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H.P.B.M.

009E(318)

## Demand Analysis \*

### Demand Determinants (Factors determining demand)

General factors		Add <sup>not</sup> factors related to luxury goods and durables	factors related to market demand
Price of producer itself	Taste & Preference of consumer	Con's expectations of future price	population (no. of consumers)
Income of the consumer	Price of related goods (substitute and complementary goods)	Con's expectation of future income	Socio economic Demographic distribution of consumer
			+ advertising + sales promotions

### Price and Demand

- Meaning of Demand: Demand in Economics means desire to buy backed by adequate purchasing power.

- Demand Functions: A mathematical expression of the relationship between quantity demanded of the commodity and its determinants is known as demand function, when it relates to the market it is called market demand functions.

- Individual Demand f":

$$Q_{dx} = f(P_x, Y, P_1, \dots, P_{n-1}, T, A, E_y, E_p, u)$$

where  $Q_{dx}$  refers to quantity demanded of product X

$P_x$  → Price of  $X$ ,  $Y$  → level of household income,

$P_1, \dots, P_{n-1}$  → Price of all other related products

$T$  = tastes of consumer,  $E_y$  → con's expectation abt future income

$A$  = adv., uses others,  $E_p$  → con's " " " price

## Market Demand

$$Q_{dr} = f(P_u, Y, P_1, \dots, P_{n-1}, T, A, EY, EP, P, D, u)$$

$P$  → population & size of the market

$D$  → Distribution of consumers in various categories depending on income, age, sex, ... (market segments)

### Law of Demand:

The relation of price to sales is known in economics as the 'law of demand'.

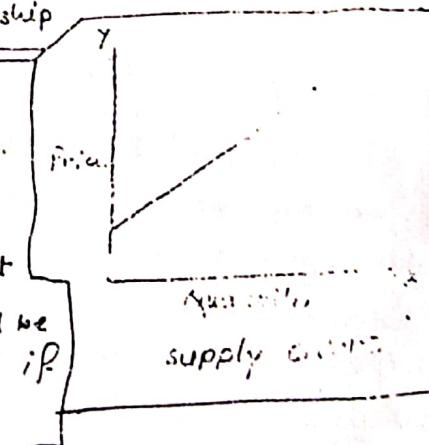
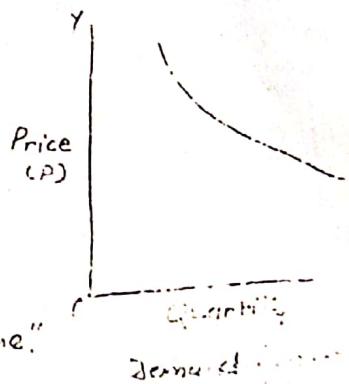
"Higher the price, lower the demand; and vice versa, other things remaining the same."

from curve of demand

negative slope - inverse relationship  
(for knowledge)

where as;  
Supply curve shows: willingness of producer (supplier) to offer quantity at particular price.

From supply curve we can see that more the price, more quantity will be offered by the producer (supplier) if stock exist.



→ generally,  $Y$  a dependent variable shown on  $Y$  axis and independent variable, is shown on  $X$  axis. But here, convention among economist is such that they portray price-quantity rel<sup>sh</sup>. by representing quantity ( $Q$ ) on  $X$  axis and price ( $P$ ) on  $Y$  axis.

→ Demand curve - price-Qty. rel<sup>sh</sup>. of Rel<sup>sh</sup> between  $Q$  &  $P$ .

and other variables are not shown by 'Demand curve'

→ It (D.C.) tells: at a particular price - what is the MAX., a consumer can purchase? (W) for particular demand ( $Q$ ), what pri

In algebraic form:  $[Q = f(P)]$ ,

## Chief characteristics of Law of Demand:

②

→ Inverse relationship between Price & Quantity  
→ Price, an independent variable and Demand, a dependent variable (under the law of demand, the effect of price on demand which is examined, and not the effect of demand on price)

→ Other things remain the same. (e.g. one or more such factors, say, income, substitute's price, consumer's taste and preferences, advertising & sales promotion ...)

## Reasons Underlying the law of Demand:

(a) Income effect (b) Substitution effect

(a) Income effect: The fall in the price of a commodity leads to and therefore, is equivalent to an increase in the income of the consumer because now he has to spend less for purchasing the same quantity as before. So a part of money so gained can be used for purchasing some more units of the commodity. When price rises - reverse

(b) Substitution effect: when the price of the commodity falls, consumer tends to substitute that commodity for other commodity (expensive). Conversely, when the price of a commodity rises, other commodities will be used in its place, at least to some extent. Therefore, a fall in the price of a commodity increases demand and vice versa.

