Some Forecasting Models in Tourism (case of Georgia)

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Anotation. *This article discusses a forecasting model with a combination of moving average and regression analysis. The result of modeling on a specific numerical example - the dynamics of visits of foreign travelers to Georgia - indicates that this approach to building trend models provides a good degree of data approximation and forecasting. All calculations necessary to build the model are performed using Excel tools.*

Introduction

In tourism, as in any other business, a responsible decision requires serious justification, since a mistake made in making a decision is associated with large financial losses.

In such cases, it is necessary to turn to modeling the behavior of the economic system. In most cases, mathematical models are used, which save the researcher from the need to conduct expensive experiments.

Tourism processes are usually dynamic, characterized by seasonality and trends. By analytically simplifying the dynamic rows, a certain model - a trend equation is built, which mathematically accurately describes the development trend of the event in time. The change in indicator levels can be described using a time function. Analytical smoothing method provides an opportunity to evaluate, mathematically describe and predict the event.

Among the econometric modeling models that allow for fairly good quality forecasting (for a long period) for data with trend and seasonality, we can highlight the Holt Winters model (Stanley Jere, ...2019: 258-267), (Forecasting International Tourist Arrivals..., 2021: 41 -51), Fourier trigonometric series model (Khasaia & Chumburidze 2021: 122-130), moving average method (Ivanovski ... 2018: 121-132), gradient (Khasaia 2011: 5-10) and other models. However, the calculation of parameters in these models is quite difficult.

It is much easier to make a forecast for a short period using correlation-regression analysis (Khasaia 2014: 193-195).

In the presented paper, a forecasting model with a combination of moving average and regression analysis is discussed and the dynamics of international travelers' visits to Georgia are predicted.

The main goal of studying the visits of international travelers is to scientifically substantiate its development for the future period, to provide a forecast that can be used in planning both in the tourism industry and in other socio-economic prospective calculations.

Forecasting using regression analysis

To make a long-term forecast, it is necessary to use the data of previous years of the same period (at least 3-4 years). Consider the data of visits of international travelers to Georgia by quarters in 2020-2023. (National Tourism Administration of Georgia, 2024)

Table 1.

Visits of international travelers, 2020-2023

Quarter / year	I	II	III	IV
2020	233479	114119	150320	149582
2021	134,712	351,302	815420	579837
2022	576503	1049425	2266677	1534298
2023	1208462	1651655	2706863	1505240

It is necessary to make a forecast of the visits of international travelers in the I, II, III and IV quarters of 2024 based on the data of previous years.

Using a simple econometric model, we get the regression equation, according to which we can predict the next period with 72% accuracy:

$y = 149406 * x + 361054 \ (R^2 = 0.7158)$

A higher quality of forecasting is possible by combining the moving average model and regression analysis.

Forecasting using moving average and regression analysis

The moving average method is one of the popular analysis tools. Its popularity is due to the ease of calculation and results. The essence of the method is to calculate the average of the data in a certain period of time.

Let's build a time series using the moving average method (using the "Average" function in Excel). Let's find the average deviations of the smoothed series from the given time series. Based on the initial values of the time series, we calculate a smoothed time series using the moving average method based on data from the 2 previous seasons (previous 2 quarters).

Based on the resulting model, we calculate the values of the centered moving average (the average value of numbers located nearby) and seasonal variations (the difference between the actual and centered values), and write the result in the table (see Table 2.).

Table 2.

Table of intermediate calculations

year	Quarter	Visits of international travelers	Moving average	centered moving average	seasonal variation	de-seasonal visits of international travelers
1	2	3	4	5	6	7
2020	I	233479				537015
	II	114119				28077
	III	150320	173799	153009	-2689	-382033
	IV	149582	132220	141085	8497	464441
2021	I	135	149951	112405	-112270	303671
	II	351	74858	37551	-37199	-85690
	III	815420	243	204064	611356	283067
	IV	579837	407886	552757	27080	894696
2022	I	576503	697629	637899	-61396	880039
	II	1049425	578170	695567	353858	963383

	III	2266677	812964	1235508	1031170	1734324
	IV	1534298	1658051	1779269	-244971	1849157
2023	I	1208462	1900488	1635934	-427472	1511998
	II	1651655	1371380	1400719	250936	1565613
	III	2706863	1430059	1804659	902204	2174510
	IV	1505240	2179259	2142655	-637415	1820099

Let's find the average seasonal change using the data in Table 2 (column 6) and write it in Table 3 (see Table 3).

