APPLYING THE EXPONENTIAL SMOOTHING MODEL FOR FORECASTING TOURISTS' ARRIVALS – EXAMPLE OF NOVI SAD, BELGRADE AND NIŠ

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A R T I C L E I N F O

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A B S T R A C T

Predicting future movements of tourism demand based solely on the past behaviour of variables such as number of overnight stays is crucial for the development of tourism and mitigation of seasonality. Nowadays, there are many different models that could be used for forecasting. Sometimes, some simpler models could fit better to collected data and, in the other hand, more sophisticated ones are more convenient. In this paper, the exponential smoothing models have been applied on the data that was taken from Republic Statistical Office (RSO). The research was conducted on monthly data relating to the number of overnight stays in Belgrade, Novi Sad and Niš during the period from January 2000 to December 2013. Based on the selected data, forecasting was made for overnight stays until May 2018. It is concluded that the selected models correspond to the observed data, and the precision of the obtained predictions is determined by comparing the BIC precision measures.

Introduction

The impact of seasonal demand variation is one of the dominant policy and operational concerns of tourism interests in both the public and private sectors. Forecasts of tourist arrivals are essential for planning, policy making and budgeting purposes by tourism operators (Gounopoulos et al., 2012). According to Claveria and Torra (2014), some of the reasons for this increase in the number of studies of tourism demand modelling

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and forecasting are: the constant growth of world tourism, the utilisation of more advanced forecasting techniques in tourism research and the requirement for more accurate forecasts of tourism demand at the destination level. The consolidation of tourism planning at a regional level in many countries is one of the main reasons behind the increasing demand for accurate forecasts of tourist arrivals in a specific region (Claveria, Torra, 2014).

The most important urban tourist destinations in Serbia are the main administrative centers, Belgrade, Novi Sad and Niš. Thanks to the favorable tourism and geographical position, natural values of the area, a rich cultural and historical heritage and accommodation facilities, these urban centers develop various forms of tourist movements. Therefore, it is necessary to make the analysis of tourist turnover, in order to highlight the main directions of tourism development.

Exponential smoothing (ES) methods have become very popular because of their (relative) simplicity and good overall performance. Such methods are sometimes also called naıve because no covariates are used in the models, i.e., the data are assumed to be self-explanatory. They are also extremely easy to compute. In summary, ES is a weighted average of past values from an observed process that assigns a decreasing weight to past values (Maia, Carvalho, 2011).

This paper presents the analysis of an exponential smoothing model that allows us to forecast time series jointly, subject to correlated random disturbances and measured by Bayesian information criterion. The purpose of this study is to apply the Exponential smoothing (ES) methods to forecast the tourist arrivals to Belgrade, Novi Sad and Niš, and demonstrate the forecasting performance of this model. In this paper, the used data were taken from the Republic Statistical Office (RSO) and the survey covered the city of Belgrade, Novi Sad and Niš, Serbia with the aim to provide the empirical evidence that is the use of exponential smoothing model is useful for generating accurate prediction intervals, in practice.

Literature review

There are many strategies that are used to address the effects of seasonality. These include pricing strategies, diversifying the attraction, market diversification and seeking assistance from the government and industry bodies. Being ubiquitous, all tourism enterprises and regions are impacted by seasonality whether severely or mildly. Seasonality can be defined as “the temporal imbalance in the phenomenon of tourism, which may be expressed in terms of dimensions of such elements as numbers of visitors, expenditure of visitors, traffic on highways and other forms of transportation, employment and admissions to attractions”, (Butler, 1994, p.332; Cuccia, Rizzo, 2011). According to Cuccia and Rizzo (2011), the number of tourists is a measure of the quantitative dimension of the demand, while their expenditures measure the economic value of the demand for the tourism destination.

Seasonality has been studied in a number of ways; however, the concept relating to tourism activities is largely a temporal and spatial issue. In the context of tourism, it is usually expressed in both monetary terms (social and capital costs) and visitor (or customer) numbers (Jang 2004). One of the most comprehensive studies of the factors influencing seasonality in tourism is the work of Butler and Mao (1997). Their work is supported by other researchers (Gajić et al., 2015; Ursache, 2015; Papić-Blagojivić et al., 2016) who identify a number of similar dimensions of seasonality and present a variety of prescriptions for alleviating the negative impacts of seasonality. According to Butler and Mao (1997), seasonality has two dimensions: natural (physical) and institutional (social and cultural), involving both the origin and destination regions.

