

MATHEMATICAL METHODS, MODELS AND CONTEMPORARY PHYSICAL PROCESSES

DEVELOPING AN UNEMPLOYMENT FORECAST USING THE SLIDING AVERAGE METHOD

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The sliding average method is one of the well-known methods for smoothing time series. Applying this method, it's possible to eliminate random fluctuations and obtain values corresponding to the influence of the main factors. The need to develop the reliability of predictive indicators of socio-economic development and the identification of the most accurate methods for this determine *the relevance of the study*.

The purpose of the article is to develop a forecast of the unemployment rate in the Republic of Belarus for 3 years using the sliding average method.

Material and methods. The factual basis of the research was the materials of the National Statistical Committee of the Republic of Belarus, Internet resources on the topic of the research. The methods used were descriptive and analytical, comparison, generalization, analysis and synthesis.

Findings and their discussion. Sliding average smoothing is based on the fact that random deviations mutually cancel out in averages. This is due to the replacement of the initial levels of the time series with the arithmetic mean within the selected time interval. The resulting value refers to the middle of the selected time interval (period). Then the period is shifted by one observation, and the calculation of the average is repeated. In this case, the periods for determining the average are taken the same all the time. Thus, in each case under consideration, the average is centered, i.e. referred to the midpoint of the smoothing interval and represents the level for this point. When smoothing a time series with sliding averages, all levels of the series are involved in the calculations. The wider the smoothing interval, the smoother the trend is. The result is a smoothed dynamic range of values that allows you to clearly trace the trend of changes in the investigated parameter [1].

The working formula for this method is:

$$Y_{t+1} = m_{t-1} + \frac{1}{n} * (Y_t - Y_{t-1}), \text{ where}$$

t+1 – forecast period;

t – the period preceding the forecast period (year, month, etc.);

Y_{t+1} – projected indicator;

m_{t-1} – sliding average for two periods before the forecast;

n – the number of levels included in the smoothing interval;

Y_t – the factual value of the phenomenon under study for the previous period;

Y_{t-1} – the factual value of the phenomenon under study for two periods preceding the forecast.

To calculate the predicted value using the sliding average method, you must:

1. Determine the value of the smoothing interval, for example equal to 3 ($n = 3$).

2. Calculate the sliding average for the first three periods:

$$m_{2017} = \frac{Y_{2016} + Y_{2017} + Y_{2018}}{3} = \frac{5,8 + 5,6 + 4,8}{3} = 5,4$$

The resulting value is entered into the table in the middle of the taken period. Next, we calculate m for the next three periods 2017, 2018, 2019.

$$m_{2018} = \frac{Y_{2017} + Y_{2018} + Y_{2019}}{3} = \frac{5,6 + 4,8 + 4,2}{3} = 4,87$$

Further, by analogy, we calculate m for each three adjacent periods and enter the results into the table.

$$m_{2019} = \frac{Y_{2018} + Y_{2019} + Y_{2020}}{3} = \frac{4,8 + 4,2 + 4,0}{3} = 4,33$$

3. Having calculated the sliding average for all periods, we build a forecast for 2021 using the formula:

$$Y_{t+1} = m_{t-1} + \frac{1}{n} * (Y_t - Y_{t-1})$$
$$Y_{2021} = 4,33 + \frac{1}{3} * (4,0 - 4,2) = 4,33 - 0,07 = 4,26$$

Determine the sliding average m for 2020.

$$m_{2020} = \frac{4,2 + 4,0 + 4,26}{3} = 4,15$$

Building a forecast for 2022.

$$Y_{2022} = 4,15 + \frac{1}{3} * (4,26 - 4,0) = 4,15 + 0,09 = 4,24$$

Determine the sliding average m for 2021.

$$m_{2021} = \frac{4,0 + 4,26 + 4,24}{3} = 4,17$$

Building a forecast for 2023.

$$Y_{2023} = 4,17 + \frac{1}{3} * (4,24 - 4,26) = 4,17 - 0,01 = 4,16$$

Place the results in the table.

Table – Forecast of the unemployment rate in the Republic of Belarus for 2021-2023, %.

Year	Unemployment rate, Y_t , %	Sliding average, m , %	Calculating the average relative error, $\frac{ Y_t - m }{Y_t} * 100$, %
2016	5,8	–	–
2017	5,6	5,4	3,57
2018	4,8	4,87	1,46
2019	4,2	4,33	3,1
2020	4,0	–	–
Total:			8,13
Forecast 2021	4,26		
Forecast 2022	4,24		
Forecast 2023	4,16		

Source: compiled by the authors based on statistical data [2].

Calculate the average relative error:

$$\varepsilon = \frac{8,13}{3} = 2,71\% < 10\% - \text{forecast accuracy is high.}$$

As a result of the applied sliding average method for calculating the forecast of the unemployment rate in the Republic of Belarus, it was revealed that in 2021 its rate will increase to 4.26% and slightly decrease by 2023 to 4.16%. On the basis of this, it becomes possible to select the appropriate instruments of state regulation in the strategy of sustainable development of the country for the near future.

Conclusion. Thus, since the average relative error is less than 10%, the forecast accuracy is high. And also, comparing the sliding average method with other forecasting methods, we can conclude that the sliding average method provides more reliable results than the exponential smoothing method and the least squares method.

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