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Medium and Long Term Macroeconomic Forecast of the Development of the Services Sector

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Abstract: This article analyzes the fact that most of the models used in forecasting the development trends of the service network, especially in Uzbekistan, require a very large database, which complicates the process of forecasting by central and local government bodies and leads to an impossible level, and each stage requires solving many tasks. For the selection of forecasting methods, it is stated that it originates from the possibilities of connecting the goals and tasks of forecasting, showing them clearly in relation to each object and providing information for developments.

Key words: national economy, service sector, economic forecasting, statistical criteria, medium- and long-term forecasting, ARIMA model.

Introduction: Modeling and forecasting of economic events and processes, especially the development trends of economic sectors and the main sector of services, is one of the most important stages of economic-statistical research.

Today, most of the models used in forecasting the development trends of the service network, especially in Uzbekistan, require a very large database. This complicates the process of forecasting by central and local government bodies and leads to an impossible level.

Each stage requires solving many tasks. For example, in order to choose forecasting methods, it is necessary to connect the goals and tasks of forecasting, to show them clearly in relation to each object, and to proceed from the possibilities of providing information for developments.

Therefore, we analyze the classification of forecasting methods. Many authors note different approaches to the classification of forecasting methods based on different characteristics.

There are a number of approaches to forecasting objects, the main ones being:

1. The historical approach consists in considering its historical forms in interconnections. The forecast is based on extrapolation.

2. A comprehensive approach includes consideration of phenomena in their connection and connection, taking into account all aspects.

3. Systematic approach ensures consideration of every phenomenon of reality as a system, that is, analysis of several interconnected phenomena. A systematic approach is a method of logical thinking, according to which the process of developing and justifying any decision is based on determining the general goal of the system and connecting the activities of all subsystems to achieve this goal. It makes it possible to find a solution to complex production and economic problems when there is a sufficiently high uncertainty in the behavior of the system and the information about it is incomplete.

In general, forecasting is a complex process that includes the following steps (Figure 1).

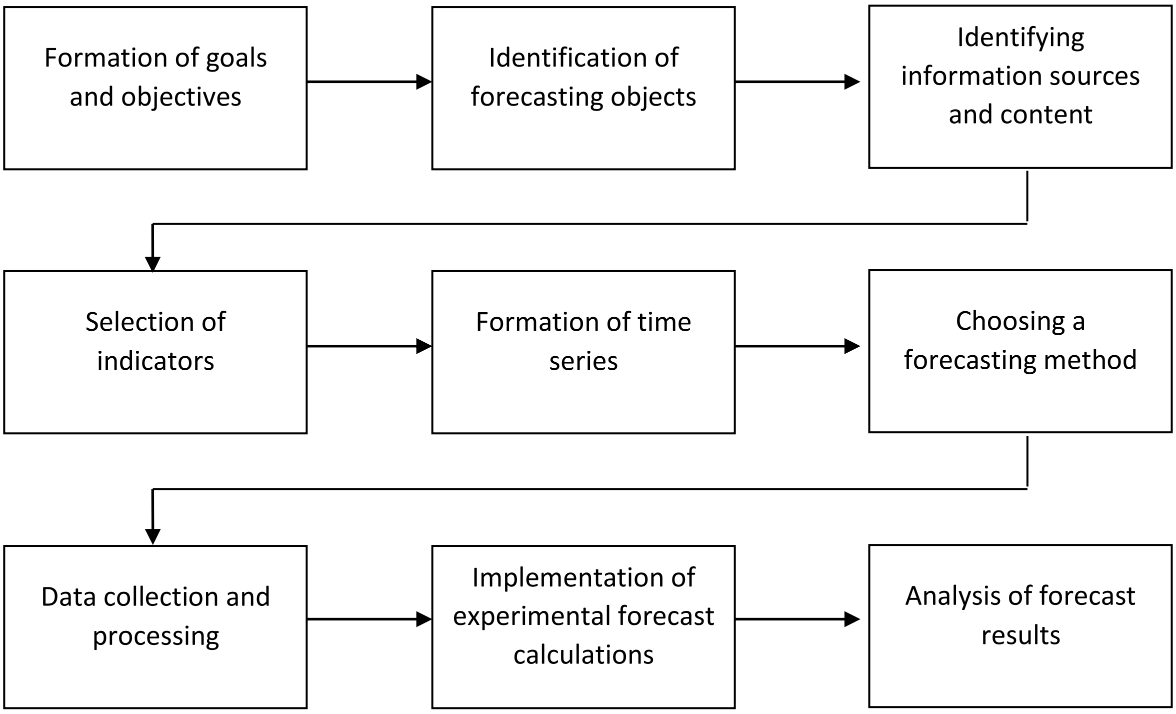

Figure 1. **The main stages of forecasting the development of economic sectors, including the service sector.**

The entire range of forecasting methods can be divided into groups of simple and complex methods according to their level of uniformity. A group of simple methods combines forecasting methods that are similar in terms of content and tools used (for example, morphological analysis, extrapolation, etc.).

