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10. TECHNIQUES OF DEMAND FORECASTING IN ECONOMY

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Annotation. The article discusses various methods of demand forecasting. Such actions as conducting marketing research, analysing customer requirements and desires allow businesses to quickly adapt to various market situations. By adjusting the business to a specific economic situation, it is possible to ensure high demand for products and the prosperity of business.

Keywords. Demand forecasting, methods, qualitative techniques, quantitative techniques, component, models.

Demand forecasting is the process of predicting demand for the organisation's products or services in a specified time period in the future [1]. Such forecasting techniques are used to predict future customer demand based on historical data and other relevant factors. They help businessmen plan for future needs, manage inventory levels and make strategic decisions. The choice of technique depends on the type of available data, the nature of the business, and the level of required accuracy [2]. In modern economy, which is subjected to continuous change and high competition, demand forecasting becomes an important element of strategic management for any company. It is important not only to anticipate future sales volume, but to understand the underlying mechanisms that shape consumer choice and adapt to them. Accurate demand forecasting allows companies to make informed decisions in inventory management, production optimisation, resource allocation and marketing campaign planning. However, unlike internal business processes, demand is an external factor with limited influence. The problem is that demand depends on basically unpredictable variables, such as economic fluctuations, changes in consumer preferences, competitors' actions, and even geopolitical events. Therefore, being flexible and able to adapt to changing market conditions along with the desire to maximise forecast accuracy is the key to success. Demand forecasting is a complex process that requires analysing historical data, performing expert assessments and taking into account a variety of factors affecting the consumer market [3]. It is important to mention that there are many approaches to demand forecasting, which can be divided into two big groups: qualitative and quantitative. Demand forecasting methods is shown in the Figure 1 [1].

