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APPLICATION OF FORECASTING METHODS TO DETERMINE PROSPECTS OF DEVELOPMENT OF MAIN INDUSTRIES AND AGRICULTURAL SECTOR OF DNIPROPETROVSK REGION

Abstract. The data of the State Statistics Department of Ukraine for Dnipropetrovsk region for 4 years quarterly were used to forecast the development of industry and enterprises of the agricultural sector. The prediction was performed using the methods of the maximum likelihood by software package STATISTICA. Industries are projected to decline by 15% to 20% in 2021.

Keywords: forecasting methods, industry, agricultural sector, Dnipropetrovsk region, forecast for 2021.

To develop a forecast, it is necessary to build a dependence of the species $y = f(x_i)$, where y – the predicted parameter x_i – other parameters that can be measured and which will allow you to find the value of the parameter y in perspective ($1 \le i \le N$, N – number of independent parameters).

The relationship between random and non-random variables is called regression, and the method of analysis of such relationships is called regression analysis. The use of regression analysis implies the mandatory fulfillment of the prerequisites of

correlation analysis. Only if the above conditions are met, the estimates of the correlation and regression coefficients obtained by the least squares method will be unbiased and have minimal variance.

The use of correlation analysis involves the following prerequisites [1]:

a) Random variables y $(y_1, y_2..., Y_n)$ i x $(x_1, x_2..., X_n)$ can be considered as a sample from a two-dimensional general population with a normal distribution law.

b) The expected value of the error is zero

c) Individual stochastically independent observations, ie the value of this supervision should not depend on the value of previous and subsequent observations.

d) Covariance between the error associated with one value of the dependent variable y, and the error associated with any other value of y, equal to zero.

e) The error variance associated with one value in is equal to the error variance associated with any other value.

e) The covariance between the error and each of the independent variables is zero.

g) The direct applicability of this method is limited to cases where the equation of the curve is linear with respect to its parameters b_0, b_i..., b_k This does not mean, however, that the equation of the curve with respect to variables should be linear. If the empirical equations of observations are not linear, then in many cases it is possible to bring them to a linear form and already. then apply the least squares method.

h) Observations of independent variables are carried out without error.

But when forecasting time series, which are actually statistics of economic indicators, which are recorded at exactly intervals, there is a problem of determining independent parameters. Different second give hundreds of parameters that can affect the desired parameter. In these conditions, it is best to use the previous values of the desired parameter, the so-called autoregressive dependence of the species:

$$y_t = \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + ... + \varphi_p y_p + \varepsilon_t,$$

where y_t – value of y in time t; φ_i – coefficients of the equation, (i = 1, 2, ..., p); p – autoregression order (ie, the number of previous values of the required parameter); ε_t – random variable.

The most acceptable in this situation is the use of autoregression models through the moving average method, which are particularly useful for describing and predicting processes that detect uniform fluctuations around the mean. However, this model is only suitable for stationary series, mean, variance and autocorrelation, which are approximately constant over time.

Consider the available data - indicators of assets and liabilities and the balance of all industries and the agricultural sector of Dnipropetrovsk region from January 2015 to November 2019 [3] - [4]. The data were presented in an Excel spreadsheet and exported to the software package STATISTICA [2]. Thus, it is necessary to analyze and forecast two variables with 59 observations on six balance sheet items.

The combined model of autoregression and integrated moving average (ARIMA) was proposed by Box and Jenkinson in 1976 [1].

The abbreviation ARIMA, derived from the word autoregression (AR) and moving average (MA) for the variable average, is commonly used in the literature and statistical packages.

We will make predictions three times to estimate the received values and to choose the most reliable forecast:

1) predicting the approximate method of maximum likelihood of MacLeod and Sales (1983);

2) predicting the approximate method of maximum likelihood of Macleod and Sales (1983) with a constant;

3) the exact method of maximum likelihood according to Melard (1984) with a constant.

To begin with, we use industry data to assess the quality of forecasting of these three methods.

To determine the order of autoregression, we perform a correlation analysis, the data of which are presented in Fig. 1.