Material and methods: Complex methods often reflect a combination of methods implemented by special forecasting systems (for example, forecasting graphic method, Pattern system, etc.). According to the nature of the forecasting data, all forecasting methods are divided into classes: factographic, expert and combined.

The method of extrapolation using autoregressive models found its scientific basis in the works of A.N. Kolmogorov, N. Viner, I.K. Shannon on economic forecasting.

In general, there are currently about 180 forecasting methods, but in practice only 20-30 of them are widely used in economic forecasting.

The presence of several methods does not mean that maximum methods should be used in one study. In practice, as a rule, only a part is used, depending on the nature of the goals and objectives, available data and forecasting.

In economic forecasting, some methods are used for objects of all levels (total services, areas of its composition), others - only for one level (specific composition, for example, educational services). Specialized methods are used to study a narrow range of problems. The use of methods depends on economic forecasting periods: operative or short-term (one year), medium-term (one to 5 years), long-term (5 to 20 years) and very long-term (more than 20 years).

The complexity of forecasting for a longer period depends on the length of the time series of the data.

The dissertation research is tasked with medium-term forecasting of the services industry, which allows studying the future behavior of this complex, uneven and rapidly developing industry.

From time series as primary data, ie:

- from the indicators of the last 14 years (2010-2023) in the field of services formed within the framework of this dissertation;
- (chain) growth rates of these indicators were used.

In time series, the sequence of observations itself contains important information. In some cases, when analyzing economic events and processes, it is important to know what may happen next.

Such a forecast should extrapolate the immediate behavior of the system in terms of its past behavior as accurately as possible.

To describe each time series, a specific model is required, which allows to obtain a certain set of artificial data in the form of a time series. The model was built in 1976 by the American scientists Box and Jenkins using ARIMA-processes. We believe that the Box–Jenkins approach is one of the best ways to understand and forecast economic time series.

We first perform a forecast using the traditional trend method so that we can compare the accuracy of the approach. Forecasting is done using linear and exponential smoothing methods. The linear trend formula is given below:

$$y_{it} = \beta_0 + \beta_1 x + \varepsilon_{it}$$

Coefficients were found by the method of least squares:

$$f(\beta_0, \beta_1) = \sum_{t=1}^{n} (y_{it} - \beta_i t - \beta_0)^2$$

Along with forecasting, mean absolute forecast error (MAPE), mean squared error (MSE) and standard deviation (SD) were also calculated.

The following formula was used to calculate MAPE – average absolute error of forecasting:

$$MAPE = \frac{1}{N} \sum_{t=1}^{N} \frac{(Z(t) - \hat{Z}(t))}{Z(t)} 100$$

This is: $Z(t)$ – current indicators of time series (values), $\hat{Z}(t)$ – time series forecast indicators.

MSE is the formula for mean squared error rate:

$$MSE = \frac{1}{N} \sum_{t=1}^{N} (Z(t) - \hat{Z}(t))^2$$

SD – the formula for finding the standard deviation:

$$SD = \sqrt{\frac{1}{N} \sum_{t=1}^{N} (\hat{Z}(t) - ME)^2}$$

It's: ME – mean error.

Exponential smoothing is a mathematical transformation method used in time series forecasting, the method is also called simple exponential smoothing, or Brownian method.

$$A_t = \alpha Y_t + (1 - \alpha) A_{t-1}$$

$$A'_t = \alpha A_t + (1 - \alpha) A'_{t-1}$$

It's: α – smoothing factor, A_t – t first forecast result for time, Y_t – t values of the indicator in time, A'_t – t second prediction result for time.

Dynamic series trend detection and analysis is often done by smoothing it. Exponential smoothing is one of the most common array smoothing methods. It is based on exponential averaging.

Exponential smoothing can be viewed as a filter whose input dynamic range is transformed into the current values of the exponential average at the output. Since the introduction of the Brownian method, exponential averaging has often been used for short-term forecasting.

