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TIME SERIES & FORECASTING

CONTENTS

FORECASTING

Forecasting is a technique of making predictions of the future based on past and present data and by analysis of trends. Forecasting methods can be classified as qualitative or quantitative. Qualitative methods involve the use of expert judgment to develop forecasts, particularly appropriate when historical data are unavailable. Quantitative forecasting methods can be used when historical data are available.

If the historical data are past values of the variable to be forecast, the forecasting procedure is a time series method and the historical data are a time series. A **time series** refers to the past recorded values of the variables under consideration. The data may relate to the past monthly sales of products, or daily demands placed on services like electricity and transportation.

The aim of time series analysis is to determine a pattern in the time series and then extrapolate the pattern into the future. Causal forecasting methods assume that the variables have a cause-effect relationship and that one or more independent variables could be used to predict the value of a single dependent variable. For instance, a regression analysis may be used to develop an equation showing how sales and ads spending are related.

TIME SERIES PATTERNS

If the pattern of a time series can be expected to continue in the future, the past pattern can be used as a guide in selecting an appropriate forecasting method. A useful first step is to construct a time series plot which is a graph of the relationship between time and the time series variable; time is on the horizontal axis and the time series values are on the vertical axis. Some of the common types of data patterns:

Trends: These relate to the long-term persistent movements or changes in data like price increases, population growth, and consumer preferences. Figure 29.1 provides some examples of trends.

Seasonal variations: These relate to same repeating patterns over successive periods, which occur because of consumption patterns or social habits, during different times of a year (e.g., the demand for products like sweaters/coats, soft drinks, and refrigerators). Figure 29.2 illustrates seasonal variations.

Cyclical variations: These exists if the time series plot shows an alternating sequence of points below and above the trend line beyond one year. It could arise

out of the phenomenon of business cycles. The business cycle refers to the periods of expansion followed by periods of contraction. The period of a business cycle may vary from one year to thirty years. Figure 29.3b provides an example of cyclical variations.

Random or irregular variations: These refer to the erratic movements in the data which cannot be easily attributed to the trend, seasonal or cyclical components. Such variations can arise out of a wide variety of factors like sudden weather changes, a communal clash or strike. These are random in nature; their future occurrence and the resulting effects on demand are difficult to forecast. The effects of the events can be eliminated by smoothing the time series data. An example of random variations is provided in Figure 29.3a.

Figure 29.1 Examples of Trends

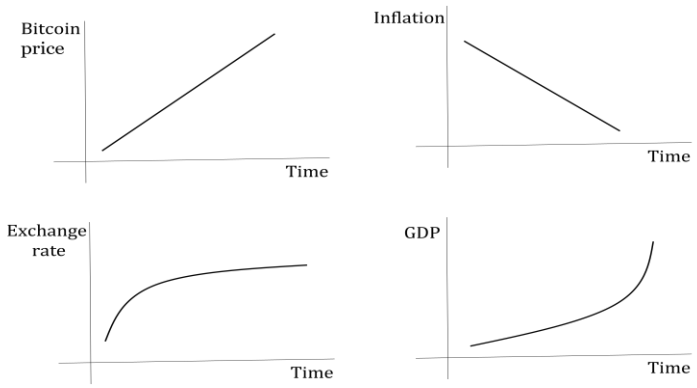


Figure 29.2 Seasonal Variations

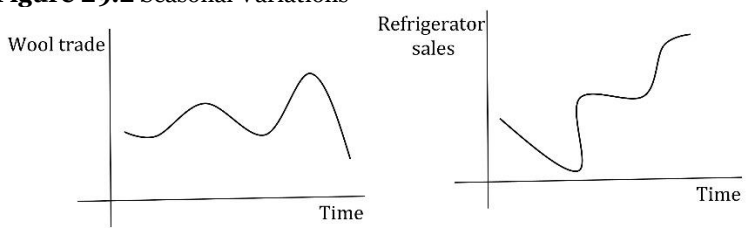
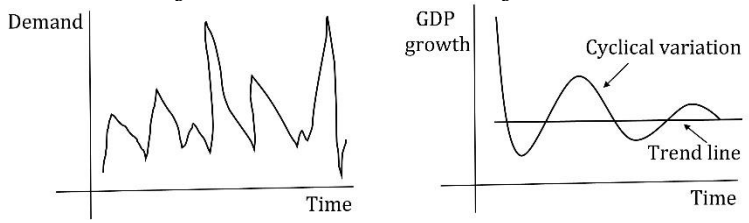


Figure 29.3 Random/irregular and cyclical variations

a. Random or irregular variations *b. Cyclical variations*



In historical time series, one of the major tasks is to remove the trend in time series, a process called **decomposition**. The trend line is then used to project into the future. In most short-term forecasting situations, the cyclical component is too small and tends to cancel each other out over time.

In most cases, the major task is the removal of seasonal variations from the time series, a process called **deseasonalization**. By deseasonalizing the data, analysts can better understand the underlying patterns and trends without the interference of seasonal effects.