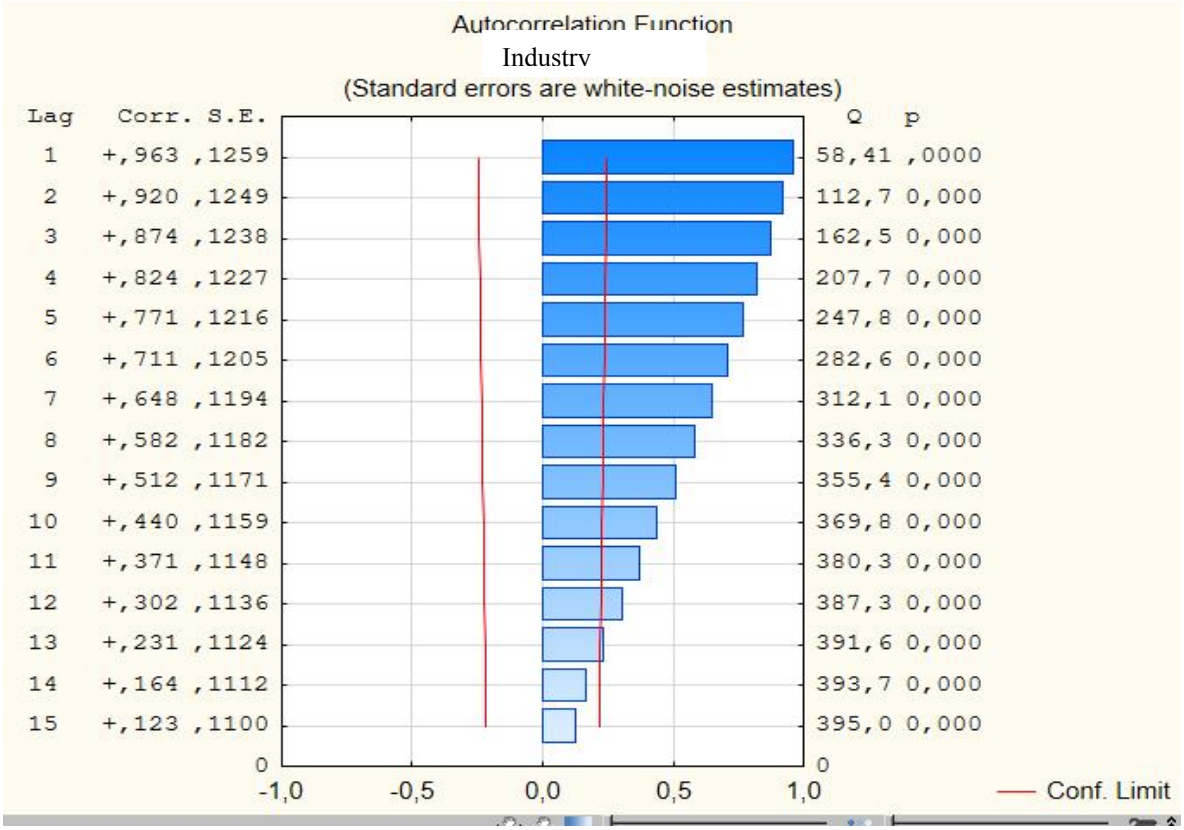

Figure. 1. Graph of autocorrelation function

As can be seen from the figure, the largest statistically significant effect on the next value of the gross industrial indicator is its 12 previous values, which will be used to build an autoregressive model by the three methods mentioned above.

All data are divided into quarters for the above period, and the forecast will be made for 8 quarters ahead, ie, for 2020 and 2021.

In fig. 2 – fig. 4 shows the results of forecasting by these methods.

