



## Paper 1: Fundamentals of Economics and Management (FEM)

### PRINCIPLES OF PRODUCTION

In order to produce goods and services which can be sold, and generate **revenue** and **profits**, a firm must purchase or hire scarce inputs, which are its **factors of production**. These factors can be fixed or variable.

#### Fixed factor inputs

Fixed factors are those that do not change as output is increased or decreased, and typically include premises such as its offices and factories, and capital equipment such as machinery and computer systems.

#### Variable factor inputs

Variable factors are those that do change with output, which means more are employed when production increases, and less when production decreases. Typical variable factors include labour, energy, and raw materials directly used in production.

#### Time periods for the firm

The fundamental principles of production relate closely to the time periods in question, of which there are four:

#### The very short run

A firm is said to be in its **very short run** when the only way to increase output is by using up existing stocks of inputs.

#### The short run

A firm is said to be in its **short run** when it can increase its output by using more variable factors, such as by hiring more workers, but not by increasing its fixed factors. In the short run firms do not use extra fixed factors, such as moving to new premises, to increase output. Therefore, in the short run at least one factor of production is fixed.

#### The long run

A firm enters its **long run** when it increases its scale of operations. Increasing scale means that no factor of production is fixed, and all are variable. Typically, this means that a firm expands by building or renting larger premises, purchasing or leasing new machinery and employing more workers.

#### The very long run

A whole industry enters the **very long run** when there is a significant change in the use of technology. For example, the widespread use of the internet to book holidays has drastically altered how the holiday industry is structured.



Economic analysis tends to focus only on the short and long run, and largely ignores the very short and very long run.

### Time periods for a market

A whole market can also be considered in terms of the short and long run.

### The industry short run

An industry is in its short run when its capacity is fixed. This usually means that the number of firms in the industry is fixed, with no new firms entering or leaving the market.

### The long run

This exists when there is an increase, or decrease, in the capacity of the industry to produce, and this usually means that the number of firms in a given market increases, or decreases.

### The law of diminishing returns

The **law of diminishing marginal returns** comes into play whenever a firm tries to increase output by applying additional variable inputs to a fixed factor. Production requires the combination of both fixed and variable factors to create an output. Economic theory predicts that if firms increase the number of variable factors they use, such as labour, while keeping one factor fixed, such as machinery, the extra output or returns from each additional, marginal unit of the variable factor must eventually diminish.

Diminishing marginal returns forms part of a larger principle, called the principle of variable proportions. This states that, assuming one factor is fixed, the marginal returns generated from adding new variable factors will not be constant. In fact, returns will rise at first, reach a turning point, and then eventually diminish. The law of diminishing marginal returns simply refers to the last phase of this wider principle.

### Consider the following example:

#### Returns to labour

Assuming one factor is fixed, the addition of extra workers will result in increasing returns followed eventually by diminishing returns.

WORKERS	TOTAL PRODUCT	AVERAGE PRODUCT	MARGINAL PRODUCT
1	6		
2	16		
3	28		
4	42		



5	56		
6	66		
7	69		
8	70		
9	69		

### Exercise

Consider the total output produced by workers making hand-crafted wooden cabinets, and calculate:

1. **Average product**, which is output per worker
2. **Marginal product**, which is the additional output from adding one extra worker.

### Answer

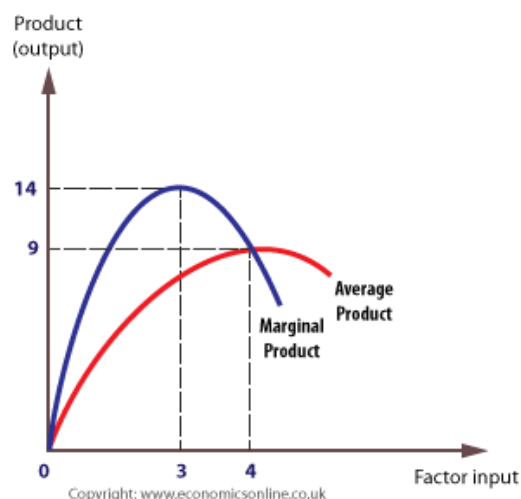
#### Observations

#### What happens to productivity?

Marginal productivity is relatively low when only a few workers are employed. However, marginal productivity rises quickly as each extra worker contributes more than the previous one. Eventually marginal productivity begins to decline, in this case, with the employment of the fourth worker. With the employment of seven workers marginal product is zero, and total product is at a maximum. This means that marginal productivity is low at the extremes of output – at high and low levels.

