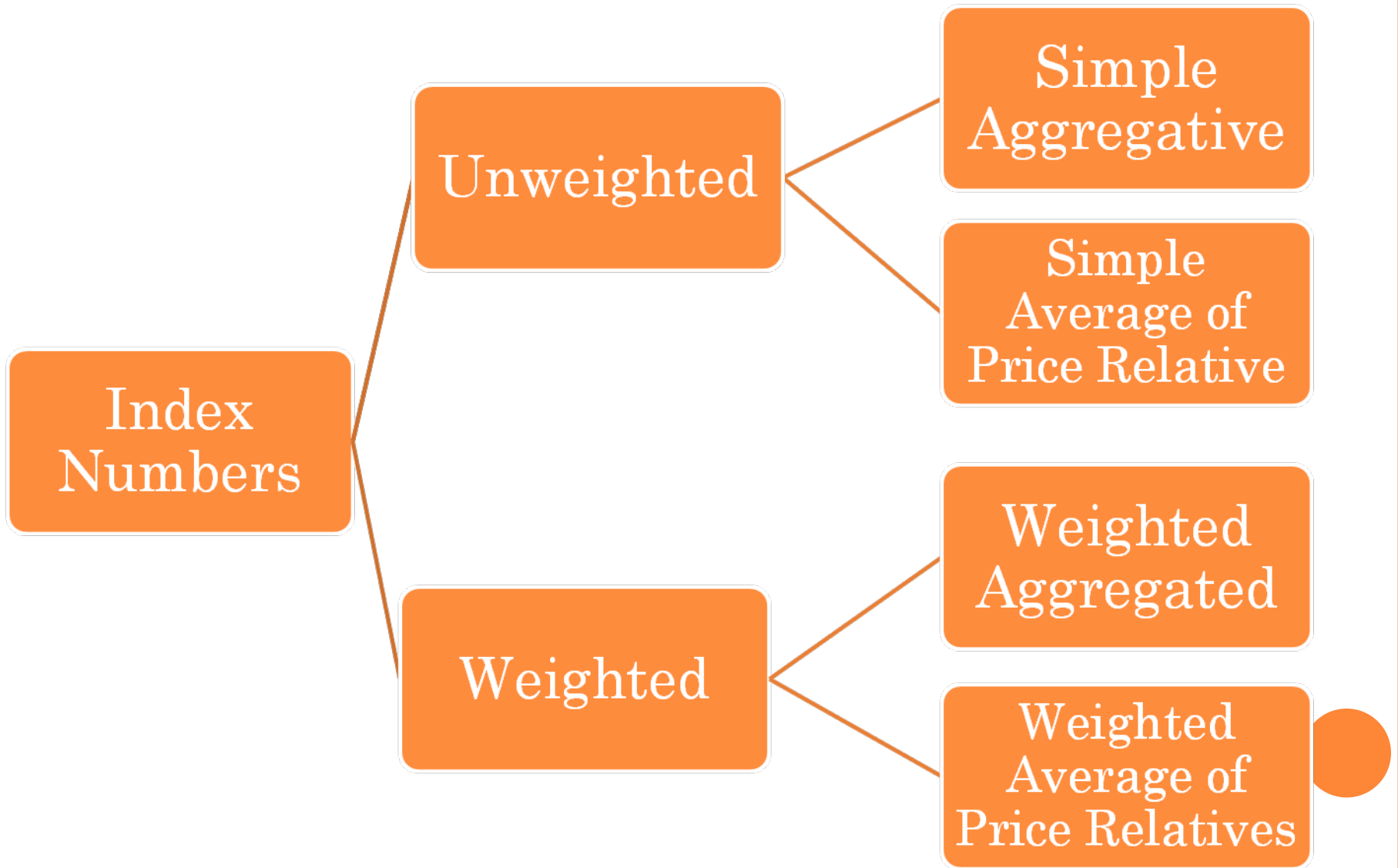
Quantity Index

Value Index

Composite Index



# METHODS OF CONSTRUCTING INDEX NUMBERS



# SIMPLE AGGREGATIVE METHOD

It consists in expressing the aggregate price of all commodities in the current year as a percentage of the aggregate price in the base year.