## Exceptions to the Law of Demand:

→ Exceptions to the Law of Demand:

→ There are some goods - purchased mainly for their 'Snob appeal' or Ostentation. Veblen called 'conspicuous consumption'. If price rises - snob appeal rises - rise in demand. If

price falls - their capacity to perform the function of ostentation diminishes. (Veblen goods - diamond)

→ Speculative market. a rise in price creates more purchases frequently and vice versa. e.g. Share mkt, some Industrial mkt,

→ The Giffen case: Giffen found - in 19<sup>th</sup> century - Ireland, people were so poor that they spent major income on - potatoes small part on - meat.  
 when price of potatoes ↑ - economise on meat to maintain consumption of potatoes. further to fill the resulting gap - they had to purchase more potatoes. Thus the rise in price of potatoes increases its sales rather than decrease. (but such case happen only when the considerable income is spent on inferior good)

- Individual Demand and Market Demand  
 Demand at given price - by individual purchaser - Ind<sup>l</sup> Demand
- Total quantity demanded by all purchasers - Mkt. Demand
- Market Research & Law of Demand  
 (self - survey + market research)
- Price elasticity of Demand:  
 Law of demand tells us abt only direction of change, but not the rate at which the change takes place.  
 "The degree of responsiveness of quantity demanded to change in price." - gives rate of change

$$E_p = \frac{\text{Proportionate change in the quantity demanded}}{\text{Proportionate change in price}}$$

$$\therefore E_p = \frac{\frac{\text{change in qty. demanded}}{\text{qty. demanded}}}{\frac{\text{change in price}}{\text{Price}}}$$

①

$$\epsilon_p = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{P_2 - P_1}{P_1}}$$

where  
①  $Q_1$  → qty. demanded before price change

$Q_2$  → Qty. demanded after price change

$P_1$  → Price charged before price change

$P_2$  → Price charged after price change

e.g.: If  
 $Q_1 = 2000$      $Q_2 = 2500$

$$P_1 = 10 \quad P_2 = 9$$

$$(2500 - 2000)$$

$$\epsilon_p = \frac{\frac{2500 - 2000}{2000}}{\frac{9 - 10}{10}} = -2.5$$

-ve sign <sup>to</sup> indicate inverse relationship between price and demand. In practice, minus sign is omitted from the final result.

modified Formula:

$$\epsilon_p = \frac{\frac{Q_2 - Q_1}{Q_2 + Q_1}}{\frac{P_2 - P_1}{P_2 + P_1}} = \frac{\frac{Q_2 - Q_1}{2}}{\frac{P_2 - P_1}{P_2 + P_1}}$$

$$\frac{Q_2 - Q_1}{Q_2 + Q_1} = \frac{\Delta Q_1}{Q_{2+}Q_1} \rightarrow ②$$

$$\frac{P_2 - P_1}{P_2 + P_1} = \frac{\Delta P_1}{P_{2+}P_1}$$

$$\epsilon_p = \frac{\frac{500}{4500}}{-\frac{1}{19}} = \frac{19}{-19} = -2.11$$

Interpretation: A one percent reduction in price will result in a 2.5% increase in quantity demanded from 1st formula and 2.1% increase in qty. demanded according to the modified formula(2).

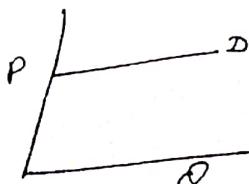
→ here we are limiting our selves to arc elasticity only. (2 finite points on curve) Whereas as at particular point, point elasticity can be found out by

$$\text{Point elasticity} = \frac{dQ/p}{dP/p} = \frac{P}{Q} \cdot \frac{dQ}{dP}$$

Types of price elasticity

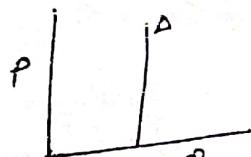
1) Perfectly elastic demand: no reduction in price is needed to cause an increase in demand. firm can sell the qty. it wants at the prevailing price but not at all at even a slightly higher price.

curve - horizontal  
num. Expression - ∞



2) Perfectly inelastic demand: where a change in price however large, causes no change in quantity demanded

curve - vertical  
num. Expression - 0

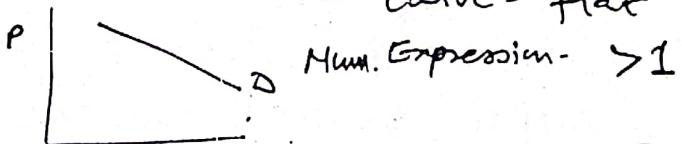


3) Demand with unity elasticity: give an equal proportionate change in the ~~price~~ demand. shape of the demand curve - rectangular hyperbola.

proportionate change in price  
num. Expression - 1.

