Exponential forecasting of the monthly volume of the tourism receipts in Bulgaria

Previsão exponencial do volume mensal de receitas turísticas na Bulgária

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Abstract

In Compliance with the annual Act for the State Budget, the Bulgarian Ministry of Finance usually makes twice a year an internal budget restructuring in the budgets of the separate Ministries and State Agencies of the Bulgarian State. What is intriguing in this internal budget restructuring is that it is usually done in the months when the tourism receipts in the form of Value Added Tax turnovers are usually accumulated by the Bulgarian tax administration. The need of proper forecasts that could eventually justify or reject such a hidden harvesting policy has never been examined and put to the public attention. The present paper regards several major problems in the application of the exponential smoothing methods for the purpose of the long-run forecasting of the monthly volume of the tourism receipts in Bulgaria. These problems include: (i) the problem of determining the time series pattern; or the so-called “forecast profile”; (ii) the selection of a suitable forecasting method; (iii) Calculating of short-run and long-run forecasts; (iv) the comparison of the results of the forecast techniques on the basis of the errors in the forecasts. As a result the Holt-Winters method is applied with the conclusion that the produced forecasts could trigger a process a more financially autonomous national tourism administration that will allow a greater part of the collected tax revenues for the tourism sector to be returned into the tourism industry in a form of public investments through this very same more autonomous national tourism administration.

Keywords: Forecasting, exponential smoothing, Holt-Winters method, monthly tourism receipts.

1. Introduction

In Compliance with the annual Act for the State Budget, the Bulgarian Ministry of Finance usually makes twice a year the so called “Internal compensating changes in the budget credits of the first rate holder of budget credits” (Ministry of Finance, 2014). Behind this complex phrase is hidden a not very popular state account practice of restructuring (increasing or decreasing the separate budget categories) in the budgets of the separate Ministries and State Agencies of the Bulgarian State. What is intriguing in this internal budget restructuring is that it is usually done in the months of March and April in the first part of the year and then in the months of September and October for the second half of the year, when the tourism receipts in the form of Value Added Tax turnovers are usually accumulated by the National Revenue Agency (the tax administration) of Bulgaria. The need of proper forecasts that could eventually justify or reject such a hidden harvesting policy has never been examined and put to the public attention.

Furthermore, if revealed with the help of the proper forecasting techniques, this hidden policy of harvesting on the back of the Bulgarian tourism industry, could finally result in the creation of a more financially autonomous national tourism administration (preferably a Ministry of tourism) that will
allow a greater part of the collected tax revenues for the tourism sector to be returned into the tourism industry in a form of public investments through this very same more autonomous national tourism administration.

Based on the monthly data available data in category “Traveling” of the balance of payment of the Republic of Bulgaria, which are regularly sustained and published by the Bulgarian National Bank on its web site (Bulgarian National Bank, 2014), a time series can be built for the volume of the tourism receipts (Graph 1) from January 2000 to March 2014. This time series comprises a set of 170 time periods (170 months).

Graph 1 - Monthly volume of the tourism receipts in Bulgaria

Taking into the considerable size of this time series a search can be made for a suitable forecasting model for the monthly volume of Bulgaria’s tourism receipts. A possible solution in this regards could come in the face of the so-called “univariate” methods (DeLurgio, 1998) and namely and most particularly in the group of the exponential smoothing methods. This group of methods relies on the assumption that if a considerably long time series of a certain indicator can be composed, this very same considerably long time series will have reflected all the possible external influences induced by all the possible external factors and thus time series will have incurred an internal logic of development and an internal information signal could be extrapolated further in future. The building up of forecast model, especially with the use of the exponential smoothing methods, however, needs a more sophisticated and multistage approach with a certain number of clearly set objectives.

2. A literature review on the topic

The development and usage of the exponential forecasting methods dates back from the works of R. G. Brown in the 1940’s the results of which were published in 1959. These were further developed and expanded by C. C. Holt in 1957 and Peter Winters in 1960.

