Methods of Demand Estimation and Forecasting

- ***The purpose of estimating current demand for the product is to plan an appropriate level of short-term production and the price of the product, given the market conditions.***

- ***In contrast, the purpose of estimating future demand is to have the knowledge of the future demand for making long-term plans for future production, product pricing, capital investment, organising inventories, and for sales promotion by advertisement if required.***

- ***The estimation of the long-term demand is, in fact, demand forecasting.***

- ***The forecasting demand is often necessary for large scale corporations, especially under the changing economic conditions of the country and the consequent change in business prospect of the relevant industry.***

NEED FOR DEMAND ESTIMATION AND FORECASTING

- ***The need for estimating current demand arises because the firms have to determine the quantity to be produced and the price to be charged with short-term business perspective.***

- ***In fact, most business firms and even businessmen do have knowledge of demand for their product.***

- ***What will be the change in sales revenue if price is changed? How will demand increase if effective advertise is made?***

- ***It is for such reasons that the need for estimating current demand arises.***

- ***A general approach to prevent the adverse effect of risk and uncertainty is to obtain reliable information regarding the possible future demand and to plan and manage business accordingly.***

- ***The information regarding the future demand is obtained estimating the future demand, known as demand forecasting.***

- ***Demand forecasting is estimating the future demand for the product of the firm. A reliable forecast of the future demand helps to a great extent in the following areas of future business management.***

  - Determining production target,
  - Planning and scheduling production,
  - Acquisition of required inputs (capital, labour, raw materials),
  - Formulating pricing policy in competitive market, and
  - Planning advertisement.

THE PROCESS OF DEMAND ESTIMATION AND FORECASTING

The following steps are generally adopted for estimating and forecasting demand.

(i) **Specification of the objective: The objective or the purpose of estimating and forecasting demand must be clearly specified in advance. The objectives of demand estimation are generally specified as follows:**

(a) Estimation of short-term or the current demand for product,

(b) Estimation of current demand for the product of a firm or of the industry,

(c) Estimation of demand in a market segment or the entire market of a product,

(d) Estimation of long-term demand for demand forecasting.

METHODS OF DEMAND ESTIMATION AND FORECASTING: AN OVERVIEW

(i) Consumer Survey Method—the Direct Consumer Survey, and

(ii) Opinion Poll Method.

(iii) Market Studies and Experiments

(iv) Statistical Methods

Consumer Survey Method – Direct Interview

Depending on the purpose, time and cost, consumer surveys are conducted by three methods:

(a) Complete enumeration: This method is known as direct interview method. When all the consumers are interviewed, the method is known as complete enumeration survey or comprehensive interview method

(b) Sample survey: When only a few selected representative consumers are interviewed, it is known as sample survey method.

(c) End-use survey method: The end-use method of demand forecasting has certain theoretical and practical value, especially in forecasting demand for inputs.

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❑ *Opinion Poll Methods*

***The opinion poll methods is used by collecting opinions of those who are supposed to possess knowledge of the market, e.g., sales representatives, sales executives, professional marketing experts and consultants. The opinion poll methods include*:**

Market Studies and Experiments

- ***This method is known in common parlance as market experiment method.***

- ***Under this method, the first step of firms is to select some areas of the representative markets, e.g., three or four cities having similar features, viz., population, income levels, cultural and social background, occupational distribution, and similar choices and preferences of consumers.***

- ***Then, they carry out market experiments by changing prices, advertisement expenditure and other controllable variables of the demand function under the assumption that other factors remain constant.***

- ***The controlled variables may be changed over time either simultaneously in all the markets or in the selected markets***

STATISTICAL METHODS

Statistical methods are considered to be superior techniques of demand estimation for the following reasons.

(i) In the statistical methods, the element of subjectivity is minimum,

(ii) Statistical method of estimation is scientific as it is based on the theoretical relationship between the dependent and independent variables,

(iii) Estimates are relatively more reliable because forecasts are based on observed facts, and

(iv) Estimation involves short period of task and low financial cost.

Three kinds of statistical methods are used for demand projection.

(1) Trend Projection Methods,

(2) Barometric Methods, and

(3) Econometric Method.