The obtained results reflect the following. It can be seen that total services, including wholesale and retail trade, repair of motor vehicles and motorcycles, education, health and social services, rental and leasing services, architecture, engineering research, technical testing and analysis services, personal and other services have growing trends.

Here, transportation and storage, real estate transactions, computers, personal items and household goods repair services during the Covid-19 pandemic recession, accommodation and food services, financial and insurance activities and information and communication services to other services, we can see the relative development.

However, this method of forecasting reflects the general situation, development trends, prevents analysis taking into account all elements, or does not illuminate the situation in detail. Therefore, analysis using other methods of forecasting will further increase the quality of the work.

Now we make the forecast using the proposed ARIMA method. ARIMA-processes (short for Autoregressive Integrated Moving-Average) are linear statistical models that very accurately describe the behavior of various types of time scenarios, including medium-term ups and downs of the "Business Cycle".

They combine autoregressive processes, integration processes, and moving average processes to simulate the behavior of many different real time series.

Thus, ARIMA-processes allow obtaining time series of data similar to primary series with the same type of disorder, smoothness and cyclical behavior.

When building a method, it is necessary to know the following:

1) Boxing – from the set of Jenkins ARIMA-processes, a process is selected that allows to obtain the same visible indicators as the considered time series (except for the random factor);

2) Forecast value is the average (expected) value of the evaluated process for the considered time period or time point (moment);

3) The standard error of the forecast is the standard deviation of all possible (permitted) future values at the considered time point (time period);

4) The forecast limits are above and below the forecast value, so that future values can be confirmed to be within the specified forecast limits, for example, with 95% probability. This implies that the time series continues to behave like a random process.

STATA program "Time Series/Forecasting" module was used for forecasting and analysis of time series, in which analyzes were performed on the composition of the total provided services.

Result and discussion: Therefore, the ARIMA model is a process of adding an independent random component at time t to the difference of the previous random component from the linear function of the previous change.

This process "remembers" where it is, how it got there, and remembers the elements of the previous random component. Its formula is as follows:

$$y_t^{(j)} - y_{t-1}^{(j)} = C^j + \sum_{i=1}^{R} p_i^{(j)} \left(y_{t-i}^{(j)} - y_{t-1-i}^{(j)} \right) - \sum_{l=1}^{M} q_l^{(j)} \varepsilon_{t-l}^{(j)} + \varepsilon_t, \qquad (1.7)$$

It's: C^j – constant, $p_i^{(j)}$– i autoregression coefficient for order, $i = 1 \div R$; $y_{t-i}^{(j)}$ – the previous value of the data; $q_l^{(j)}$– l sliding average coefficient for the order, $l = 1 \div M$; $\varepsilon_{t-l}^{(j)}$ – the previous random component value, ε_t – t random component value during time, j – economic indicator number.

Based on the above, at the first stage of forecasting the structural indicators of the total provided services, the autoregression process is used, which remembers both its previous state and its random component. The ARIMA models obtained for the economic indicators of the area at comparable prices will have the following form:

1) Total volume of services provided:

$$y_t^{(1)} - y_{t-1}^{(1)} = -4357.592 + 1.849\left(y_{t-1}^{(1)} - y_{t-2}^{(1)}\right) + 2.414\varepsilon_{t-1}^{(1)} + \varepsilon_t$$

As an example, we interpret the estimates of the ARIMA model shown above. According to this model, the total volume of provided services changes by a small amount per year, since the value of the indicator for each year is determined taking into account the level of previous years. More precisely, when finding the forecast value for each (t) year, the constant 5367.1 thousand soums (the long-term average value of the process) is multiplied by the corresponding autoregression coefficients of 0.53 and 0.16, as well as adding a new random error for the next (t-1) and (t-2) moved values for periods.

The interpretation of the following models is carried out in a similar way.

