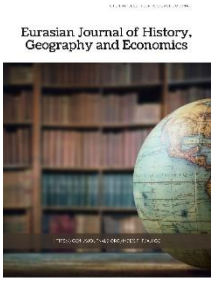

Building trend models and forecasting skills for students

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ABSTRACT

In this article, the author presents the importance of forming econometric skills in students, especially the necessary methods for building trend models and forecasting skills. He also used the case-study method to build trend models and presented cases step by step. He presented the construction of the trend model based on the additive model, analysis and forecasting with the help of cases

Keywords: econometric model, trend model, additive, multiplicative, case study, seasonal, time series, forecast, spatial model

There are several approaches to analyzing the structure of time series with seasonal or cyclical fluctuations.

The simplest approach is to calculate the value of the seasonal components using the moving average method and build an additive or multiplicative model of the time series.

A dynamic series is a series of statistical indicators located in a sequence (in chronological order), their change indicates that the studied phenomenon has a certain development trend. The dynamic range includes a lag constructor.

A time series is a sequence of numerical indicators that characterize the level and change of an event or process.

The additive model has the following general appearance:

$$Y = T + S + E$$

The main component of the time series is the trend. A trend is a stable tendency of a series over time, more or less free from the effects of random fluctuations. Indicators of changing tendencies of complex social events and processes can only be approximated by one or another equations and trend lines.

In this model, each level of the periodic series is considered to consist of a sum of trend (T), seasonal (S) and random (E) components.

In order to develop students' ability to build trend models and forecast, the electricity consumption statistics for 4 years, i.e. 16 (spring, summer, autumn, winter) seasons are presented in tabular form. Based on the forecast of electricity consumption in the next 5 years in the additive model.

Table 1

t	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
y	7,5	5,6	6,3	10,4	8,7	6	7,3	11,4	9,5	6,8	7,7	12,4	10,5	7,8	8,3	12,2

Duties:
1. Provide information about time series and spatial models.
2. Estimate the seasonal components in the additive model.
3. Create a linear trend model in the additive model based on the given values.
4. Forecast the next period using the data.
Recommended resources for students.
Do a case based on the topic "Basic concepts of time series" from the "Introduction to Econometrics" textbook.
Instructions for students:
1. Determine the exact purpose of the presented case.
2. Use the t-time and y-electric energy consumption provided in the process of creating the seasonal component.
3. Create a trend model using the "Least Squares Method".
4. Create an additive model, forecast 17, 18, 19, 20 seasons.
Case resolution process:
1. Students are divided into small groups and time series data are presented.
2. The seasonal component is calculated as the total for four quarters, the moving average for four quarters, the centered moving average, and the assessment of the seasonal component.
3. A linear trend model is created.
4. The results of the subgroups are summarized, an additive model is created and forecasted.
The solution. A time series is a sum of values of a certain object or process in several consecutive periods. A spatial model is information that reflects the state of a set of various objects or processes at a certain time. Electricity consumption for 4 years, i.e. 16 seasons (spring, summer, autumn, winter) is given. First, the seasonal component is created.

Table 2
Seasonal components

Quarter number. t	Electricity consumption, y_t	Total for four quarters	Moving average over four quarters	Centered sliding is average	Assessment of the seasonal component
1	7,5	-	-	-	-
2	5,6	29,8	7,45		
3	6,3	31	7,75	7,6	-1,3
4	10,4	31,4	7,85	7,8	2,6
5	8,7	32,4	8,1	7,975	0,725
6	6	33,4	8,35	8,225	-2,225
7	7,3	34,2	8,55	8,45	-1,15
8	11,4	35	8,75	8,65	2,75
9	9,5	35,4	8,85	8,8	0,7
10	6,8	36,4	9,1	8,975	-2,175
11	7,7	37,4	9,35	9,225	-1,525
12	12,4	38,4	9,6	9,475	2,925
13	10,5	39	9,75	9,675	0,825
14	7,8	38,8	9,7	9,725	-1,925
15	8,3	-	-	-	-
16	12,2	-	-	-	-

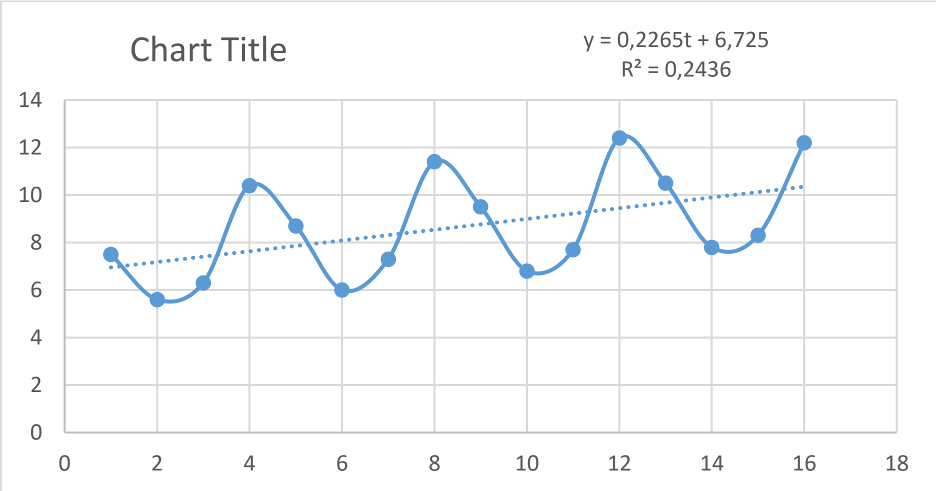
After determining the seasonal component, the corrected seasonal component is determined and the average electricity consumption for each season is determined.

Table 3
Corrected seasonal component

	1	2	3	4
1	-	-	-1,3	2,6

2	0,725	-2,225	-1,15	2,75
3	0,7	-2,175	-1,525	2,925
4	0,825	-1,925		
Total for i-quarter (for all years)	2,25	-6,325	-3,975	8,275
Corrected seasonal component, S_i	2,19375	-6,38125	-4,03125	8,21875

The results of the corrected (S) seasonal component are known. (T) The trend model is constructed using a system of normal equations determined by the "method of least squares". y=at+b trend model is created. The trend model of electricity consumption during t-quarters is as follows: $y = 0{,}2265t + 6{,}725$



When the additive model created for the next 5 years, i.e. seasons 17, 18, 19, 20, is in the form *Y=T+S*

$Y_{17} = 0{,}2265*17 + 6{,}725+2{,}19$

$Y_{18} = 0{,}2265*18 + 6{,}725-6{,}38$

$Y_{19} = 0{,}2265*19 + 6{,}725-4{,}03$

$Y_{20} = 0{,}2265*20 + 6{,}725+8{,}21$

Using the additive model, it is possible to forecast 12.76 in the 17th season, 4.42 in the 18th season, 6.99 in the 19th season, and 8.58 in the 20th season.

It can be seen that the role of methods in the formation of econometric competences in students is high, in particular, the skills of building trend models, analysis and forecasting can be formed with the help of cases. Using the additive model, key periods are forecasted by calculating the trend (T), seasonal (S) and random (E) components. All three components can be calculated step by step and then analyzed. Econometric models are built on the basis of spatial and dynamic models. Spatial models are based on objects or processes, while dynamic models analyze and forecast based on time or period.

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