In 1960s Pegles (1969) developed the first taxonomy for the classification of the available at that time exponential smoothing forecasting methods. In the 1980’s Gardner (Gardner, 1985; 1987) presented some interesting techniques aimed at smoothing of the error residuals in the achieved forecasts. Gardner (1985) and Taylor (2003) also further expanded the opportunities for classifying the exponential smoothing forecasting methods according to so-called “forecasting profiles” or “forecasting patterns” (See also point 3).

The problem of the initialization of variables that are to be used in the exponential smoothing equations was also regarded by a numerous authors such as Ledolter and Abraham (1984) and Hyndman (2014). In 2002 Hyndman, Koehler, Snyder, Grose, and later in 2008 Hyndman, Koehler, Ord and Snyder published there works on the usage of the so-called state-space approach in exponential smoothing.

In the years, the capacity of the exponential forecasting methods to produce reliable forecast was further explored also by other researchers such Ledolter and Abraham (1984), Gardner and McKenzie (1985; 1988), Chatfield and Yar (1988), Hamilton (1994), Tashman and Kruk (1996), Delurgio (1998), Williams and Miller (1999), Tsay (2005) and many others.

In Bulgaria, the exponential smoothing methods up to the 1990’s were virtually unknown due to the weak English language skills of the researchers and the preference given in the field of forecasting to the multivariate forecasting methods and mainly the usage of French and Swedish econometric models. In 1996 Sirakov published a book named “Conjuncture and Forecasting of International Markets” in which an application of the Brown’s single exponential smoothing was made in regards to the Bulgarian export of textile production equipment and machinery for the African countries and mainly in Nigeria. This application was however very narrow in scope. An Internet publication that that tried to make the exponential forecasting smoothing methods more popular in Bulgaria was made in 2007 by Ivanov form the New Bulgarian University as a part of his lecture course materials on business processes forecasting. Another try for a more explicit explanation and usage of the exponential forecasting methods and namely the Halt and Halt-Winters method was made in another book published in Bulgarian language by Mishev and Goev, i.e. “Statistical analysis of time series” (2012). Even here, however, the theoretical presentation of the regarded method was limited and narrowed to the practical application of several software packages. In the field of the Bulgarian tourism, the publish
studies in the application of the exponential smoothing methods are also limited to some few papers dealing with the application of the Holt and Holt-Winters method for forecasting of the number of tourism arrivals in certain areas and in the country as a whole.

3. Objectives

The task of creating an exponential smoothing forecast model for the monthly volume of the Bulgarian tourism receipts, meets with solving of several major problems:

Determining the time series pattern, or the so-called “forecast profile” (Gardner, 1987, pp.174-175) (Hyndman, Koehler, Ord & Snyder, 2008, pp.11-23) and the quality of the data in the pattern, on the basis of which to select the suitable forecasting exponential smoothing model.

Selecting of a suitable forecasting techniques;

Calculating the forecast values (up to March, 2025) and finding of a best-fit model on the basis of the errors in the forecasts (R2, Mean Absolute Percentage of Error (MAPE) and etc.);

Drawing of conclusions on the results of the achieved forecasts.

4. Methodology and main results

With regards to the first problem, set in the previous point of the present paper, i.e. the problem of determining the times series pattern, or the so-called times series’ “forecast profile” is usually solved by comparing the times series in regard with a pre-set classification of exponential smoothing methods or the derived form them forecast profiles in terms of development curves (Dimitrov, 2011) (Dimitrov, 2013). As Hyndman et al. (2008, pp.11-12), this classification of smoothing methods originated with Pegles’ taxonomy (Pegles, 1969, pp.311-315).

A simple visual analysis of the times series of the monthly volume of the tourism receipts in Bulgaria for the time period 1964 – 2012 with Hyndman et al and Taylor’s classification (Table 1) shows out that these particular time series can be associated to the following group of forecasting patterns (forecasting profiles according to the Gardner’s classification) called the “linear trend, multiplicative seasonality” profile (A, M pattern) and (iii) to the “linear trend, additive seasonality” profile (A, A pattern) (Graph 2).

A more detailed visual review of the regarded times series on the basis of the fluctuations maxima and minima shows out that there are clearly expressed yearly cycles, i.e. cycles of 12 months with an increasing amplitude in the cyclical fluctuations. This finding can be further used in the process of selecting the proper forecasting technique.