In order to influence the impact of seasonality on the destination, it is important to know the main tourist flows. The dominant time series in tourism forecasting studies is annual data. According to Onder and Gunter (2015), less than 10% of tourism demand forecast articles have used data with monthly frequency, even though the use of monthly data increases the number of observations, and despite the fact that accurate forecasts of tourist arrivals for the coming months are important from a short-term or operational tourism management perspective (Onder, Gunter, 2015). The most frequently used models for forecasting with monthly data is the Error-Trend-Seasonal or Exponential Smoothing.

For many years, various time series models have been successfully applied for forecasting tourist arrivals (Holt, 1957; Hassani et al., 2015). From the large number of models that are available today to the researchers this paper presents exponential smoothing models. Exponential smoothing model was first suggested in the statistical literature by Holt (1957), Brown (1959) and Winters (1960), and gained popularity as a forecasting method for a wide diversity of time series data (Everett and Gardner,1985; Cho, 2003; Everett and Gardner, 2006). Exponential smoothing model is a widely used method in time series analysis and has been adopted in traffic forecasting for decades (Peng et al., 2008). The major advantage of exponential smoothing methods is that they are simple, intuitive, and easily understood. Forecasts based on exponential smoothing methods are computationally straightforward. Generally, exponential smoothing is regarded as an inexpensive technique that gives good forecast in a wide variety of applications. In addition, data storage and computing requirements are minimal, which makes exponential smoothing suitable for real-time application.

In order to accommodate trends and seasonality in the data, an appropriate form of exponential smoothing is the Holt-Winters procedure (Witt et al., 1994), and this is the model adopted in our study. This model formulation is based on the assumptions that each of the individual time series comes from the univariate Holt-Winters' model (Vallet et al., 2011), that all of them share a common structure, that is, common smoothing parameters, and that corresponding errors in the univariate models are contemporaneously correlated.

These models are less frequently applied in the tourism demand literature, despite evidence that they often provide adequate forecasts of directional and trend changes in tourism demand

(Cho, 2003). Smoothing models have ready application for forecasting tourism demand, since they can react quickly to changes in economic conditions and recent observations tend to be assigned larger weights in the forecasting process (Coshall, 2009).

Exponential smoothing models have been shown to generate accurate forecasts of tourism demand (Lim, McAleer, 2002). It is a forecasting method that seeks to isolate trends or seasonality from irregular variation. It has been found to be most effective when the components describing the time series may be changing slowly over time (Yaffee, McGee, 2000). This method gives more accurate forecasts in the short run, as in our case, while the estimates for a longer period is less precise so the other methods are preferred. Their success is rooted in the fact that they belong to a class of local models that adapt their parameters to the data automatically during the estimation procedure, and therefore implicitly account for (slow) structural changes in the training data. Moreover, as the influence of new data is controlled by hyperparameters, this has the effect of smoothing the original time series (Maia, Carvalho, 2011).

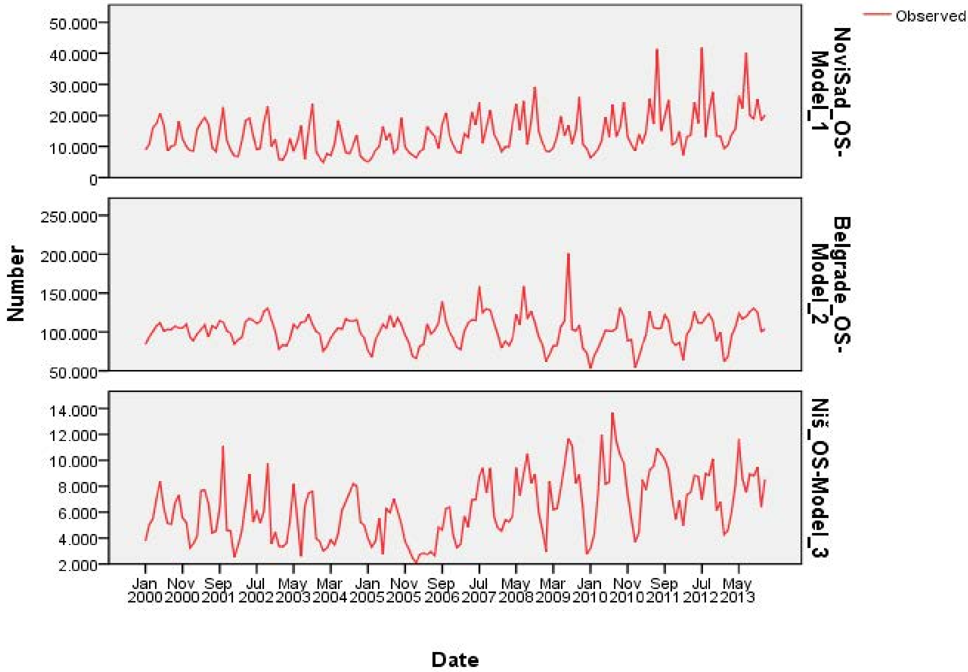
In exponential smoothing, a new estimate is the combination of the estimate for the present time period plus a portion of the random error generated in the present time period. When used for forecasting, exponential smoothing uses weighted averages of the past data. The effect of recent observations is expected to decline exponentially over time (Cho, 2003). The main question is how much weight should be attached to each of the past observations, with the likelihood being that more recent readings have more influence on future forecasts of tourism demand than do observations a long way in the past (Coshall, Charlesworth, 2011).