Trend Projection Methods

- **The *trend projection method is a 'classical method' of demand estimation and business forecasting.***

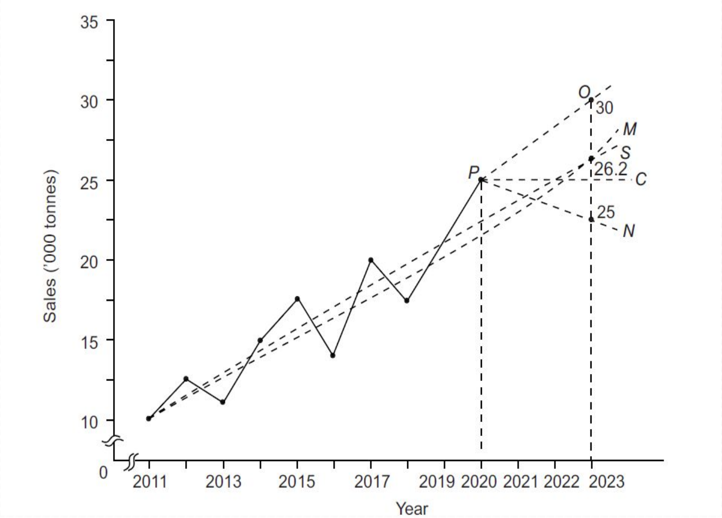
- ***The use of this method requires a long and reliable time-series data. The trend projection method is used under the assumption that the factors responsible for the past trends in the variable to be projected (e.g., sales and demand) will continue to play their same role in future in the same manner and to the same extent as they did in the past in determining the magnitude and direction of the variable.***

- ***It merely represents one of the several means to obtain an insight of what the future may possibly be and whether or not the projections made using these means are to be considered as most appropriate will depend very much on the reliability of past data and on the judgement that is to be exercised in the ultimate analysis.***

There are three techniques of trend projection based on time-series data.

(a) Graphical Method- *Under this method, annual sales data is plotted on a graph paper and a line is drawn through the plotted points.*

By extending the trend lines (marked M and S), we can forecast an approximate sale of 26,200 tonnes in 2023.



Trend Projection

(b) Trend Fitting Equation–

- ***The Least Square Method***

- ***Fitting trend equation is a formal technique of projecting the trend in demand. Under this method, a trend line (or a curve) is fitted to the time-series sales data with the aid of statistical techniques.***

- ***The kind of the trend equation that can be fitted to the time-series data is determined either by plotting the sales data (as shown in Figure) or by trying different kinds of trend equations for the best fit.***

The two most common types of trend equations are:

(i) Linear Trend. When a time-series data reveals a rising trend in sales at a constant rate, then a straightline trend equation of the following form is fitted.

$$S = a + bT$$

where *S* = *annual sales, T* = *time (years), and a and b are constants.* The co-efficient b *gives the measure of constant annual increase in sales.*

The co-efficients a and b are estimated by solving the following two equations based on the principle of least square.

$$\Sigma S = na + b\Sigma T$$
$$\Sigma ST = a\Sigma T + b\Sigma T^2$$

Example 1:-

From the following table, forecast sales for the year 2025 and 2026 by Least Square method. **(3+2)**

Year	2019	2020	2021	2022	2023
Sales	20	36	42	56	65

Example 1:- Solution

Year	Sales(inlakhs)	T	ST	T^2
2019	20	-2	-40	4
2020	36	-1	-36	1
2021	42	0	0	0
2022	56	1	56	1
2023	65	2	130	4
N = 5	$\sum S = 219$	$\sum T = 0$	$\sum ST = 110$	$\sum T^2 = 10$

$\sum S = na + b\sum T$ $\qquad$ $\sum ST = a\sum T + b\sum T^2$

⇨ 219 = 5a + 0 $\qquad$ => 110 = 0 + 10b

⇨ ▪**a= 43.8** $\qquad$ => **b = 11**

S = a + bT => S = 43.8 + 11T

Example 2:-

The business analyst for a video company wants to forecast this year's demand for DVD decoders based on the following historical data:

Year	Demand (000 units)
Five years ago	900
Four years ago	700
Three years ago	600
Two years ago	500
Last year	300

What will be this year demand?

Example 2:- Solution

Year	Y	X	X^2	XY
1	900	-2	4	-1800
2	700	-1	1	-700
3	600	0	0	0
4	500	1	1	500
5	300	2	4	600
n=5	$\sum Y=3000$	$\sum x=0$	$\sum X^{2}= 10$	$\sum xy= -1400$

a= 600 & b= -140

Y= a+bx & Y= 600-140X

Y this year= 600-(140×3), or Y=180

Example 3:-

The demand values of starter motor of particular vehicle in thousands during the past 6 years (2011-2016) are summarized in Table.

