CHAPTER-9

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 segment2 or the entire market of a product,

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

(ii) Determination of time perspective: The time perspective of demand estimation is determined on the basis of the objective of demand estimation.

(iii) Determination and collection of required data: After the objective and time perspective of demand estimation are determined, the next important step in the process of demand estimation is to specify the kind and level of data required for making reliable estimate of demand.

(iv) Specifying the method of demand estimation: Given the objective of demand estimation, the method of demand estimation has to be specified in advance.

(v) Data analysis and derivation of conclusions: Finally, the demand data collected through consumer survey or from secondary sources has to be analysed systematically to derive conclusion regarding the status of product demand.

METHODS OF DEMAND ESTIMATION AND FORECASTING: AN OVERVIEW

- ***Survey methods are the most common and simple methods of estimating current demand and projecting future demand for a product.***

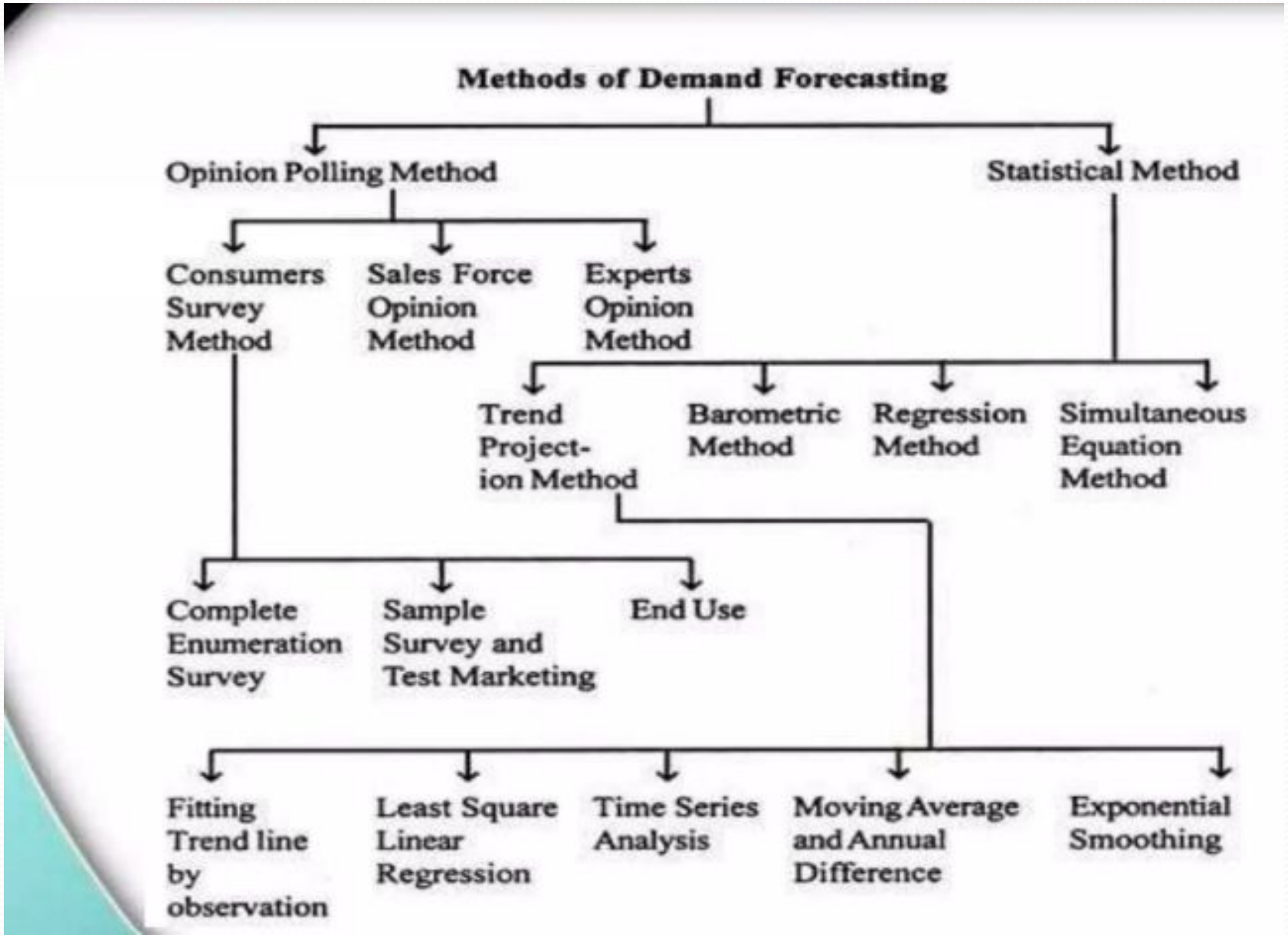
- ***Survey methods are generally used when the purpose is to make short-run forecast of demand for a product.***