#### Product curves

It can be observed that, at first, the marginal returns curve increases and then decreases. The marginal returns curve cuts the average returns curve when average returns are at their peak.





### How is this pattern explained?

With a small number of workers, output is low and a division of labour cannot be employed, and workers cannot specialise or develop new skills.

However, marginal returns increase quickly as specialisation occurs and efficiency increases. This creates the opportunity for labour to develop skills and become more productive.

Eventually, marginal returns diminish as the effects of specialisation and new skills wear off. This pattern has a considerable impact on the firm's short-run cost curves.

## Paper 2: Fundamentals of Accounting (FOA)

### HALSEY PREMIUM PLAN & ROWAN PREMIUM PLAN

**Individual Bonus Plan:** The bonus to be paid to the worker is computed on the basis of savings in the hours. It is to pay to the workers a basic time rate plus a portion of the wages equivalent of the time saved as related to the agreed/allowed time for the work.

The individual bonus schemes commonly used as:

- ❖ Halsey Premium Bonus Plan and,
- ❖ Rowan Premium Bonus Plan

#### Halsey Premium Bonus Plan:

F.A. Halsey, an American engineer has suggested this wage incentive plan in the year 1891.

**The basic features of Halsey Premium bonus plan are as follows:**

- For each unit or job, a standard time is determined.
- Time rate is guaranteed for the worker.
- When the worker completes the job or operation in less time than allowed time (standard time), he is paid 50% of time saved as bonus.
- The employer will gain for remaining 50% of time saved by the worker.
- If the job is completed in more than the standard time, wages for standard time are guaranteed.

**Drawback:**

- The major drawback of the system is that employer is not protected against over speeding jobs by workers resulting in waste.

- **The formula for computing the total wages is as follows:**

$$\text{Total Wages} = (\text{Time taken} \times \text{Hourly rate}) + \left[ \frac{50}{100} \times \text{Time saved} \times \text{Hourly rate} \right]$$



**Rowan Premium Bonus Plan:**

James Rowan in Glasgow introduced this wage incentive scheme in the year 1898. This scheme is a modification of Halsey Plan as regards payment of premium.

**The basic features of Rowan Plan are as follows:**

- For each unit or job, a standard time is ascertained.
  - Time rate is guaranteed for the worker.
  - Bonus is paid upon the time saved calculated as a proportion of time taken to the time allowed (Standard time).
  - The employer shares the benefit of increased output. It protects the employer against loose rate setting.
- **The formula for computation of total earnings is as follows:**

$$\text{Total Wages} = (\text{Time taken} \times \text{Hourly rate}) + \left[ \frac{\text{Time saved}}{\text{Standard time}} \times \text{Time taken} \times \text{Hourly rate} \right]$$

**Example: 1**

In a factory guaranteed wages at the rate of ₹1.80 per hour are paid in a 50 hour week. By time and motion study it is estimated that to manufacture one unit of a particular product 20 minutes are taken, the time allowed is increased by 25%. During the week A produced 180 units of the product. Calculate his wages under the following method:

- ❖ Halsey premium bonus.
- ❖ Rowan premium Bonus.

**Answer:**

- ❖ Calculation of wages under Halsey premium Bonus

Standard time for actual production	=180×25/60	=75 hours
Earning under Halsey plan	=(50×1.8)+(50/100(75-50)×1.8)	
	=90+22.5	=₹112.50

- ❖ Calculation of wages under Rowan premium Bonus

Standard time for actual production	=180×25/60	=75 hours
Earning under rowan plan	=(50×1.8)+(75-50/75)×(50×1.8)	
	=90+30.00	=₹120.00

✚ Which bonus plan is more profitable for an efficient worker, can be explained by the following example:



**Example:**

Which is a better plan out of Halsey 50 percent bonus scheme and Rowan bonus scheme for an efficient worker? In which situation the worker get same bonus in both schemes?