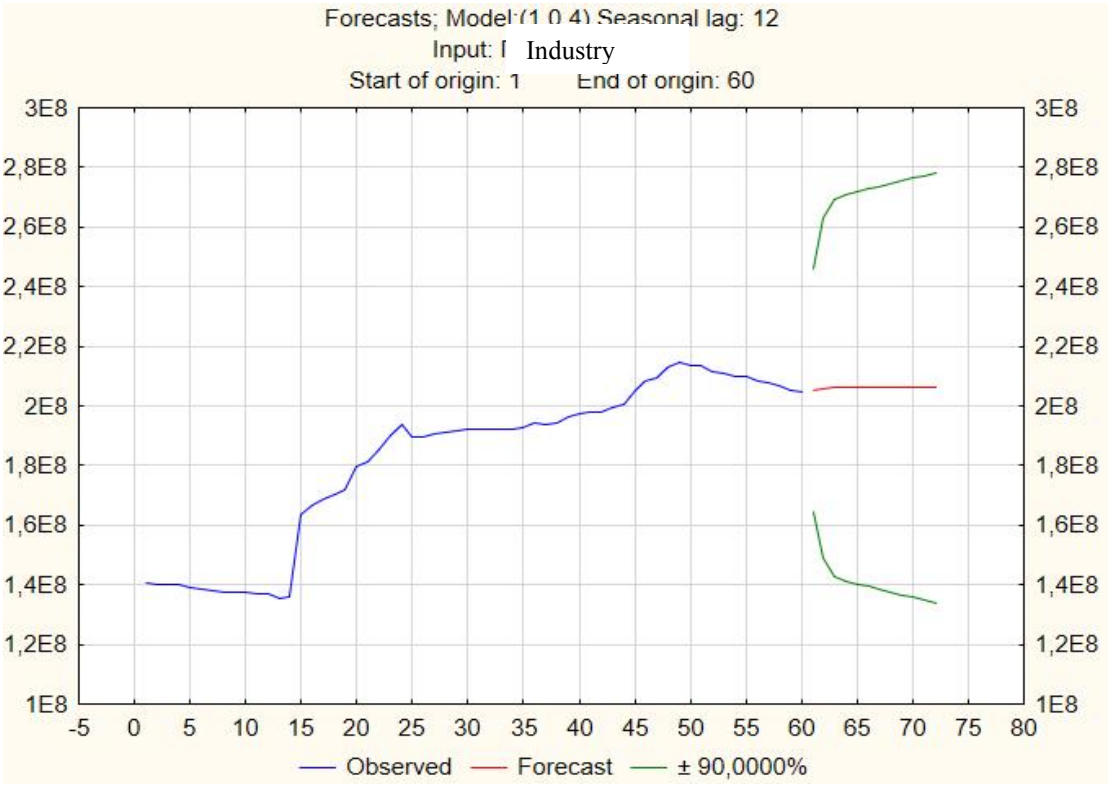

Figure. 2. Graph of input and predicted values by the approximate method of maximum likelihood of McLeod and Sales

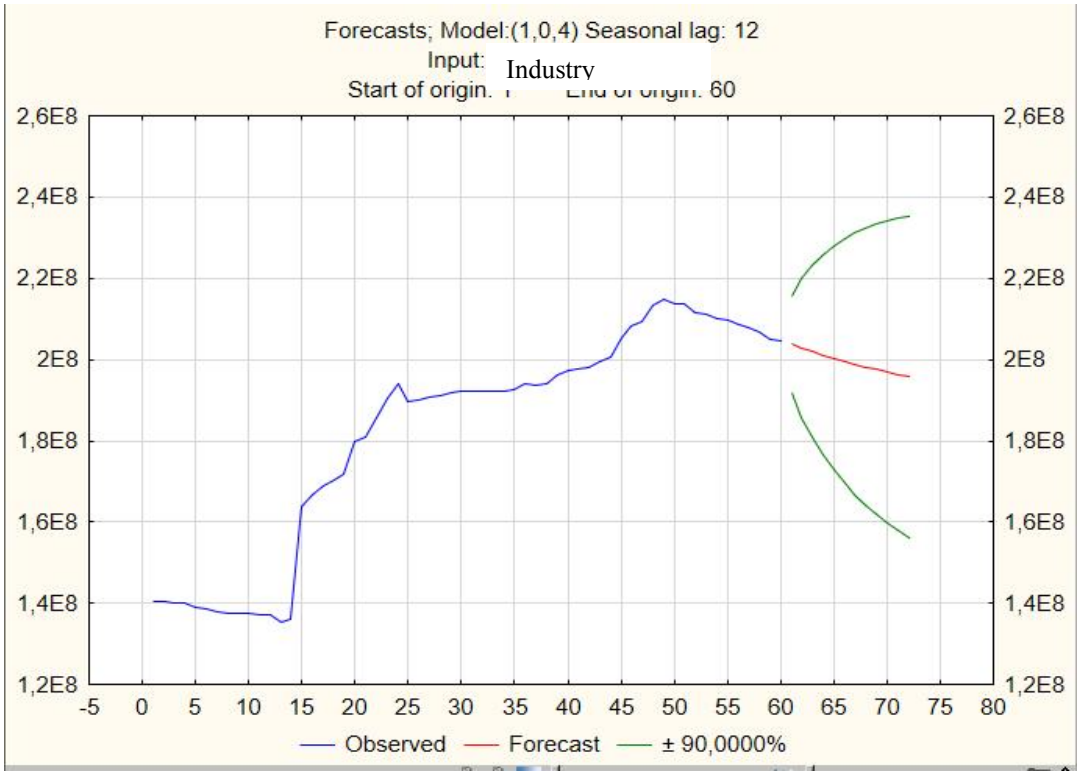

Figure. 3. Graph of input and predicted values by the approximate method of maximum likelihood with a constant