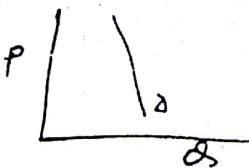
4) Relatively elastic demand: reduction in price leads to more than proportionate change in demand.

curve - flat



5) Relatively inelastic demand: reduction in price → less than proportionate increase in demand

curve - steep  
num. Expression - < 1



### Factors Determining Price Elasticity of Demand:

- Nature of commodity: demand of necessities/luxuries is generally inelastic (salt), demand of luxury goods - elastic generally
- Extent of use: more use - more elastic (steel)
- Range of substitutes: more substitutes - more elastic
- Income level: People with high income less affected by price change
- Proportion of Income spent on the commodity: where an individual spends only a small part of his income on the commodity, the price change does not materially affect his demand for the commodity.  
e.g. match box, salt - inelastic
- Urgency of demand:
  - the availability of substitutes } essentiality
  - habit and social customsalt - less elastic - inelastic  
cigarettes - "
- Durability of commodity: durable or repairable
  - more durable or repairable - more elastic the demand. (e.g. if price rises, get repaired it and wait for reduction in price or at least use it for long time)
- Purchase frequency of a product: if the frequency of purchase increases - high elastic

### Revenue Relationships:

→ Average revenue: total receipts from sales divided by the number of units sold

$$AR = \frac{TR}{Q}$$

→ Total revenue:  $TR = P \cdot Q$

(P: Price, Q: Qty.)

→ Incremental Revenue:  $IR = R_2 - R_1 = \Delta R$

→ Marginal Revenue: additional revenue which would be earned by selling an additional (marginal) unit of a firm's product

$$MR = \frac{R_2 - R_1}{Q_2 - Q_1} = \frac{\Delta R}{\Delta Q}$$

diff between IR and MR :

1) IR is the change in total revenue irrespective of the change in sales whereas MR is the change in total revenue per unit change in sales

2) IR revenue is not confined to the effects of price change. It rather measures the effect of any kind of managerial decision on total revenue.

$$IR = R_2 - R_1 = \Delta R$$

$$MR = \frac{R_2 - R_1}{Q_2 - Q_1} = \frac{\Delta R}{\Delta Q}$$

### Elasticity of Demand and Total Revenue:

change in Price

$e > 1$

$e = 1$

$e < 1$

Rises

TR falls

TR unchanged

TR rises

Falls

TR rises

TR unchanged TR falls

## Relationship between Average Revenue, MR and e:

$$1) AR = MR \times \frac{e}{e-1}$$

$$2) MR = AR \times \frac{e-1}{e}$$

$$3) e = \frac{AR}{AR - MR}$$

or change in demand and Elasticity of Demand:

In economics, both are different.

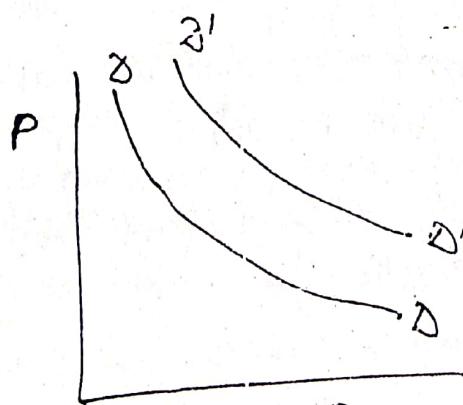
'change in demand' occurs when price does not change.

'change in demand' occurs when price does not change but demand changes due to some other factors viz.