2) Volume of information and communication services:

$$y_t^{(2)} - y_{t-1}^{(2)} = -676.884 + 1.344y_t^{(2)} - y_{t-1}^{(2)} + \varepsilon_{t-1}^{(2)} + \varepsilon_t$$

3) Volume of financial and insurance services:

$$y_{t-1}^{(3)} - y_{t-2}^{(3)} = 250.414 + 1.347\left(y_{t-1}^{(3)} - y_{t-2}^{(3)}\right) + \varepsilon_{t-1}^{(2)} + \varepsilon_t$$

4) Volume of transportation and storage services:

$$y_{t-1}^{(4)} - y_{t-2}^{(4)} = 27.896 + 1.184\left(y_{t-1}^{(4)} - y_{t-2}^{(4)}\right) - 0{,}652y_{t-2}^{(4)} + \varepsilon_{t-1}^{(4)} + \varepsilon_t$$

5) The volume of accommodation and food services:

$$y_{t-1}^{(5)} - y_{t-2}^{(5)} = 37.837 + 1.358\left(y_{t-1}^{(5)} - y_{t-2}^{(5)}\right) + \varepsilon_{t-1}^{(5)} + \varepsilon_t$$

6) Wholesale and retail trade; volume of motor vehicle and motorcycle repair services:

$$y_{t-1}^{(6)} - y_{t-2}^{(6)} = 82.507 + 1.228\left(y_{t-1}^{(6)} - y_{t-2}^{(6)}\right) + \varepsilon_{t-1}^{(6)} + \varepsilon_t$$

7) Volume of real estate transaction services:

$$y_{t-1}^{(7)} - y_{t-2}^{(7)} = 153.072 + 1.163\left(y_{t-1}^{(7)} - y_{t-2}^{(7)}\right) + \varepsilon_{t-1}^{(7)} + \varepsilon_t$$

8) The volume of services in the field of education:

$$y_{t-1}^{(8)} - y_{t-2}^{(8)} = -126.402 + 1.327\left(y_{t-1}^{(8)} - y_{t-2}^{(8)}\right) + \varepsilon_{t-1}^{(8)} + \varepsilon_t$$

9) Volume of health and social services:

$$y_{t-1}^{(9)} - y_{t-2}^{(9)} = -6.946 + 1.311\left(y_{t-1}^{(9)} - y_{t-2}^{(9)}\right) + \varepsilon_{t-1}^{(9)} + \varepsilon_t$$

10) Volume of rental and leasing services:

$$y_{t-1}^{(10)} - y_{t-2}^{(10)} = 51.156 + 1.189\left(y_{t-1}^{(10)} - y_{t-2}^{(10)}\right) + \varepsilon_{t-1}^{(10)} + \varepsilon_t$$

11) The volume of services for the repair of computers, personal items and household goods:

$$y_{t-1}^{(11)} - y_{t-2}^{(11)} = -30.544 + 1.218\left(y_{t-1}^{(11)} - y_{t-2}^{(11)}\right) + \varepsilon_{t-1}^{(11)} + \varepsilon_t$$

12) Volume of personal services:

$$y_{t-1}^{(12)} - y_{t-2}^{(12)} = -107.212 + 1.262\left(y_{t-1}^{(12)} - y_{t-2}^{(12)}\right) + \varepsilon_{t-1}^{(12)} + \varepsilon_t$$

13) Scope of services in the field of architecture, engineering research, technical testing and analysis:

$$y_{t-1}^{(13)} - y_{t-2}^{(13)} = 228.268 + 1.171\left(y_{t-1}^{(13)} - y_{t-2}^{(13)}\right) + \varepsilon_{t-1}^{(13)} + \varepsilon_t$$

14) Volume of other services:

$$y_{t-1}^{(14)} - y_{t-2}^{(14)} = -184.482 + 1.319y_{t-1}^{(14)} - y_{t-2}^{(14)} + \varepsilon_{t-1}^{(14)} + \varepsilon_t$$

So, the trend of the gross regional product is related to the production of goods and services in general, as well as the development of industry, agriculture and construction, similarly, the total services provided are also related to the development of its structural directions, in turn, the development of economic sectors is directly related to services and it is one of the important elements of economic development.

In particular, it can be seen from the results of the forecast that, in accordance with the forecast results made using the trend method, the forecast made using the ARIMA model also shows a trend of steady growth in the volume of total assets.

Similarly, wholesale and retail trade; repair, transportation and storage of motor vehicles and motorcycles, transactions with real estate; education; provision of health care and social services; rental and leasing services; repair services for computers, personal items and household goods; personal services; we can observe relatively slow growth in architecture, engineering research, technical testing and analysis services and other services.

Conclusion: Thus, with the help of the Box-Jenkins ARIMA-process model, time series and forecast models were obtained that corresponded to the primary data in the work, that is, with the same types of disorder, smoothness and cyclical behavior. Based on the above, the approaches to modeling and forecasting the development trends of the service sector, especially the ARIMA model, in our opinion, serve to plan scientifically based measures for the development of economic sectors, including the service sector, in the medium and long term.

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