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100$$

$P_{01}$  = Index number of the current year.

$\sum p_1$  = Total of the current year's price of all commodities.

$\sum p_0$  = Total of the base year's price of all commodities.



## **EXAMPLE:-**

**FROM THE DATA GIVEN BELOW CONSTRUCT THE INDEX NUMBER FOR THE YEAR 2007 ON THE BASE YEAR 2008 IN RAJASTHAN STATE.**

<b>COMMODITIES</b>	<b>UNITS</b>	<b>PRICE (Rs) 2007</b>	<b>PRICE (Rs) 2008</b>
<b>Sugar</b>	Quintal	2200	3200
<b>Milk</b>	Quintal	18	20
<b>Oil</b>	Litre	68	71
<b>Wheat</b>	Quintal	900	1000
<b>Clothing</b>	Meter	50	60



# SOLUTION:-

COMMODITIES	UNITS	PRICE (Rs) 2007	PRICE (Rs) 2008
<b>Sugar</b>	Quintal	2200	3200
<b>Milk</b>	Quintal	18	20
<b>Oil</b>	Litre	68	71
<b>Wheat</b>	Quintal	900	1000
<b>Clothing</b>	Meter	50	60

$$\sum p_0 = 3236 \quad \sum p_1 = 4351$$

Index Number for 2008-

$$P_{01} = \frac{\sum p_1}{\sum p_0} \times 100 = \frac{4351}{3236} \times 100 = 134.45$$

It means the prize in 2008 were 34.45% higher than the previous year.



# SIMPLE AVERAGE OF RELATIVES

## METHOD.

- The current year price is expressed as a price relative of the base year price. These price relatives are then averaged to get the index number. The average used could be arithmetic mean, geometric mean or even median.

$$P_{01} = \frac{\sum \left( \frac{P_1}{P_0} \times 100 \right)}{N}$$

Where N is Numbers Of items.

When geometric mean is used-

$$\log P_{01} = \frac{\sum \log \left( \frac{P_1}{P_0} \times 100 \right)}{N}$$



# EXAMPLE-

From the data given below construct the index number for the year 2008 taking 2007 as by using arithmetic mean.

Commodities	Price (2007)	Price (2008)
P	6	10
Q	2	2
R	4	6
S	10	12
T	8	12



# SOLUTION-

Index number using arithmetic mean-

Commodities	Price (2007) $p_0$	Price (2008) $p_1$	Price Relative $\frac{p_1}{p_0} \times 100$
P	6	10	166.7
Q	12	2	16.67
R	4	6	150.0
S	10	12	120.0
T	8	12	150.0

$$\sum \left( \frac{p_1}{p_0} \times 100 \right) = 603.37$$

$$P_{01} = \frac{\sum \left( \frac{p_1}{p_0} \times 100 \right)}{N} = \frac{603.37}{5} = 120.63$$





# WEIGHTED INDEX NUMBERS

- These are those index numbers in which rational weights are assigned to various chains in an explicit fashion.

## (c) Weighted aggregative index numbers-

These index numbers are the simple aggregative type with the fundamental difference that weights are assigned to the various items included in the index.

- Dorbish and bowley's method.
- Fisher's ideal method.
- Marshall-Edgeworth method.
- Laspeyres method.
- Paasche method.
- Kelly's method.