- ***Under survey methods, the required information is collected through a survey of consumers/users.***

- ***The survey seeks information on consumers' future plan to buy the product on the basis of which future demand has to be forecast. Surveys are conducted by two methods.***

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

  (ii) Opinion Poll Method.


Methods of Demand Forecasting
Opinion Polling Method
Statistical Method
Consumers Survey Method
Sales Force Opinion Method
Experts Opinion Method
Trend Project-ion Method
Barometric Method
Regression Method
Simultaneous Equation Method
Complete Enumeration Survey
Sample Survey and Test Marketing
End Use
Fitting Trend line by observation
Least Square Linear Regression
Time Series Analysis
Moving Average and Annual Difference
Exponential Smoothing

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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These consumer survey methods are used under different conditions and for different purposes. Their advantages and disadvantages are described below:

(a) Complete Enumeration Survey Method

- *The complete enumeration survey method is used when market size is small and all consumers can be contacted by the surveyors.*

- *In this method, almost all present and potential users of the product are contacted and are asked about their future plan of purchasing the product in question.*

- *The quantities indicated by the consumers are added together to obtain the probable demand for the product.*

(b) Sample Survey Method

- ***Sample survey method is used when population of the target market is very large and expanded over a large area.***

- ***Under sample survey method, only a sample of potential consumers is selected for interview.***

- ***Consumers to be surveyed are selected from the relevant market through a sampling method. Method of survey may be direct interview or mailed questionnaire to the sample-consumers.***

(c) The End-Use Method

- *The end-use method of demand forecasting has certain theoretical and practical value, especially in forecasting demand for inputs.*

- *Making demand forecasts by this method requires building up a schedule of probable aggregate future demand for inputs by industries and by various other sectors.*

- *In the end-use method, technological, structural and other changes that might influence the demand, are taken into account in the process of estimation. This aspect of the end-use approach is of particular importance.*

❑ *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:

(a) Expert-Opinion Method

- ***Firms having a good network of sales representatives can assign them the task for assessing the demand for the target product in the areas, regions or cities that they represent.***

- ***Sales representatives, being in close touch with the consumers or users of goods, are supposed to know the future purchase plans of their customers, their reactions to the market changes, their response to the introduction of a new product, and the demand for competing products.***

(b) Delphi Method

- *Delphi method of demand forecasting is an extension of the simple expert opinion poll method.*

- *This method is used to consolidate the divergent expert opinions to arrive at a compromise estimate of future demand. The process is simple.*

- *Under Delphi method, the task of projecting demand for a product is assigned anonymously to a group of market experts with a group leader.*

- *The task is assigned anonymously in the sense that experts are not aware of each other.*

The ***advantages of Delphi method of forecasting are :***

(i) It provides opportunity to experts to forecast the demand systematically,

(ii) It overcomes the disadvantages of face-to-face discussion by the panel of experts as it puts pressure of compromising unwillingly, and

(iii) It offers a fairly reliable demand forecast as it is based on systematic approach. However, some critics of Delphi method point out drawbacks of this method.

(c) 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.*

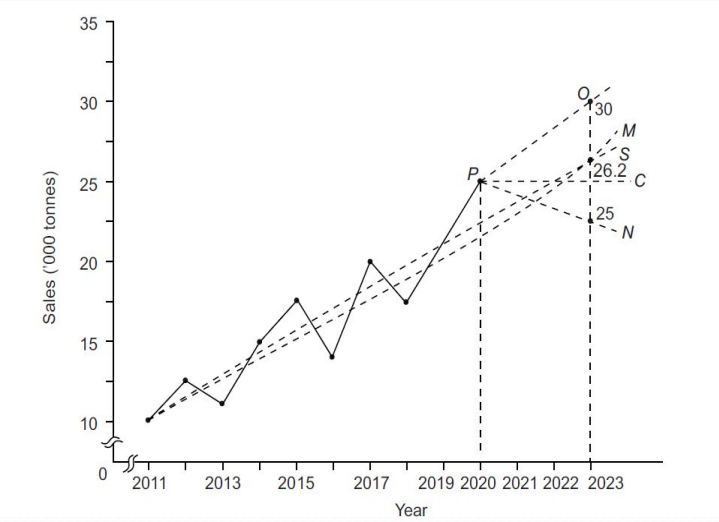
- *The use of this method requires a long and reliable time-series data. The trend projection method is used under the assumption that the factors responsible for the past trends in the variable to be projected (e.g., sales and demand) will continue to play their same role in future in the same manner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

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

illustrate here only the most ... at a const...
(*ii*) exponential trends.