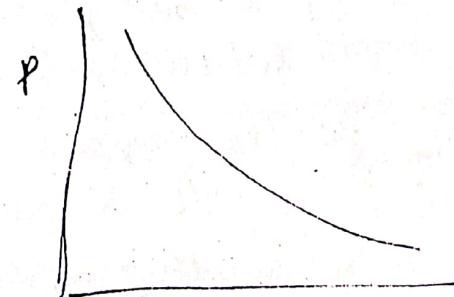
income etc., where as elasticity of demand

refers to that change in demand which occurs due to change in price, other factors remaining the same. In former case, shift of entire

Demand curve and in later case, changes on the same curve.



change in demand or  
shift in demand



Elasticity of demand

Some Business Applications of Price Elasticity:

Price discrimination: A monopolist adopts price discrimination policy only when the elasticity of demand of different consumers or submarkets is different. Consumers - who are charged more

- Public Utility Pricing: monopoly - railway, water supply according to elasticity.
- Price discrimination: wool and mutton; wool more price as less elastic.
- Joint Supply: wool and mutton; wool more price for goods with elastic demand
- Super market: slightly less price for goods with inelastic demand.
- Use of machines: if elastic demand may generally employment as more capacity can be utilized, whereas inelastic demand - may be reverse case.
- Factor pricing: The factor having price - inelastic demand can obtain a higher price than those with elastic demand. Workers producing products having inelastic demand can easily get their wages raised.
- International Trade:
  - (i) A country benefit - exports of products as have price inelastic demand for a rise in price.
  - (ii) The demand for imports should be inelastic for a fall in price and elastic for a rise in price.
  - (iii) Deciding upon devaluing a country's currency or not - price elasticity of demand. If demand is inelastic, devaluation would fail to achieve its objective.

- Shifting of Tax burden: if demand is elastic, <sup>(1)</sup> he will have to bear the tax burden himself, otherwise for his goods will go down.
- Taxation policy: Govt. can easily raise tax revenue by taxing commodities which are price inelastic.

## INCOME & DEMAND

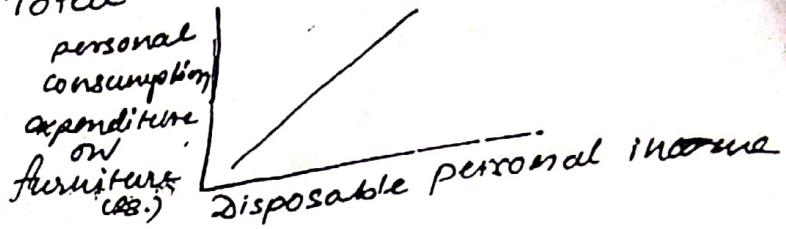
Basic demand determinant - useful in planning sales, allocating territories etc.

### ★ Important aspects:

- Consumption function: refers to the relationship of total expenditure on consumption to total income.
- The long-run relation of consumption to income is somewhat stable, and expenditure on consumption is regularly about 85 to 90 % of the income.
- In short-run, the consumption function recorded great instability.
- During periods of economic prosperity, expenditure on cons<sup>2</sup>. tends to increase absolutely but decrease as a % of income. On the other hand, in periods of depression, consumption declines absolutely but the expenditure on consumption increases as a % of income.
- In underdeveloped countries like India where people live below the subsistence level, the propensity to consume is very high. Any increase in income of the people with low income, is likely to be spent on consumption goods.

But still some limitations are there as some other factors also affect the consumption decision.

\* Product consumption fn.  
relationship between Total income and sales of particular products.



- \* Differences in Regional Income:
- diff. in purchasing power in diff. regions
  - find out coefficient - income sensitivity - ratio of % change in expenditure (in money terms) to % changes in income.

\* Income Expectation and Demand:  
applicable to consumer durable generally.

### (2) Income Elasticity of Demand:

The degree of responsiveness of quantities demanded to a given change in income.

$$E_y = \frac{\text{Proportionate change in Qty. Demanded}}{\text{Proportionate change in income}}$$

or

$$E_y = \frac{\frac{Q_2 - Q_1}{Q_1 + Q_2}}{\frac{Y_2 - Y_1}{Y_1 + Y_2}}$$

e.g.:

$$Y_1 = 1000 \text{ (Rs.)}$$

$$Y_2 = 1100$$

$$Q_1 = 10 \text{ kg. sugar}$$

$$Q_2 = 12 \text{ kg. sugar}$$

$$E_y = 1.99$$

$Q_1$  - qty. demanded before income change

$Q_2$  - qty. demanded after income change

$Y_1$  - Income before change

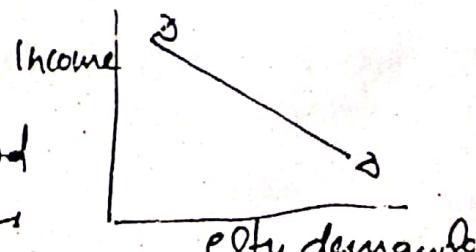
$Y_2$  - Income after change

So we can say, the demand for sugar is quite income elastic.