**Answer:**

Which bonus plan is more profitable for an efficient worker?

Let us understand this with the help of following illustration:

Time allowed for a job	= 100 hours	
Rate of wages	= ₹5 per hour	
Time taken to the job	= Worker M (highly efficient)	=30 hours
Time saved	= Worker M (highly efficient)	= 100-30 = 70 hours

❖ Bonus under Rowan Premium Bonus system

$$= \frac{\text{Time taken}}{\text{Time allowed}} \times \text{Time saved} \times \text{Rate per hour}$$

Therefore, bonus payable to worker M (highly efficient)

$$= \frac{30 \text{ hours}}{100 \text{ hours}} \times 70 \text{ hrs} \times ₹ 5 \text{ per hr} = ₹105$$

❖ Bonus under Halsey Premium Bonus (50%) system

$$= 50\% \times \text{Time saved} \times \text{Rate per hour}$$

Therefore, bonus payable to Worker M (highly efficient)

$$= (50\% \times 70 \text{ hrs} \times ₹5 \text{ per hr}) = ₹175$$

Thus, from the above illustration we can see that for a highly efficient worker the Halsey Bonus Plan (%) is more profitable as it gives him more bonuses.

**Situation where worker gets same bonus under both plans:**

Bonus under Rowan Premium Bonus system = Bonus under Halsey Premium Bonus (%) system

(Time taken /Time allowed) x time saved x rate per hour = 50% x Time saved x Rate per hour

Therefore,

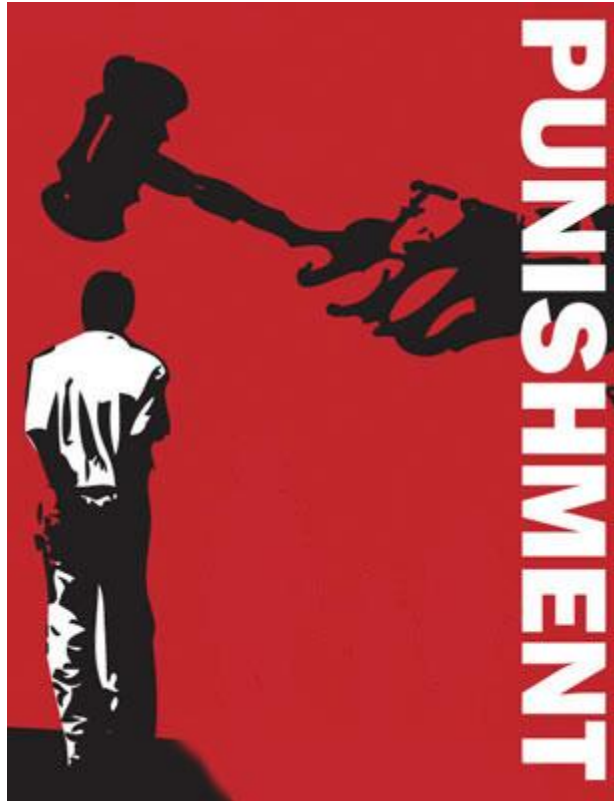
$$\text{Time Taken} = \% \times \text{Time Allowed}$$

Thus, from the above calculation we can see, a worker will get the same bonus under both Halsey and Rowan bonus plans, if the time taken to complete the job is % of the time total time allowed.



### Paper 3: Fundamentals of Laws and Ethics (FLE)

#### PENAL PROVISIONS UNDER SECTION 84 TO 86 OF ESI ACT, 1948 (AS AMENDED)



**Section -84:** This section deals with penalties for making wrong / false statements made by the Insured Persons with a view to take any benefit which is not admissible to him under the Act. Such Act is an offence punishable under Act with imprisonment for a term which may extent to six months or with fine which may extend to Two thousand rupees or with both.

It is also provided under this section that if an Insured Person is convicted by the Court for an offence committed by him under this section, he shall not be entitled to any cash benefits available under the Act for such a period as may be prescribed by the Central Government.