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

$$S = a + bT \quad \ldots(9$$

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

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

$$\Sigma S = na + b\Sigma T \quad \ldots$$

$$\Sigma ST = a\Sigma T + b\Sigma T^2 \quad \ldots$$

The terms included in Eqs. (*i*) and (*ii*) are calculated by using sales data given Table 9.1 and presented in Table 9.2.

By substituting numerical values given in Table 9.2 in Eqs. (*i*) and (*ii*), we get

$$164 = 10a + 55b \quad \ldots$$

$$1024 = 55a + 385b \quad \ldots$$

By solving Eqs. (*iii*) and (*iv*), we get the trend equation as

$$S = 8.26 + 1.48T \quad \ldots$$

Table 9.2 *Estimation of Trend Equation*

Year	*S (Sales)*	*T (Time)*	T^2	*ST (S × T)*
2011	10	1	1	10
2012	12	2	4	24
2013	11	3	9	33
2014	15	4	16	60
2015	18	5	25	90
2016	14	6	36	84
2017	20	7	49	140
2018	18	8	64	144
2019	21	9	81	189
2020	25	10	100	250
$n = 10$	$\Sigma S = 164$	$\Sigma T = 55$	$\Sigma T^2 = 385$	$\Sigma ST = 1024$

Having estimated the parameters of the trend equation (*ii*), it is ... easy to proj... the sales for 2021, 2022 and 2023.

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

$$Y = aebT \ldots$$

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

$$Y = aTb \ldots(9.4)$$

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.*

(c) Box-Jenkins Method for Seasonal Prediction: Box-Jenkins method10 of forecasting is used only for short-term projections and predictions. Besides, this method is suitable for forecasting demand by using only stationary time-series sales data. Stationary time-series data is one that does not reveal a long-term trend. In other words, Box-Jenkins technique can be used only in those cases in which time-series analysis depicts monthly or seasonal variations recurring with some degree of regularity

According to the Box-Jenkins approach, any stationary time-series data can be analyzed by the following three models:

(i) Autoregression model,

(ii) Moving average model, and

(iii) Autoregressive-moving average model.

Barometric Method of Demand Forecasting

- ***The barometric method of demand forecasting is similar to the method that meteorologists use for weather forecasting. Meteorologists use the barometer to forecast weather conditions on the basis of movements of mercury in the barometer.***

- ***This method was first developed and used in the 1920s by the Harvard Economic Service. It was, however, abandoned as it had failed to predict the Great Depression of the 1930s.***

- ***The barometric technique was however revived, refined and developed further in the late 1930s by the National Bureau of Economic Research (NBER) of the US. This method has since then been used often to forecast business cycles in the US.***

Barometric method of demand forecasting consists of the following two sub-methods of choosing the economic indicators demand.

(i) Load-lag Indicators:

The basic approach of barometric technique is to construct an index of relevant economic indicators and to forecast future trends on the basis of movements in the index of economic indicators.

The lead lag indicators used in this method are classified as :

(a) leading indicators,

(b) coincidental indicators, and

(c) lagging indicators.

A time-series of various indicators is prepared to know the future economic trend. The leading indicators consists of indicators which move up or down ahead of some other series. Some examples of leading indicators are:

(i) index of net business investment;

(ii) new orders for durable goods;

(iii) change in the value of inventories;

(iv) index of the material prices; and

(v) corporate profits after tax.

(ii) Diffusion Index:

- ***This kind of indicator leads to the usage of what is referred to as the diffusion index. A diffusion index is the percentage of rising indicators.***

- ***A diffusion index copes up with the problem of differing signals given by the indicators.***

- ***In calculating a diffusion index, for a group of indicators, scores allotted are 1 for rising series, ½ for constant series and zero for falling series.***

- ***The diffusion index is obtained by the ratio of the number of indicators, in a particular class, moving up or down to the total number of indicators in that group.***

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