FORECASTING THE VOLUME OF PRODUCTION OF THE CONSTRUCTION INDUSTRY OF SURKHANDARYA REGION USING ARIMA MODELS

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Abstract: In this article, the production volume of construction industry of Surkhandarya region is forecasted using ARIMA models. First, the stationarity of the time series was checked. The significance of the model was assessed by MAPE and the statistical significance of its parameters was assessed by Fisher's z test. It was studied that there is no autocorrelation in the residuals. As a result, forecast values until 2029 were developed.

Keywords: ADF test, ACF, PACF, model, ARIMA, MAPE, Fisher, constant.

ПРОГНОЗИРОВАНИЕ ОБЪЕМОВ ПРОИЗВОДСТВА СТРОИТЕЛЬНОЙ ПРОМЫШЛЕННОСТИ СУРХАНДАРЬИНСКОЙ ОБЛАСТИ С ИСПОЛЬЗОВАНИЕМ МОДЕЛИ ARIMA

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Аннотация: В данной статье с использованием модели ARIMA прогнозируется объем производства строительной отрасли Сурхандарьинской области. Сначала проверялась стационарность временного ряда. Значимость модели оценивали с помощью MAPE, а статистическую значимость ее параметров оценивали с помощью z-критерия Фишера. Было изучено отсутствие автокорреляции в остатках. В результате были разработаны прогнозные значения до 2029 года.

Ключевые слова: тест ADF, ACF, PACF, модель, ARIMA, MAPE, константа Фишера.

Introduction. The production of the construction industry of the region is growing rapidly. In 1 january 2024, the production volume of this industry was 7,596.5 billion soums, and the average growth since 2016 has been 126.3% (Fig. 1).

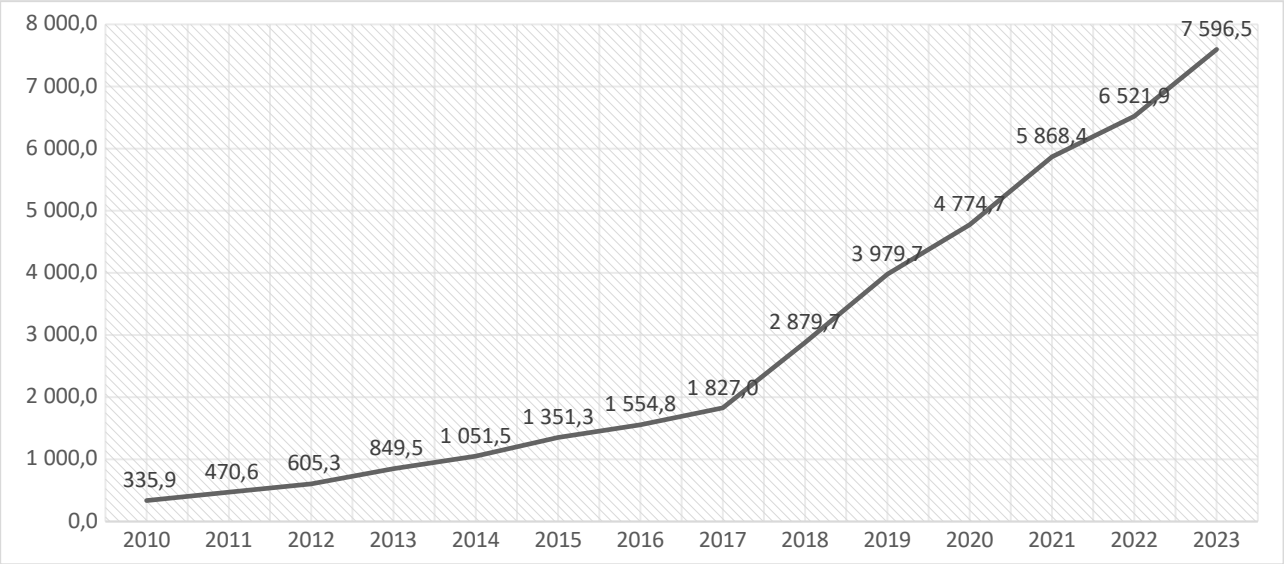

Fig. 1. Production volume of construction industry of Surkhandarya region, billion soums[1].

Methodology. Forecasting the future state of production of construction industry of the region is important in making management decisions on the reform of this sector. ARIMA models are distinguished by their accuracy and ability to adapt to various fluctuations in forecasting the volume of production of regional industries.

According to Figure 1, the production volume of the regional construction industry is not stationary over time. The use of ARIMA models in modeling such time series allows obtaining high-accuracy forecasts:

$$\Delta^d x = a + \sum_{i=1}^{p} \varphi_i \Delta^d x_{t-i} + \sum_{j=1}^{q} \theta_j \varepsilon_{t-j} + \varepsilon \qquad (1)$$

[1] Information from the Statistics Department of Surkhandarya region.

where, x_{t-i} - previous period levels of the time series; ε_{t-j} - previous period levels of residuals; a, φ_i, θ_j – coefficients.

Results. In the experiments, it was found that the 2nd difference of the time series is stationary. While the ACF and PACF correlograms indicate that the model order is ARIMA(1, 2, 0), Gretl's "ARIMA lag selection" option shows the model order as ARIMA(0, 2, 1). As a result, we got the model in Table 1 below:

Table 1

Regression analysis results[2]

Model 1: ARIMA, using observations 2012-2023 (T = 12)
Dependent variable: (1-L)^2 Qurilish
Standard errors based on Hessian

	Coefficient	*Std. Error*	*z*	*p-value*	
const	87.1373	17.0262	5.118	<0.0001	***
theta_1	−0.999998	0.260309	−3.842	0.0001	***

Mean dependent var	78.33121	S.D. dependent var	320.2918
Mean of innovations	−13.61874	S.D. of innovations	229.6961
R-squared	0.990374	Adjusted R-squared	0.990374
Log-likelihood	−83.55081	Akaike criterion	173.1016
Schwarz criterion	174.5563	Hannan-Quinn	172.5630

	Real	*Imaginary*	*Modulus*	*Frequency*
MA				
Root 1	1.0000	0.0000	1.0000	0.0000

The general view of the model is as follows:

$$\Delta^2 x = 87{,}1373 - 0{,}999998\,\Delta^2 x_{t-i} \qquad (2)$$

[2] Author's development

Discussion. From Table 1, we can see that the model parameters are significant according to Fisher's z test. Results of estimating the approximation error of the model showed that $MAPE = 7.678\%$. Also, the absence of autocorrelation in the residuals and the normality of their distribution ($\chi^2 = 1{,}771$) were checked.

Using the model, the production volume of the construction industry in the region was forecast until 2029 (Table 2).

Table 2

Forecast values[3]

No.	Forecast values	Standard error	lower limit of the confidence interval 95%	upper limit of confidence interval 95%
1	8765,23	229,7	8315,04	9215,43
2	10021,11	324,8	9384,44	10657,79
3	11364,13	397,8	10584,36	12143,89
4	12794,28	459,4	11893,88	13694,67
5	14311,57	513,6	13304,89	15318,24
6	15915,99	562,6	14813,24	17018,75

Thus, by 2029, the production volume of the region's construction industry is forecast to reach 15,915.99 billion soums and increase by 2.1 times compared to 2023.

References.

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