→ zero income elasticity - e.g. salt

→ Negative income elasticity - inferior good  
increase in income - biri t. cigarettes

→ Positive income elasticity - superior good - most goods



## PRICE OF RELATED GOODS & DEMAND

Substitutes & Complements  
Cross Elasticity of Demand:

The proportionate change in the quantity demanded of a particular commodity in response to a change in the price of another related commodity.

$$e_c = \frac{\frac{Q_{x_2} - Q_{x_1}}{Q_{x_2} + Q_{x_1}}}{\frac{P_{z_2} - P_{z_1}}{P_{z_2} + P_{z_1}}}$$

OR  $e_c = \frac{\text{Proportionate change in the quantity purchased of } X}{\text{Proportionate change in the price charged for } Z}$

If cross elasticity  $\rightarrow$  positive (+ve)  $\Rightarrow$  substitutes (goods)

If cross elasticity  $\rightarrow$  negative (-ve)  $\Rightarrow$  complements (goods)

Cross Elasticity of Prices:

$$P_x E_{py} = \frac{\frac{P_{y_2} - P_{y_1}}{P_{y_2} + P_{y_1}}}{\frac{P_{x_2} - P_{x_1}}{P_{x_2} + P_{x_1}}}$$

for substitutes C.E. of price is positive

for complements C.E. of price is negative

$\rightarrow$  C.E. ranges from +1 (perfect substitutes) to -1 (perfect complements) theoretically, but in reality measure may go beyond these due to error in data and to various other extraneous factors.

## ADVERTISING & DEMAND

Two important fns. of advertising in context of demand  
(i) to shift the demand curve to the right ✓  
(ii) to reduce the elasticity of demand. ✓

However, adv. has a cost.

The salient features of the advertising - sales relationships are:

- 1) Certain amount of sales is possible even without any adv.
- 2) Other things i.e., price, quality, channels of distribution and similar factors affecting the sales remaining the same, there is a direct rel<sup>n</sup>. between the extent of advertisement and the volume of sales. Thus the increase in the expenditure on advertising is likely to lead to an increase in sales.
- 3) Up to a point, an increase in advertisement will lead to a more than proportionate increase in sales. But beyond this point, an increase in advertisement will lead to a less than proportionate increase in sales till the saturation point is reached, after which there will be no increase in sales.



\* Advertising elasticity of Demand: (promotional elasticity)

$$E_a = \frac{\text{Proportionate change in Sales}}{\text{Proportionate change in Adv. Expenditure}}$$

$$E_a = \frac{\frac{Q_2 - Q_1}{Q_2 + Q_1}}{\frac{A_2 - A_1}{A_2 + A_1}}$$

- ⑤ Factors Affecting Advertising elasticity of demand:
1. The stage of the product's market development - new mkt, estd. mkt
  2. The extent to which competitors react to the co's adv.
  3. The quality and quantity of the co's adv. in past and present relative to that of competitors - selection of adv. media etc.
  4. The influence of non-adv. determinants of demand - price, income ..
  5. The time interval that elapses b/w adv. expenditure and response of sales to the expenditure, which is difficult to predict.
  6. The delayed effect co's past adv. and the extent to which it affects current and future sales.
- ⑥ Determining Advertisement Outlays:
- (i) % of sales approach: fix % of past, present and expected sales on adv. outlays
  - (ii) 'All you can afford' approach: % of profit or cash funds more profitable more adv.
  - (iii) 'Return on Investment' approach:
  - (iv) 'competitive parity' approach: what other firms are spending on adv. in industry.
  - (v) 'Objective and Task' approach: > define objective target → outline task - media → determine cost - and measure - monitor

- Economic Implications of Adv. :**
- Economic consumer, → Broadening Market
  - Informing consumer, → low cost per contact - advantage of adv.)
  - lowering selling costs (increases prices - cost)
  - encouraging competition
  - waste of resources (increases prices - cost to consumer) → Oligopoly and Mkt concentration

## Demand Distinction

- Producer's goods and consumers' goods
- durable goods and non-durable goods
- derived demand and autonomous demand
- industry demand and company demand
- short run demand and long run demand
- short term demand fluctuation and long term trend
- Total market and market segment

## Demand Forecasting

A forecast is a prediction or estimation of a future situation under given condition.

- passive forecasts: where prediction about future is based on the assumption that the firm does not change the course of its action.
- Active forecasts: where forecasting is done under the condition of likely future changes in the affairs by the firm.