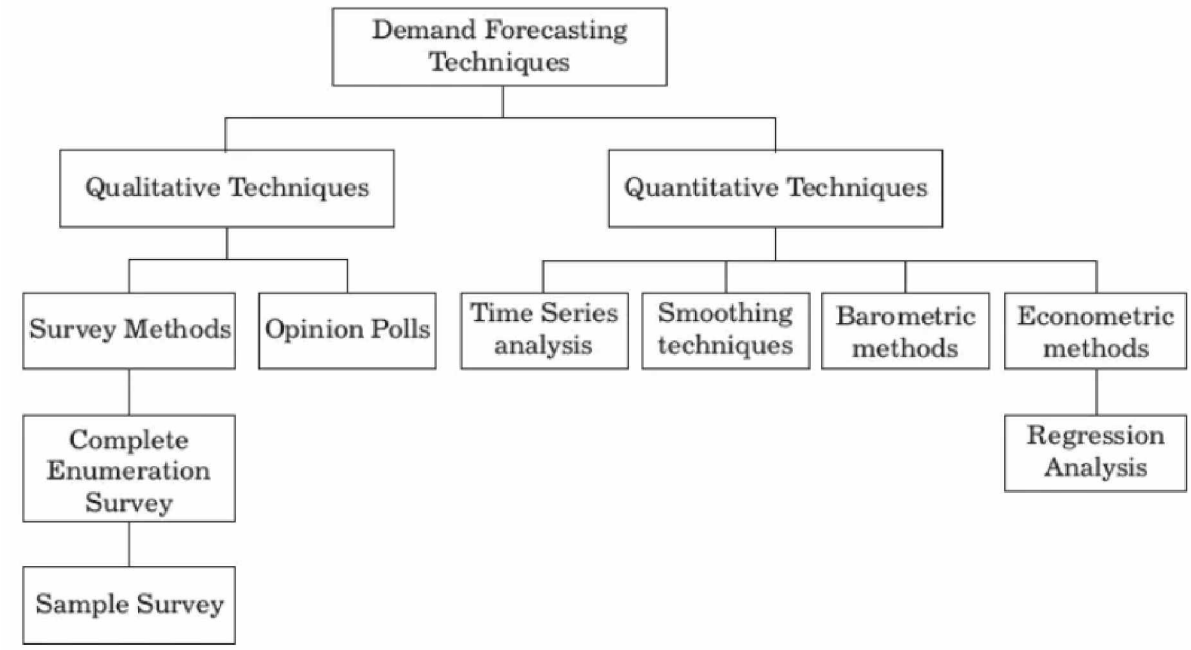

Figure 1 – Demand forecasting methods

The first group relies on the process of collecting consumer behaviour data by means of surveys or acquiring experts' data. These techniques are generally used to make short-term forecasts of demand. Qualitative methods are especially useful in situations when historical data is not available: in the case a new product or service is being introduced. These techniques are based on such tools as experience, judgement, intuition, conjecture. Surveys can be a powerful tool for qualitative forecasts, because they are based on the consumers' intentions and plans of future purchases. In a complete enumeration survey, which is also known as the census method of demand forecasting, almost all potential users of the product are contacted and surveyed about their purchasing plans. The aggregate forecast is achieved by summing the demand of individual consumers in the market. In a sample survey, only a few potential consumers (the sample group) are selected in the market and surveyed. In that case, the average demand is calculated based on the information gathered by the sample group.

Opinion polling methods are based on the opinions of knowledgeable experts in definite fields. These methods include the Expert opinion method, the second method is the Delphi method, the Market experiment method, also referred to as Market studies and experiments. In the Expert opinion method, sales representatives gather information related to the consumers' buying behaviour, their reactions and responses to market changes, their opinion about new products, etc. This opens up prospects for understanding the requirements of customers of different ages, different social statuses and adapting business to the requirements of buyers, which will help ensure maximum demand for products. Speaking of the Delphi method, experts may reconsider and revise their own estimates and assumptions based on the information provided by other experts, which allows them to look at the situation from a few different perspectives and improve the accuracy of forecasts. Using the Market studies and experiments organisations initially select certain aspects of the market such as population, income levels, cultural and social background, occupational distribution, and consumers' tastes and preferences. Of all these aspects, only one aspect is selected, and then its effect concerning a demand is determined while keeping all other aspects constant.

Quantitative methods for demand forecasting use statistical tools, the results of these methods are based on historical data. These methods are used for long-term forecasting. There are several types of quantitative methods: time series analysis, smoothing methods, barometric methods and econometric methods [3]. Time series analysis, also known as the trend forecasting method, is one of the most popular methods that organisations use to forecast demand in the long term. A time series is a sequence of numerical indicators characterise the level of development of the phenomenon under study. There are four main components of time series analysis: trend component, cyclical component, seasonal component, irregular component [7]. The trend component takes into account the gradual change of a time series. The cyclical component is a regular pattern of sequences of values above and below the trend line during of more than one year. The seasonal component implies the search for regular patterns of variability within certain time periods. The irregular component takes into account short-term unforeseen and non-recurring factors affecting the values of the time series [4]. The three different methods of time series analysis are ARIMA, STL and ETS.

ARIMA is the time series forecasting method that combines the components of autoregression (AR) and moving average (MA). ARIMA is suitable for stationary time series and provides a flexible framework for modeling different patterns. Moreover, ARIMA assumes that the relationships between variables are linear, which may limit its effectiveness in capturing complex non-linear trends. STL is a time series decomposition method that divides the time series into three components: seasonal, trend and residual. The STL method is particularly effective when working with seasonality and irregularity data. STL uses locally weighted linear regression (LOESS) to decompose the time series into these components. ETS models are based on exponential smoothing. These models include error, trend, and seasonality components. ETS models are adaptive and appropriate for datasets with time-varying characteristics. These models are more suitable for short-term forecasting. The proper application of ARIMA, STL and ETS depends on the specific characteristics of time series data and goals of the analysis. ARIMA is versatile but assumes linearity, STL is robust to seasonality, ETS models provide adaptability but may be less effective for long-term trends

Data scientists often experiment with multiple methods to determine the most appropriate approach for a particular data set and forecasting goals [4]. When there are no significant trends in the time series, it is better to use smoothing methods for demand forecasting. The most common methods used in smoothing techniques for demand forecasting include the simple moving average (SMA), the exponential moving average (EMA) and the weighted moving average (WMA). An example of the SMA is shown in the Figure 2 [9].

