Measurement of Trend

1) Method of freehand curve fitting
2) Method of moving average
3) Method of mathematical curve fitting
4) Method of semi average

- **Method of freehand curve fitting**

Free hand curve method is the simplest of all methods and easy to understand. The data of a given time series is plotted on a graph. Then a smooth free hand curve is drawn through the plotted points in such a way that it represents general tendency of the series. While drawing this curve it should be kept in mind that the curve should be smooth and the number of points above the trend curve should be more or less equal to the number of points below it. As the curve is drawn through eye inspection, this is also called as eye-inspection method. The free hand curve method removes the short term variations to show the basic tendency of the data. The trend line drawn through the free hand curve method can be extended further to predict or estimate values for the future time periods. As the method is subjective the prediction may not be reliable.

Merits:

(i) It is very simple and easy to understand.

(ii) It does not require any mathematical calculations.

Disadvantages:

(i) This is a subjective concept. Hence different persons may draw freehand lines at different positions and with different slopes.

(ii) Since the method is subjective, the prediction may not be reliable.

- **Simple Moving Averages**

The best-known trend measuring methods is the moving averages or simply takes a certain number of past periods and add them together; then divide by the number of periods. Simple Moving Averages (MA) is effective and efficient approach provided the time series is stationary in both mean and variance. MA of period m is a series of successive averages of m terms at a time, starting with 1^{st}, 2^{nd}, 3^{rd} term etc. Thus the first average is the mean of the 1^{st} m terms, the 2^{nd} is the mean of the m terms from 2^{nd} to (m+1)th term, the third is the mean of the m terms from 3^{rd} to (m+2)th term, and so on.

In case the period is odd: If the period of moving average is odd for instance for computing 3 yearly moving average, the value of 1st, 2nd and 3rd years are added up and arithmetic mean is found out and the answer is placed against the 2nd year; then value of 2nd, 3rd and 4th years are added up and arithmetic mean is derived and this average is placed against 3rd year (i.e. the middle of 2nd, 3rd and 4th) and so on. That is if the period of moving average m is odd = (2k+1), MA is placed against the mid-value of the time interval it covers, i.e., t =k+1.

In case the period is even: If the period of moving average is even for instance for computing 4 yearly moving average, the value of 1st, 2nd, 3rd and 4th years are added up & arithmetic mean is found out and answer is placed against the middle of 2nd and 3rd year. The second average is placed against middle of 3rd & 4th year. That is if the period of moving average m is even =2k, it is placed between the two middle values of the time interval it covers, i.e., between t=k and t=k+1. In this case the MA does not coincide with an original time period and an attempt is made to synchronise the MA and the original data by centering MA which consists in taking a MA of extent two, of these MA and putting the first of these values against t=k+1. This technique is called centring & the corresponding moving averages are called moving average centred. The graph obtained on plotting the MA values against the corresponding time values gives trend curve.

In this method, the main problem which is of paramount importance lies in determining the period of MA which will complete eliminate the oscillatory movements affecting the series. It has been established mathematically that if the fluctuations are regular and periodic then the MA completely eliminates the oscillatory movements provided:

(i) The period of MA is exactly equal to (or a multiple of) the period of oscillation,
(ii) The trend is linear.

Since different cycles vary in amplitude and period, in such cases the appropriate period of MA should be equal to or somewhat greater than the mean period of the cycles in the data. In such cases, the MA method does not completely wipe out the cyclical movements and hence can not give a nice picture of the general trend.

The MA method has the following Merits:

(i) It is a very simple method.
(ii) This method is very flexible in the sense that the addition of a few more figures to the data simply results in some more trend values, the previous calculation are not affected at all.

The MA method has the following drawbacks:

(i) It does not provide the trend values for all the terms, e.g., for a MA of period 2k+1, we have to forego the trend values for the first k and the last k terms of the series.
(ii) Forecasting is one of the leading objectives of trend analysis. But this method can not be used for forecasting or predicting future trend.

- **Method of mathematical curve fitting by principle of least squares**

The principle of least squares is the most popular and widely used method of fitting mathematical functions to a given set of data. The method yields very correct results if sufficiently good appraisal of the form of the function to be fitted is obtained either by a scrutiny of the graphical plot of the values over time or by a theoretical understanding of the mechanism of the variable change. An examination of the plotted data often provides an adequate basis for deciding upon the type of trend to use. Apart from the usual arithmetic scales, semi-logarithmic or doubly-logarithmic scales may be used for graphical representation of the data. The various types of the curves that may be used to describe the given data in practice are:-

(i) A straight line : $y_t = a + bt$

(ii) Second degree parabola : $y_t = a + bt + ct^2$

(iii) Exponential curves : $y_t = ab^t$

Advantages

(i) This method complete eliminates the element of subjective judgement or personal bias on the part of the investigator.

(ii) This method enables us to compute the trend values for all the given time periods in the series.

(iii) The trend equation can be used to estimate or predict the values of the variable for any period t in future or even in the intermediate periods of the given series and the forecast values are quite reliable.

(iv) The line obtained by this method is called the line of best fit.

Drawbacks

(i) Great care should be exercised in selecting the type of trend curve to be fitted i.e. linear, parabolic or some other type. Carelessness in this respect may lead to wrong results.

(ii) The method is quite tedious and time consuming as compared with other methods.

(iii) The addition of even a single new observation necessitates all calculation to be done afresh.