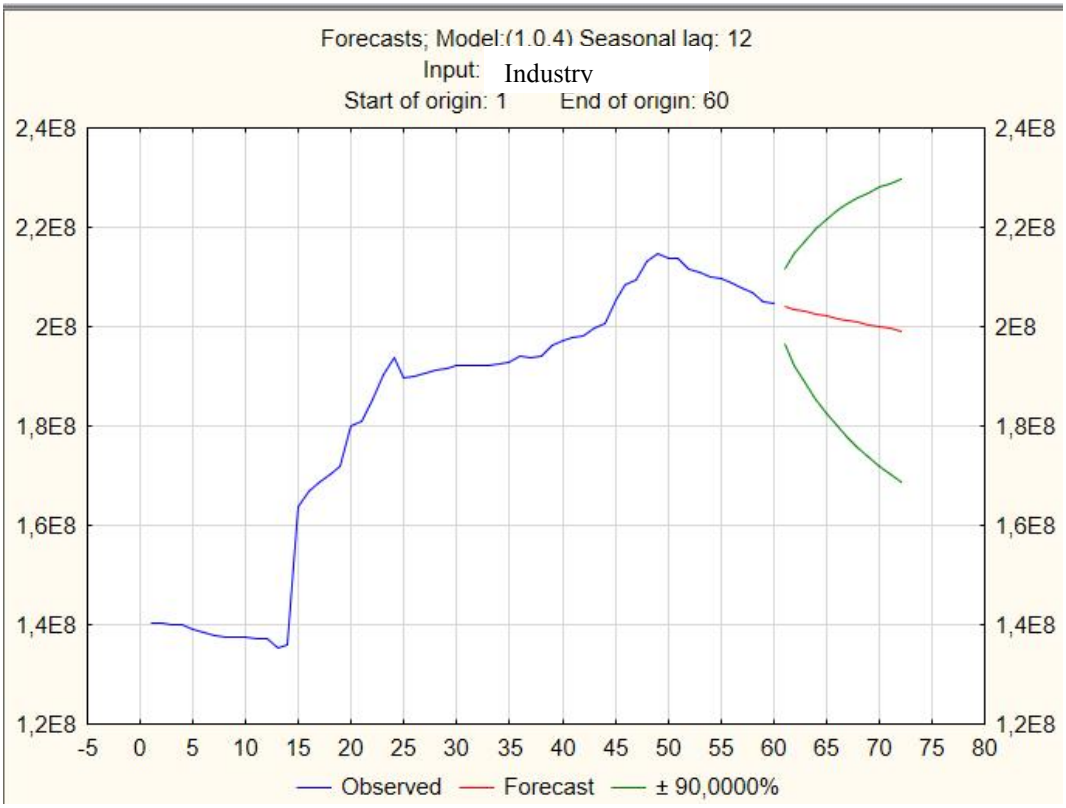

Figure. 4. Graph of input and predicted values by the method of maximum likelihood with a constant

The model of the third forecast, which provided the highest quality of forecasting, can be described by the following formula:

$$Y(t) = \sum_{i=1}^{p=1} \varphi_i \, Y_{t-1} + 1{,}76 * 10^8 + \sum_{j=1}^{q=4} \theta_j \;\; \varepsilon_{t-j}$$

where the process of white noise is equal to: $M\varepsilon_t = 0,\ D\varepsilon_t = \sigma^2.$

Now that we have identified the best method of forecasting - forecasting by the approximate method of maximum likelihood of McLeod and Sales (1983) with a constant - we make a forecast for agriculture, forestry and fisheries, which is presented in Fig. 5.