Figure 2 – Simple moving average

A simple moving average (SMA) is calculated by dividing the sum of a set of prices by the total number of prices in the series. Exponential moving average (EMA) unlike SMA pays more attention to the latest price data, so it reacts better to short-term market fluctuations. An example of the EMA is shown in the Figure 3.

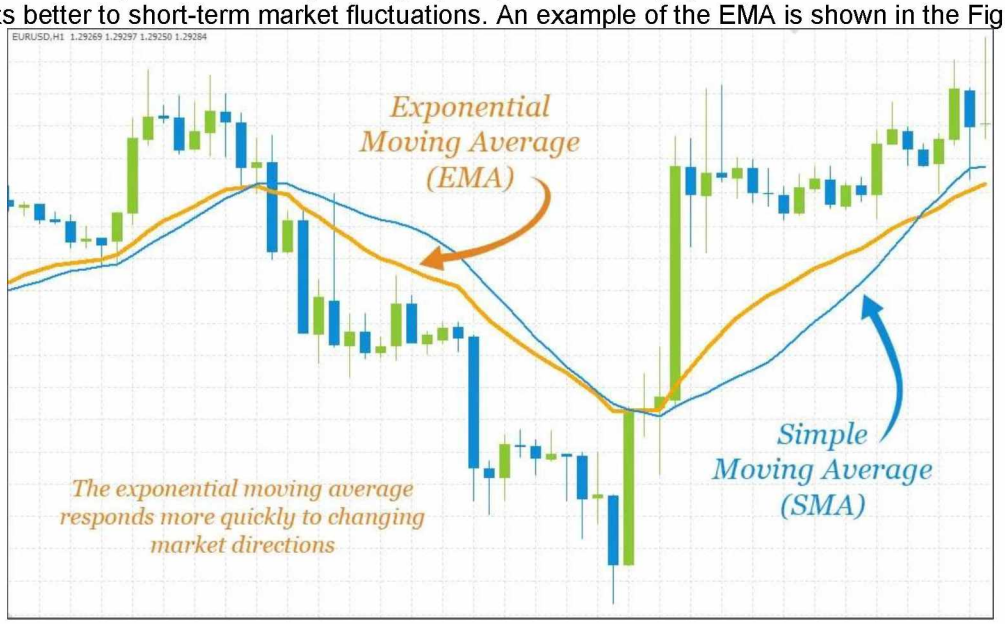

Figure 3 – Exponential moving average

A weighted moving average gives more weight to recent data points and less weight to past data points. A weighted moving average is calculated by multiplying each observation in a data set by a predetermined weighting factor. When the moving average is above the price chart, it is an uptrend. If it is vice versa, it is a downtrend. If the moving average gets close to the price, it indicates the beginning of a trend reversal. If the moving average crosses the price from top to bottom, it indicates a rapid change of the trend to a downtrend. If it is from bottom to top, the trend will be upward. To get additional confirmation it is important to check them on charts for different periods [5].

Barometric methods are used to forecast future trends based on current situations. They use the following indicators: leading, coincident, and lagging indicators. Leading indicators consider at events that have already happened. These past events form a forecast of a future. Coincident indicators move simultaneously with the current situation, for example unemployment rate. Lagging indicators include events that follow the change. They are crucial in showing how the economy will shape up in the future. These indicators are useful in predicting future economic events. For example, inflation, unemployment rate. They are indicators of the performance of the country's economy.

Econometric methods use statistical tools combined with economic theories to estimate various economic variables, such as price changes, consumer income levels, changes in economic policy, to forecast the demand. An econometric model for demand forecasting can be a single regression analysis equation or a system of simultaneous equations. The regression analysis method for demand forecasting measures the relationship between two variables. Regression analysis establishes the relationship between the dependent and independent variables: consumer income, price of related products, advertising. For example, regression analysis can be used to establish a relationship between consumers' income and their demand for luxury goods. In other words, regression analysis is a statistical tool for estimating unknown value of a variable when the value of another variable is known. Once the relationship is established, a regression equation is derived, which shows that the relationship is linear.

In summary, the use of both qualitative and quantitative methods in demand forecasting enables organisations to navigate the market. Experts, who combine these methodologies, improve not only demand management strategies, but also overall business performance. No matter what the business is, it is possible to pick a method that will be feasible with available data [8].

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