### \* Purpose of forecasting demand:

- In short run forecast seasonal patterns are of prime importance. - we fix for suitable sales policy and proper scheduling of output in order to avoid over-stocking or costly delays in meeting the orders.
- necessary modification in advertising and sales techniques.
- long run forecasts are helpful in proper capital planning - depending upon prod<sup>ty</sup>. capacity, manpower planning, investment etc.

Demand forecasting may be undertaken at three different levels,

a) Macro level - business conditions over the whole economy = income or expenditure index of industrial prod<sup>n</sup>, national

i) Industry-level - prepared by different trade association  
ii) Firm level :-

+ Steps in D.F. :

- Identification of objective
- Determining the nature of goods under consideration
- Selecting a proper method of forecasting
- Interpretation of results.

### Methods of forecasting

→ Expert opinion method

→ Delphi Method : It consists of an attempt to arrive at a consensus in an uncertain area by questioning a group of experts repeatedly until the response appear to converge along a single line or the issue causing disagreement are clearly defined. The participants (experts) are supplied the responses to previous questions from others in the group by a co-ordinator or leader, even including reasons.

→ Survey of Buyers' Intention : useful for short run

→ Collective opinion ( sales-force polling ):

- biases (subjective)
- restricted to short run only

- Analysis of time series and trend projections:  
past sales data with time are arranged in chronological form yield 'time series'. A trend line can be fitted through a series either by means of statistical method such as least square or visually by judgement.
  - changes at turning points, or at break down of time series.
  - four sets of factors has to be seen:  
Trend ( $T$ ), seasonal variation ( $S$ ), cyclical fluctuations ( $C$ ) and irregular or random forces ( $I$ ).
  - Treat the original time series data ( $O$ ) by Expressing  $O = TSCI$  so far eliminating effects of these all four.
- usual practice is first calculate trend from total data ( $O$ ). Then trend values are eliminated ( $TSCI/T$ ). Then calculate seasonal index used for removing seasonal effect. ( $SCI/S$ ).

Linear Trend:

$$\text{Sales} = a + b \text{ (Year no.)}$$

$$S = a + bT$$

$$\sum S = Na + b \sum T$$

$$\sum ST = a \sum T + b \sum T^2$$

find out a and b so

$$S = a + bT$$

and we can get value of S for any future year.

### Non Linear Trend:

Polynomial trend:  $S = a + bT + cT^2$

$$S = a + bT + cT^2 - dT^3$$

Exponential trend:  $S = a e^{bt}$

$$\log S = \log a + bt$$

Double log. trend:  $S = aT^b$

$$\log S = \log a + b \log T$$

### Smoothing Methods:

#### i) Moving average

$$\text{1st value of M.a } (\bar{Y}_1) = \frac{1}{n} (Y_1 + Y_2 + \dots + Y_n)$$

$$\text{2nd } " \quad " \quad " \quad (\bar{Y}_2) = \frac{1}{n} (Y_2 + Y_3 + \dots + Y_{n+1})$$

#### ii) Exponential Smoothing:

$$\begin{pmatrix} \text{Current} \\ \text{smoothed} \\ \text{value} \end{pmatrix} = w \cdot \begin{pmatrix} \text{current} \\ \text{observed} \\ \text{value} \end{pmatrix} + (1-w) \begin{pmatrix} \text{Previous} \\ \text{smoothed} \\ \text{value} \end{pmatrix}$$

$$S_t = w y_t + (1-w) S_{t-1}$$

$$\text{begin with } S_1 = Y_1 \quad (t=1)$$

## Use of Economic Indicator method

- 1) Construction Contracts sanctioned for the demand of building mats like cement
- 2) Personal income for the demand of consumer goods.
- 3) Automobile registration for the demand of car accessories, petrol
- 4) Agricultural income for the demand of fertilizers

Year	Farm Income index ( $X$ )	Sales of Tractors ( $Y$ )	$x_1$	$y_1$	$x_1 y_1$	$x_1^2$
1	100	110	10	11		
2	110	120	11	12		
3			12	13		
4						
5						
$\sum x_i =$		$\sum y_i =$		$\sum x_i y_i = \sum x_i^2 =$		

$$\sum y_i = n a + b \sum x_i$$

$$\sum x_i y_i = a \sum x_i + b \sum x_i^2$$

get  $a \neq b$  and

$$y = n( ) + ( ) x \rightarrow$$

$\rightarrow$  Controlled experiments

$\rightarrow$  Judgemental Approach : when ana. of Time series regression not possible —