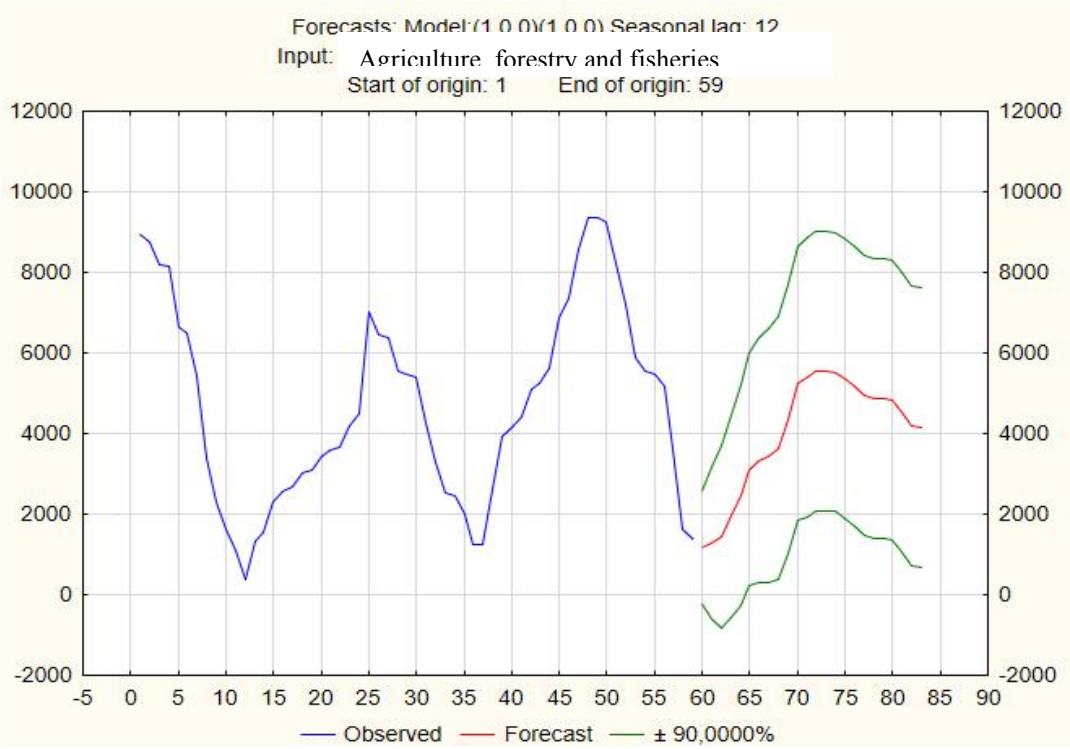

Fig. 5. Example of forecasting by the model of forecasting by the approximate method of maximum likelihood of McLeod and Sales with a constant

As forecasts for both industries showed a decline in production in the long run, forecasts were made for the two industries under seven balance sheet items for two years and liabilities and assets were calculated. In the graphs (Fig. 6 - 7) you can see that the lines of assets and liabilities are close, so we can say that the forecast is close to correct.

In total, more than 100 predictions were made.

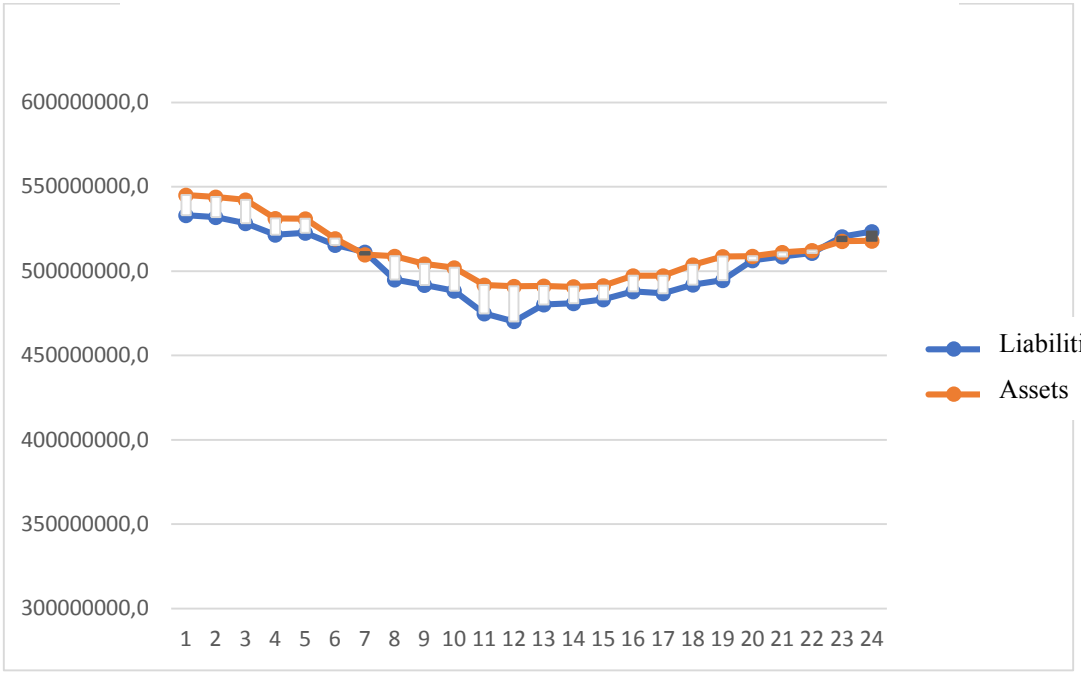

Figure. 6. Graph of projected values of industry by three asset items and four liability items