Year (X)	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Demand (Y) in thousands	**60**	**72**	**58**	**90**	**82**	**100**

a) Fit a linear regression to estimate the demand of starter motor in future.
b) Compute the demand of the starter motor for the year 2025.

YEARS	X	Y	XY	X^2
2017	-2.5	60	-150	6.25
2018	-1.5	72	-108	2.25
2019	-0.5	58	-29	0.25
2020	0.5	90	45	0.25
2021	1.5	82	123	2.25
2022	2.5	100	250	6.25
n = 6	$\sum X=0$	$\sum Y = 462$	$\sum XY = 131$	$\sum X^2 = 17.5$

a=77 b= 7.48

a) Y= a + bx

Y= 77 + 7.48X

b) Y= 77 + 7.48 (2025- 2019.5)= 118.14 in thousands

Example 4:-

Forecast and compare the sales of automatic cars and manual cars for year 2025 and 2030 on the basis of given data and decide which car can incur greater business collectively at the end of 2030.

Sl.No.	Years	Sales of Automatic car (in thousands)	Sales of Manual Car (in thousands)
1	2000	55000	75000
2	2004	78000	85000
3	2008	88000	99000
4	2012	95000	110000
5	2016	110000	115000
6	2020	200000	150000
7	2024	250000	180000

Treatment of the Abnormal Years

- ***An abnormal year is one in which sales are abnormally low or high.***

- ***Time series data on sales may reveal, more often than not, abnormal years. Such years create a problem in fitting the trend equation and lead to under or over-statement of the projected sales.***

- ***Abnormal years are, therefore, carefully analyzed and data suitably adjusted. The abnormal years may be dealt with :***

(i) by excluding the year from time-series data, (ii) by adjusting the sales figures of the year to the sales figures of the preceding and succeeding years, or (iii) by using a 'dummy' variable.

(ii) Exponential Trend: When the total sale (or any dependent variable) has increased over the past years at an increasing rate or at a constant percentage rate per time unit, then the appropriate trend equation to be used is an exponential trend equation of any of the following forms.

(1) If trend equation is given as

$$Y = ae^{bT}$$

Then its semi-logarithmic form is used as

$$\log Y = \log a + bT \ldots$$

This form of trend equation is used when growth rate is constant.

(2) If trend equation takes the following form

$$Y = aT^b \ldots(9.4)$$

then its double logarithmic form is used as

$$\log Y = \log a + b \log T \ldots(9.5)$$

This form of trend equation is used when growth rate is increasing.

(3) Polynomial trend of the form

$$Y = a + bT + cT2 \ldots(9.6)$$

In above five equations *a, b and c are constants, Y is sales, T is time, and e = 2.718. Once the parameters of the equations are estimated, it becomes quite easy to forecast demand for the years to come.*

Econometric Methods

- ***The econometric methods combine statistical tools with economic theories to estimate economic variables and to forecast the intended economic variables.***

- ***The demand estimates and demand forecasts made through econometric methods are much more reliable than those made through any other method.***

- ***The econometric methods are, therefore, most widely used to forecast demand for a product, for a group of products, and for the economy as a whole.***

The econometric methods are briefly described here under two basic methods.:

(1) Regression Method

- ***Regression analysis is the most popular method of demand estimation. This method combines economic theory and statistical techniques for estimation of demand.***

- ***Economic theory is applied to specify the determinants of demand and to determine the nature of the relationship between the demand for a product and its determinants.***

- ***Economic theory thus helps in determining the general form of demand function. Statistical techniques are used to estimate the values of parameters in the estimated equation.***

The variables of the model are classified as (i) endogenous variables and (ii) exogenous variables.

- ***Endogenous variables are those that are determined within the model. These are included in the model as dependent variables, i.e., the variables that are to be explained by the model. These are also called 'controlled' variables. It is important to note that the number of equations included in the model must equal the number of endogenous variables.***

- ***Exogenous variables are those that are deemed to be determined outside the model. These are inputs of the model. Whether a variable is treated as endogenous or exogenous depends on the purpose of the model.***

Thank You