Materials and methods

In the paper, the exponential smoothing models have been applied to the historical data of the number of overnight stays in the three cities and, based on the chosen accuracy measure, Bayesian information criterion (BIC), it was concluded that the model corresponds to the selected data very well. The used data were taken from the Republic Statistical Office (RSO) and the research was conducted on monthly data relating to the number of overnight stays in Novi Sad, Belgrade and Niš during the period from January 2000 to December 2013. In order to generate the forecasts, it is necessary to specify the values of the three smoothing constants (overnight stays in Belgrade, Novi Sad and Niš).

The series *Overnight stays* – Novi Sad, Belgrade and Niš is shown in the Figure 1. From Figure 1. it can be seen the presence of seasonal effects on the observed data. Factors of seasonal effects further confirm that there is larger number of tourists' arrivals in all three series during the period from April to October; also, each series has a certain characteristics. The figure shows that in the series *Overnight stays* - Novi Sad the significant increase in the number of overnight stays starts in May 2011.

Figure 1. Overnight stays in Novi Sad, Belgrade and Niš



In order to put in the same place the seasonal character of the observed series and trend component, authors used the three seasonal exponential smoothing models: simple seasonal and two different Winters models: additive and multiplicative. The Winters additive model adds to the Holts model the seasonal parameter. The other one, the multiplicative Winters model, consists of a linear trend and a multiplicative seasonal parameter δ. The general formula for multiplicative Winters model is (Yaffee, McGee, 2000, pp. 40):

$$Y\tau = (\mu_t + b_t t)S_{t-p+h} + e_t,$$

where

μ_t is the mean of the observed time series at period t;

b_t is the trend component;

S_{t-p+h} is the seasonal component, where p is the seasonality periodicity and h is the number of periods in forecasting; and

e_t is the forecast error at period t.

The exponential smoothing models use three parameters in forecasting: parameter α as weighting or smoothing parameter of level, parameter γ as weighting parameter of trend and parameter δ as weighting parameter for seasonal components. These parameters are all interrelated. For example, large value of δ will tend to have low value of α and vice versa (Cho, 2003).

Winters' additive and multiplicative exponential smoothing models incorporate these three parameters. The former model is appropriate for a series with a linear trend and a seasonal effect that does not depend on the level of the series. The latter model is appropriate for the same type of trend, but when the seasonal effect does depend on the level of the series (Coshall, 2009).

The Simple Seasonal and both Winters model were applied to observed data. According to the chosen precisions measure Winters multiplicative model is more convenient for the series *Overnight stays* – Novi Sad and Simple Seasonal model is more suitable for series *Overnight stays* – Belgrade and Niš because the Bayesian information criterion-BIC is the lowest for these models. The compared values of Bayesian information criterion are shown in the Table 1.

Results and Discussions

Results show that during the months of low season, the seasonal variation component has lower values (see January, February, November and December). While in July, August and September, this component has higher values. The consequences of this seasonal variation demand a strategic response in supply to overcome their adverse effects. Hence, tourist companies must adopt different measures to face the increase in demand, for example, in the number of staff hired, which may have negative implications derived from variations in training levels of employees or productivity levels (Guzman-Para, et al., 2015).

Table 1. Model statistics

Model	Model Fit statistics- Normalized BIC		
	Simple Seasonal	**Winters Multiplicative**	**Winters Additive**
Novi Sad-Model_1	16,187	16,164	16,223
Belgrade-Model_2	18,799	18,816	18,856
Niš-Model_3	14,636	14,836	14,711

Source: Own calculations

Chosen models were used for estimating the values of three parameters for series *Overnight stays* – Novi Sad, Belgrade and Niš and the results are shown in the Table 2.