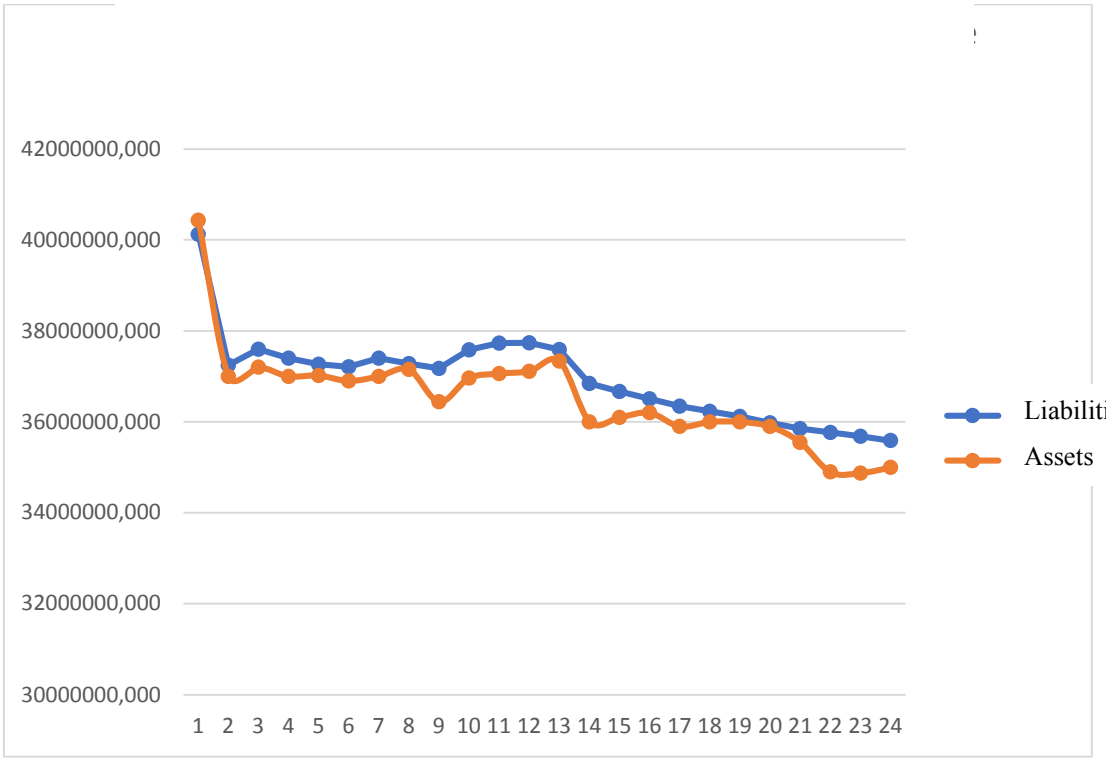

Figure. 7. Graph of projected values of agriculture, forestry and fisheries by three items of assets and four items of liabilities

Thus, forecasts of two industries were made under seven balance sheet items and liabilities and assets were calculated. In total, more than 100 predictions were made and the most reliable ones were selected.

According to the projected values, Dnipropetrovsk region expects a deterioration of the socio-economic situation, namely in industry - there is a tendency to decline until the end of 2020, then by the end of 2021 the situation will improve; in the agricultural sector there is a downward trend until the end of 2021.

References :

1. Prognozuvannia. [Prognostication] Available at: https://uk.wikipedia.org/wiki/%D0%9F%D1%80%D0%BE%D0%B3%D0%BD%D0%BE%D0%B7%D1%83%D0%B2%D0%B0%D0%BD%D0%BD%D1%8F (accessed 20 August 2020).
2. StataSoft. Available at: http://statsoft.ru/products/STATISTICA_Base/ (accessed 20 August 2020).
3. Promislovist [Industry] Available at: http://www.dneprstat.gov.ua/statinfo/p/ (accessed 21 December 2019).
4. Silske, lisove I rybne gospodarstvo [Agriculture, forestry and fisheries] Available at: http://www.dneprstat.gov.ua/statinfo/sg/ (accessed 21 December 2019).