**Section -85:** This section deals with penalties for non – compliance with the various provisions of the ESI Act and Regulations made there under, such as non-payment of contribution, non-submission of Returns, non-Production of records, non-submission of Declaration Forms in respect of their employees, obstruction of Inspector or any other official of the corporation in discharging his duties etc. Such non-compliance with any of the provisions of



the Act constitutes an offence committed by the employer of a covered Factory / Establishment which is punishable under Section 85(a) to 85(g) of the Act.

**Section -85(a):** Envisages that if an employer fails to pay any contribution payable under the Act within the prescribed time-limit, he thus commit an offence u/s 85(a) of the Act, which is punishable with imprisonment for a term which may extent to three years u/s 85(i) of the Act, provided it shall not be less than One year and fine of Ten thousand rupees u/s 85(i) (a) of the Act where employees' share of contribution is deducted by the employer from their wages but not paid. In other case where term of imprisonment shall not be less than 6 months and fine of Five thousand rupees u/s 85(i) (b).

**Section 85(b) to 85(g):** Says that if an employer commits an offence under this section for non-compliance with any other provisions of the Act, which is punishable with imprisonment for a term which may extends to One year or with fine up to Four thousand rupees or with both.

**Section 85A:** This section deals with enhanced punishment in certain cases after previous conviction. If any employer convicted by a Court for an offence punishable under the Act, committing the same offence, shall, for every such subsequent offence, be punished with imprisonment for a term which may extend to Two years and with fine of Five thousand rupees.

It is provided that if such subsequent offence is for failure to pay contribution payable under the Act, the employer shall, for every such subsequent offence, be punished with imprisonment for a term which may extend to Five years but which shall not be less than Two years and shall be liable to pay fine of Twenty five thousand rupees.

**Section 85-B:** Provides that the corporation may recover damages from the employer by way of penalty under this section if any employer fails to pay contribution payable under the Act within the specified time-limit or pays contribution belatedly provided that before recovering such damages, the employer shall be given a reasonable opportunity of being heard.

The amount of damages may not exceed the amount of contribution paid / payable.

**The percentages of Damages leviable are as under:**

(i) If delay is less than 2 months	@ 5% per annum
(ii) If delay is for 2 months & above but less than 4 months	@ 10% per annum





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(iii) If delay is for 4 months & above but less than 6 months	@ 15% per annum
(iv) If delay is more than 6 months	@ 25% per annum

There is also a provision to reduce or waive damages recoverable under this section in respect of a Factory / Establishment which is a Sick industrial Unit and in respect of which Rehabilitation Scheme has been sanctioned by BIFR, under Regulation 31-C. of ESI (General) Regulations, 1950.

- In case of change of Management including transfer of undertaking to worker's Co-operative or in case of merger or amalgamation of Sick Industrial Unit with a healthy company, Damages levied / leviable can be waived completely.
- In other cases, depending on merits, damages levied / leviable can be waived up to 50 %.
- In exceptional hard cases, the damages levied / leviable can be waived either partially / totally.

It is further provided that any damages recoverable may be recovered as an arrear of Land Revenue under section 45-C to 45-I of the Act.

**Section-85-C:** Provides that where an employer is convicted for an offence of non-payment of contribution under this Act, the Court in addition to giving any punishment by order, direct him to pay the amount of contribution for which he was convicted within a time period. The Court can also extend the time given periodically.

If the employer still fails to pay the contribution and submit returns within the time given by the court or within the extended time period given, the employer is deemed to have committed a further offence and shall be punishable with imprisonment under Section-85 and is also liable to pay a fine which may extend to one thousand rupees for every day of default.

**Section-86:** Provides that no prosecution under this Act shall be instituted without previous sanction of the Insurance Commissioner or of such other officer of the corporation as may be authorized in this behalf by the Director General of the Corporation.

It is also provided that No Court inferior to that of a Metropolitan Magistrate or Judicial Magistrate of the First Class shall try any offence under this Act.

And No Court shall take cognizance of any offence under this Act except on a complaint made in writing in respect thereof.