Table 2. Exponential Smoothing Model Parameters

Model		Estimate
Novi Sad-Model_1	α (Level)	0,190
	γ (Trend)	0,001
	δ(Season)	0,420
Belgrade-Model_2	α (Level)	0,400
	γ (Trend)	0,000
	δ (Season)	0,000
Niš-Model_3	α (Level)	0,300
	γ (Trend)	0,000
	δ (Season)	0,005

Source: Own calculations

The low value of the parameter *α* (0.190) for the first series indicates that the observed series is quite stable during the period. From the value of the trend parameter *γ* it can be concluded that the slope of the trend line is constant during the observation period. The third parameter, *δ*, shows seasonal effects. In the series of Novi Sad, the impact of seasonal effects is more pronounced in comparison to the other two series, since the value of the parameter *δ* is 0,420. Considering that the observed parameters are interrelated, based on the higher values for parameter *α* and lower values for parameter *δ* for series Belgrade and Niš, we can conclude that the number of tourists stays in these two cities depends on recent data, with a constant trend and stable seasonal effect. On the other hand, the values of these parameters for Novi Sad indicate that the seasonal factor have greater influence. We assume that this is due to the pronounced seasonality (EXIT festival etc.)

Based on the selected models, forecasting was made for tourist arrivals until May 2018. The results are shown in Figures 2, 3 and 4.

Figure 2. Observed, fit and forecast values by applying Winters multiplicative model for the series *Overnight stays* – Novi Sad

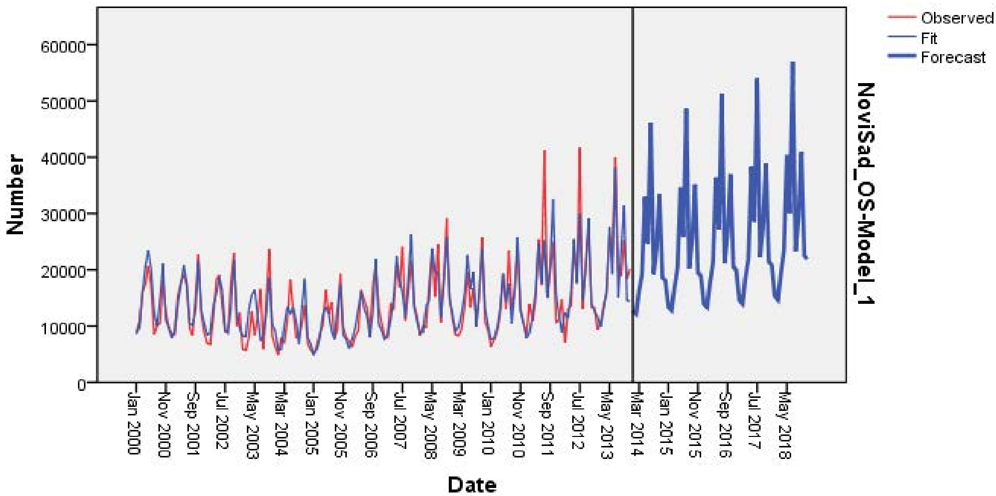


Figure 3. Observed, fit and forecast values by applying Simple Seasonal model for the series *Overnight stays* – Belgrade

