



TIME SERIES ANALYSIS ITS COMPONENTS MODELS

OVERVIEW

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MEANING & DEFINITIONS



A time series is.....

- A set of data depending on the time
- A series of values over a period of time
- Collection of magnitudes belonging to different time periods of some variable or composite of variables such as production of steel, per capita income, gross national income, price of tobacco, index of industrial production.

- *Time is act as a device to set of common stable reference point.*
- *In time series, time act as an independent variable to estimate dependent variables*



Mathematical presentation of Time Series

- A time series is a set of observation taken at specified times, usually at 'equal intervals'.

Mathematically a time series is defined by the values $Y_1, Y_2 \dots$ of a variable Y at times $t_1, t_2 \dots$. Thus,

$$Y = F(t)$$



CAUSES OF VARIATIONS IN TIME SERIES DATA

- Social customs, festivals etc.
- Seasons
- The four phase of business : prosperity, decline, depression, recovery
- Natural calamities: earthquake, epidemic, flood, drought etc.
- Political movements/changes, war etc.



IMPORTANCE OF TIME SERIES ANALYSIS



- A very popular tool for Business Forecasting.
- Basis for understanding past behavior.
- Can forecast future activities/planning for future operations
- Evaluate current accomplishments/evaluation of performance.
- Facilitates comparison



Time Series - Examples

- Stock price, Sensex
- Exchange rate, interest rate, inflation rate, national GDP
- Retail sales
- Electric power consumption
- Number of accident fatalities



COMPONENTS OF TIME SERIES

A cartoon illustration of a person with a backpack, possibly a student or traveler, standing next to a yellow bag and a gold medal with the number '1' on it. The person is wearing a green shirt and blue pants.

WHAT IS COMPONENTS?

- Characteristic movements or fluctuations of time series.



Types of Components

1.

- Secular Trend or Trend

2.

- Seasonal Variations/Fluctuations

3.

- Cyclical Variations/Fluctuations

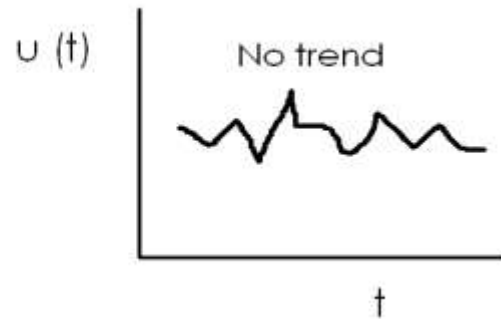
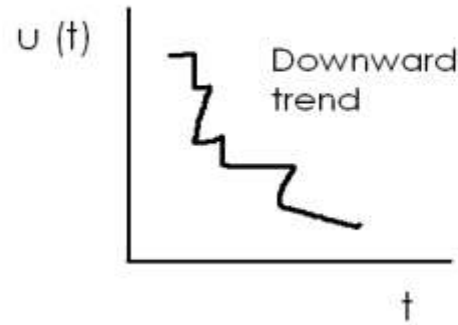
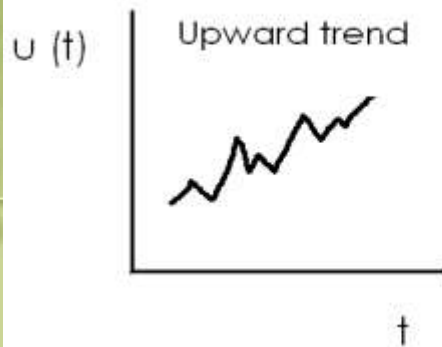
4.

- Irregular Variations/Movements



SECULAR TREND OR TREND

- The general tendency of the data to grow or decline over a long period of time.
- The forces which are constant over a long period (or even if they vary they do so very gradually) produce the trend. For e.g., population change, technological progress, improvement in business organization, better medical facility etc.
- E.g., Formation of rocks



- Downward trend-declining death rate
- Upward trend-population growth
- Mathematically trend may be *Linear or non-linear*



PURPOSE OF MEASURING TREND

Knowledge of
past behavior

Estimation

Study of other
components



SEASONAL VARIATIONS/FLUCTUATIONS

- The component responsible for the regular rise or fall (fluctuations) in the time series during a period not more than 1 year.
 - Fluctuations occur in regular sequence (periodical)
 - The period being a year, a month, a week, a day, or even a fraction of the day, an hour etc.
-
- Term “SEASONAL” is meant to include any kind of variation which is of periodic nature and whose repeating cycles are of relatively short duration.
 - The factors that cause seasonal variations are: (a) Climate & weather condition, (b) Customs traditions & habits



CHACTERISTICS/FEATURES OF SEASONAL VARIATIONS

- Regularity
- Fixed proportion
- Increase or Decrease
- Easy fore cast



PURPOSE OF MEASURING SEASONAL VARIATIONS

- Analysis of past behavior of the series
- Forecasting the short time fluctuations
- Elimination of the seasonal variations for measuring cyclic variations



EXAMPLES OF SEASONAL VARIATIONS

- Crops are sown and harvested at certain times every year and the demand for the labour goes up during sowing and harvesting seasons.
- Demands for woollen clothes go up in winter
- Price increases during festivals
- Withdrawals from banks are heavy during the first week of the month.
- The number of letters posted on Saturday is larger.



CYCLIC VARIATIONS

- Cycle refers to recurrent variations in time series
- Cyclical variations usually last longer than a year
- Cyclic fluctuations/variations are long term movements that represent consistently recurring rises and declines in activity.



BUSINESS CYCLE

- Consists of 4 phases:
prosperity, decline, depressions, recovery



purpose

- Measures of past cyclical behavior
- Forecasting
- Useful in formulating policies in business



IRREGULAR VARIATIONS

- Also called erratic, random, or “accidental” variations
- Do not repeat in a definite pattern
- Strikes, fire, wars, famines, floods, earthquakes
- unpredictable



CHARACTERISTICS

- Irregular & unpredictable
- No definite pattern
- Short period of time
- No Statistical technique



ANALYSIS OR DECOMPOSITION OF TIME SERIES



CONSISTS OF.....

- Discovering
- Measuring
- Isolating
- Components of the time series



MATHEMATICAL MODELS OF TIME SERIES

Additive model

1. We assume that the data is the *sum* of the time series components.

$$Y_t = T + S + C + I$$

2. If the data do not contain one of the components (e.g., cycle) the value for that missing component is zero. Suppose there is no cycle, then

$$Y_t = T + S + I$$

3. The seasonal component is independent of trend, and thus magnitude of the seasonal swing is constant over time.

Multiplicative model

1. We assume that the data is the *product* of the various components.

$$Y_t = T \times S \times C \times I$$

2. If trend, seasonal variation, or cycle is missing, then the value is assumed to be 1.

Suppose there is no cycle, then

$$Y_t = T \times S \times I$$

3. The seasonal factor of multiplicative model is a proportion (ratio) to the trends, and thus the magnitude of the seasonal swing increases or decreases according to the behavior of trend



OVERVIEW

- TIME SERIES
- IMPORTANCE
- COMPONENTS
- ANALYSIS
- MODELS



THANK YOU