## LASPEYRES METHOD-

This method was devised by Laspeyres in 1871. In this method the weights are determined by quantities in the base.

$$P_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100$$

## Paasche's Method.

This method was devised by a German statistician Paasche in 1874. The weights of current year are used as base year in constructing the Paasche's Index number.

$$P_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$



## DORBISH & BOWLEYS METHOD.

This method is a combination of Laspeyre's and Paasche's methods. If we find out the arithmetic average of Laspeyre's and Paasche's index we get the index suggested by Dorbish & Bowley.

$$p_{01} = \frac{\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1}}{2} \times 100$$

## Fisher's Ideal Index.

Fisher's deal index number is the geometric mean of the Laspeyre's and Paasche's index numbers.

$$P_{01} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$



## MARSHALL-EDGEWORTH METHOD.

In this index the numerator consists of an aggregate of the current years price multiplied by the weights of both the base year as well as the current year.

$$P_{01} = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

## Kelly's Method.

Kelly thinks that a ratio of aggregates with selected weights (not necessarily of base year or current year) gives the base index number.

$$P_{01} = \frac{\sum p_1 q}{\sum p_0 q} \times 100$$

q refers to the quantities of the year which is selected as the base. It may be any year, either base year or current year.

## EXAMPLE-

Given below are the price quantity data, with price quoted in Rs. per kg and production in qtls.

Find- (1) Laspeyers Index (2) Paasche's Index  
(3) Fisher Ideal Index.

ITEMS	2002		2007	
	PRICE	PRODUCTION	PRICE	PRODUCTION
BEEF	15	500	20	600
MUTTON	18	590	23	640
CHICKEN	22	450	24	500



# SOLUTION-

ITEMS	PRICE ( $p_0$ )	PRODUC TION ( $q_0$ )	PRICE ( $p_1$ )	PRODU CTION ( $q_1$ )	( $p_1q_0$ )	( $p_0q_0$ )	( $p_1q_1$ )	( $p_0q_1$ )
BEEF	15	500	20	600	10000	7500	12000	9000
MUTTON	18	590	23	640	13570	10620	14720	11520
CHICKEN	22	450	24	500	10800	9900	12000	11000
<i>TOTAL</i>					34370	28020	38720	31520



# SOLUTION-

1. Laspeyres index:

$$p_{01} = \frac{\sum p_1 q_0}{\sum p_0 q_0} \times 100 = \frac{34370}{28020} \times 100 = 122.66$$

2. Paasche's Index :

$$p_{01} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{38720}{31520} \times 100 = 122.84$$

3. Fisher Ideal Index

$$P_{01} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100 = \sqrt{\frac{34370}{28020} \times \frac{38720}{31520}} \times 100 = 122.69$$



# WEIGHTED AVERAGE OF PRICE RELATIVE

In weighted Average of relative, the price relatives for the current year are calculated on the basis of the base year price. These price relatives are multiplied by the respective weight of items. These products are added up and divided by the sum of weights.

Weighted arithmetic mean of price relative-

$$P_{01} = \frac{\sum PV}{\sum V}$$

Where-  $P = \frac{P_1}{P_0} \times 100$

P=Price relative

V=Value weights=  $P_0 q_0$





# VALUE INDEX NUMBERS

Value is the product of price and quantity. A simple ratio is equal to the value of the current year divided by the value of base year. If the ratio is multiplied by 100 we get the value index number.

$$V = \frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$$



# CHAIN INDEX NUMBERS

When this method is used the comparisons are not made with a fixed base, rather the base changes from year to year. For example, for 2007, 2006 will be the base; for 2006, 2005 will be the same and so on.

Chain index for current year-

$$= \frac{\text{Average link relative of current year} \times \text{Chain index of previous year}}{100}$$



## EXAMPLE-

- From the data given below construct an index number by chain base method.

Price of a commodity from 2006 to 2008.

YEAR	PRICE
2006	50
2007	60
2008	65



# SOLUTION-

YEAR	PRICE	LINK RELATIVE	CHAIN INDEX (BASE 2006)
2006	50	100	100
2007	60	$\frac{60}{50} \times 100 = 120$	$\frac{120 \times 100}{100} = 120$
2008	65	$\frac{65}{60} \times 100 = 108$	$\frac{108 \times 120}{100} = 129.60$



# REFERENCES

1. Statistics for management.  
Richard i. Levin & David S. Rubin.
2. Statistics for Business and economics.  
R.P.Hooda.
3. Business Statistics.  
B.M.Agarwal.
4. Business statistics.  
S.P.Gupta.



Thank you!