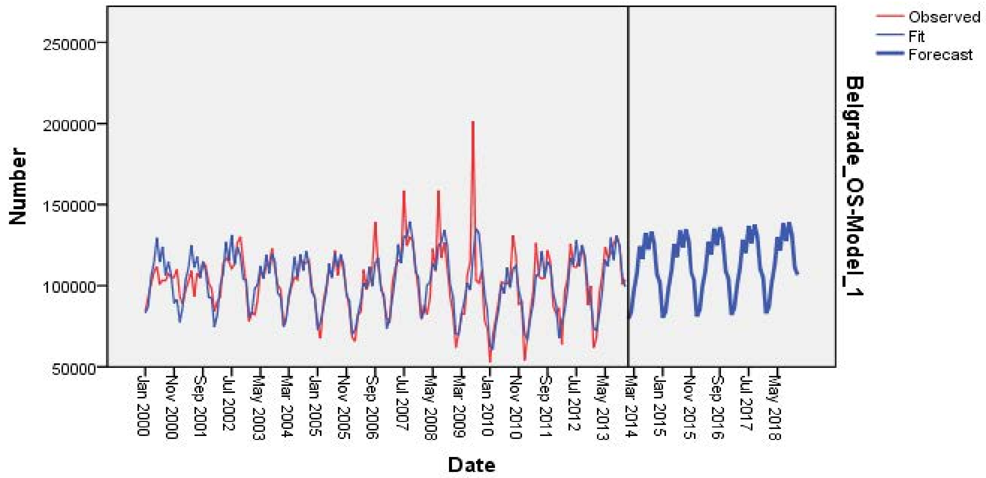
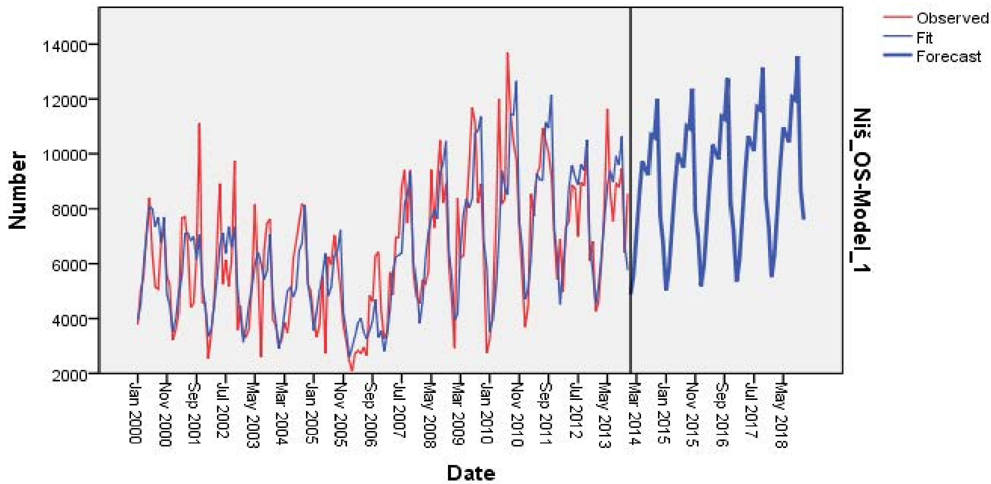


Figure 4. Observed, fit and forecast values by applying Simple Seasonal model for the series *Overnight stays* – Niš



Data from Table 2, Table 3 and Table 4, indicates that we can expect a significant increase of tourist turnover only in Novi Sad, in the observed period. The Novi Sad, Belgrade and Niš have many manifestations, and some of them are of international character, but on the Petrovaradin (part of Novi Sad), is maintains the one of the biggest European festivals "Exit" festival. So, we can conclude that we can expect more tourists in Novi Sad during the summer months. When it comes to Belgrade and Niš, we can conclude that these destinations are a frequent destinations for school excursions (spring and autumn), events, congress tourism etc., and in the observed period there will no be major oscillations.

Conclusions

It is important to say that tourism demand is influenced by many factors, including exchange rate fluctuations, relative inflationary movements, political/environmental events, and changes in holiday patterns. Planning for the future and forecasting what is likely to happen next, is crucial to the success of the whole tourism industry (Onder, Gunter, 2015). Without reducing the extent of the seasonal concentration, it will be very hard to create and maintain a competitive and sustainable tourist product. The statistical data of our case studies seems to show that forecasting of tourist arrivals can play a more strategic role in overcoming seasonality. However, such a process is not straightforward and requires the shared and coordinated action of policy-makers from different layers of government (regional, provincial and municipal) in different fields: tourism, culture, infrastructures and training to overcome the vertical fragmentation (between central vs. local government) that usually characterizes the public decision-making process (Vujko, Gajić, 2014).

As exponential smoothing models are used widely, it is imperative to investigate whether unit roots are present in the time series data prior to using these models. We employ a set of monthly time series for the number of tourist arrivals to Serbia. We consider the number of tourist arrivals from three individual tourist centers (Belgrade, Novi Sad and Niš) from 2000 to 2013. and have found that the analysis of an exponential smoothing model perform most desirably, especially when the forecast horizon is long. We asked for data from the Republic Statistics Office, and they gave us data for the observed period.

The results obtained from the prediction of real correlated time series are encouraging. Exponential smoothing methods within the framework of state space models have proved to be a successful methodology in the forecasting of tourism data. The main finding of the paper is that, in general, the prediction intervals from the exponential smoothing show satisfactory probability coverage properties and generate prediction intervals with desirable statistical properties, at least in the context of tourism forecasting. One of the disadvantage lie in the fact that this method has restrictions because of number of seasonal coefficients in the therm how often they are updated. Combining of several models and occasional repetition of the same calculation allows us to overcome this limitation. But, we also must underline that exponential smoothing has the advantage of being relatively easy to understand and use in practice.

Conflict of interests

The authors declare no conflict of interest.

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