The sum of the mean seasonal variation should tend to zero, but it doesn't, so we make an adjustment. In our case, it is equal to 412626, so we need to adjust the seasonal variations with the correction factor K=412626/4= 103156,597, that is, we have to subtract K from the average seasonal variation, we get the adjusted seasonal variation, the sum of which tends to zero (see table 3).

Table 3.

Adjustment for seasonal variation

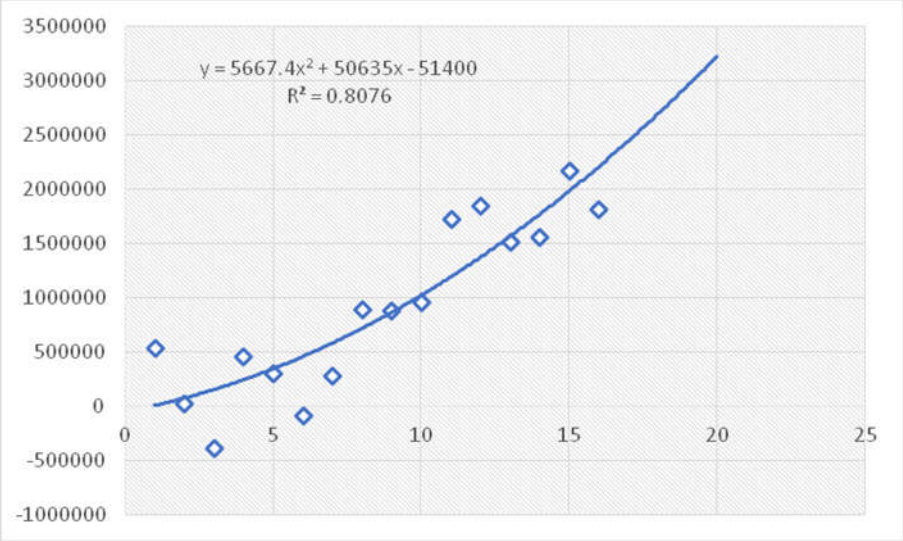
Quarter	I	II	III	IV	sum
Average seasonal variations	-200379	189198	635510	-211702	412626
Adjusted seasonal average	-303536	86042	532353	-314859	0

Remove (subtract) the seasonality components from the actual values of the time series, i.e., deseasonize the data and enter the data obtained (deseasoned international visits) in Table. 2.

We approximate the deseasoned data using the least squares method in Excel, which will allow us to take into account the trend and the random component of the number of visits by international travelers (see Cart 1).

Diagram 1.

Approximation of deseasonalized data by regression model



We obtained a model of international travelers' visits - a trend equation with a coefficient of determination of 0.81:

$$y = 5667.4 * x^2 + 50635 * x - 51400 \quad (R^2 = 0.81)$$

Thus, the obtained model with 81% accuracy gives us the basis to say that 11 million international travelers are expected to visit Georgia in 2024, and the figures based on quarters (taking into account the seasonality component) is given in Table 4.:

Table 4.

International traveler visit forecast data

Quarter	I	II	III	IV
Visits of international travelers	2047564	2549147	3644956	2787882

Conclusion

Modeling results for a specific numerical example - international visitor visits to Georgia - prove that the trend modeling approach, which includes a combination of moving average and regression analysis, provides a good quality of data approximation and forecasting.

The use of trend models will give the entities involved in tourism the opportunity to obtain a significant economic effect, since the organization can anticipate the possible development of events and prepare for them in advance.

According to the forecast of visits of international travelers to Georgia, we can conclude that international tourism is trending upward and in 2024 will not only reach the 2019 level (before the pandemic), but will also exceed it by 17%.

The main thing is that this growth trend is not affected by circumstances related to military aggression or other disasters.

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პროგნოზირების ზოგიერთი მოდელები ტურიზმში (საქართველოს შემთხვევა)

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ანოტაცია. *ტურიზმში, ისევე როგორც ნებისმიერ სხვა ბიზნესში საპასუხისმგებლო გადაწყვეტილება მოითხოვს სერიოზულ დასაბუთებას, ვინაიდან გადაწყვეტილების მიღებისას დაშვებული შეცდომა დაკავშირებულია დიდ ფინანსური დანაკარგებთან.*

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