**Section-86-A (Offences by Companies):**

- ✦ If the person being a company committing an offence, every person, who at the time the offence was committed was in-charge of, and was responsible to, the company for the conduct of business of the company, as well as the company shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly.

Provided further that the person proceeded against proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent the commissions of such offence.

- ✦ Not with standing anything contained in Sub-Section (1) where an offence under the Act is committed with the consent or connivance or neglect on the part of any Director, Manager, and Secretary or any officer of the company, they are deemed to be guilty of that offence and can be punished accordingly.

**Section-75:** Deals with provisions for Adjudication of Disputes & claims: If any employer or employee under the Act has any disputes / questions that may be settled by E.I. Court after adjudicating the matter if made before it, subject to the condition that 50 % security deposit is required to be made u/s 75 (2B) (unless it is waived/reduced for the reasons recorded by the Ld. Court)

**Penal Action u/s 138 of N.I. Act:**

If employer submits a cheque to the corporation towards payment of contribution, interest, damages or any other amount due, which is bounced subsequently by the Bank for the reasons of Insufficient Fund he thereby commits an offence under this section and shall be punished with imprisonment for a term upto One year or with fine which may extend to twice the amount of cheque or with both.

**Penal Action u/s 405/406/409 of I.P.C.:**

If an employer deducts employees' share of contribution from their wages but does not pay the said contribution, he thereby commits an offence of criminal Breach of Trust which is punishable under this section with imprisonment which may extend to 3 years or with fine or with both.



## Paper 4: Fundamentals of Business Mathematics and Statistics (FBMS)

### INDEX NUMBER

- ❖ 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**

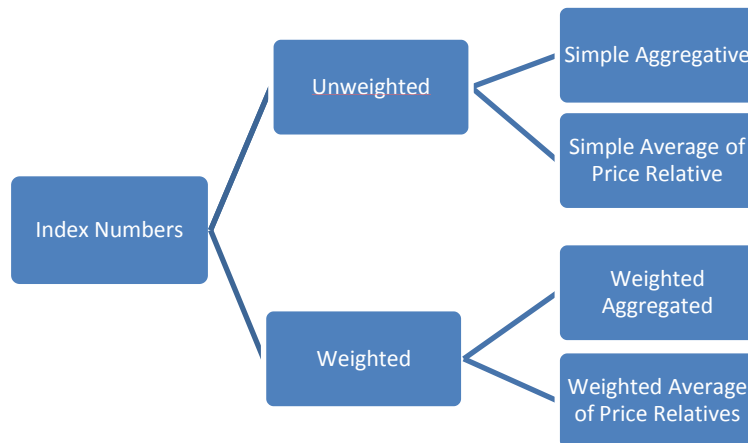
Price Index

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<sub>01</sub> = Index number of the current year.

P<sub>1</sub> = Total of the current year's price of all commodities.

P<sub>0</sub> = 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.



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

Solution:-

COMMODITIES	UNITS	PRICE (Rs.) 2007	PRICE (Rs.) 2008
Sugar	Quintal	2200	3200
Milk	Quintal	18	20
Oil	Litre	68	71
Wheat	Quintal	900	1000
Clothing	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-

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

**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)	Price (2008)	Price Relative
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

$$\sum \left( \frac{P_1 \times 100}{P_0} \right) = 603.37$$

$$P_{01} = \frac{\sum \left( \frac{P_1 \times 100}{P_0} \right)}{N} = \frac{603.37}{5} = 120.63$$



### **WEIGHTED INDEX NUMBERS**

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

(A) 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.

$$p_{01} = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

**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.

$$p_{01} = \frac{\sum p_1q}{\sum p_0q} \times 100$$

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) Laspeyres Index (2) Paasche's Index (3) Fisher Ideal Index.

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

**Solution-**

ITEMS	PRICE	PRODUCTION	PRICE	PRODUCTION				
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
TOTAL					34370	28020	38720	31520

**Solution-**

**1. Laspeyres index:**

$$p_{01} = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{34370}{28020} \times 100 = 122.66$$





**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	$\frac{65}{60} \times 100 = 108$	$\frac{108 \times 120}{100} = 129.60$