The finding that the time series of the monthly volume of the tourism receipts in Bulgaria for the time period January 01, 2000 – March 31, 2014 have clearly expressed in terms of increasing fluctuations cycles, as well as the fact that it corresponds to the “linear trend, multiplicative seasonality” profile (A, M pattern), provides a solution to the third problem, the one of selecting and using of a suitable...
forecasting exponential smoothing method. As both Gardner and Hyndman et al. point out this profile corresponds to the method of the triple exponential smoothing in the presence of a linear trend and multiplicative seasonality, known also as a variation of the Holt-Winters method. The mathematical notation of the Holt-Winters method for multiplicative seasonality is as follows:

The smoothing of the level (the base) - “B”:

\[ B_t = \alpha \frac{Y_t}{S_{t-L}} + (1-\alpha) (B_{t-1} + T_{t-1}) \quad 0 \leq \alpha \leq 1 \]

The smoothing of the trend - “T”:

\[ T_t = \beta (B_t - B_{t-1}) + (1-\beta) T_{t-1} \quad 0 \leq \beta \leq 1 \]

The smoothing of the seasonal factor - “S”:

\[ S_{i} = \gamma \frac{Y_t}{B_t} + (1-\gamma) S_{i-L} \quad 0 \leq \gamma \leq 1 \]

The achieving of the final forecast “Ft+m” for “t+m” periods ahead in the future:

\[ F_{t+m} = (B_{t+m} + mT_{t+m})S_{t+m-L} \]

Where: \( \alpha \), \( \beta \) and \( \gamma \) are the smoothing constants for the level, the trend and the seasonality respectively which could take values between 0 and 1. The initialization of the values of the level “B”, the trend “T” and the seasonal factor “S” is achieved through the following set of equations:

For the level (the base) - “B0”:

\[ B_0 = \frac{1}{L}(Y_1 + Y_2 + \ldots Y_L) \]

For the trend - “T0”:

\[ T_0 = \frac{1}{L} \left( \frac{Y_{L+1} - Y_1}{L} + \frac{Y_{L+2} - Y_2}{L} + \ldots + \frac{Y_{L+L} - Y_L}{L} \right) \]

For the seasonal factor - “S0”:

\[ S_0 = \frac{1}{N} \sum_{j=1}^{N} \frac{Y_{(j-L)+j}}{A_j} \quad \forall j = 1, 2, \ldots, L \]

Graph 3 - Plotting of the forecast calculations achieved through SPSS® with the use of the best fit model for Holt-Winters multiplicative forecasting (\( \alpha = 0.001 , \beta = 0.260 \) and \( \gamma = 0.988 \))

<table>
<thead>
<tr>
<th>Model Description</th>
<th>Model Type</th>
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<tbody>
<tr>
<td>Model ID</td>
<td>Tourism receipts</td>
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</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of Predictors</th>
<th>Model Fit statistics</th>
<th>Ljung-Box Q(18)</th>
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<tr>
<td>Tourism receipts-Model_1</td>
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<td>Stationary R-squared</td>
<td>MAPE</td>
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</table>
Graph 3 - Plotting of the forecast calculations achieved through SPSS® with the use of the best fit model for Holt-Winters multiplicative forecasting ($\alpha=0.001$, $\beta=0.260$ and $\gamma=0.988$) (Continuation)

<table>
<thead>
<tr>
<th>Model</th>
<th>Estimate</th>
<th>SE</th>
<th>t</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>Tourism receipts-Model_1</td>
<td>No Transformation</td>
<td>Alpha (Level)</td>
<td>0.001</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gamma (Trend)</td>
<td>0.260</td>
<td>0.502</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delta (Season)</td>
<td>0.988</td>
<td>0.073</td>
</tr>
</tbody>
</table>

Source: Authors’ own calculations and data provided by the Bulgarian National Bank (BNB, 2014).

Graph 4 - A more detailed and zoomed plotting of the forecast calculations achieved for the period March 2014 – March 2025 through the best fit model ($\alpha=0.001$, $\beta=0.260$ and $\gamma=0.988$)

Source: Authors’ own calculations and data provided by the Bulgarian National Bank (BNB, 2014).
After producing the optimal forecast calculations through the best fit model (the one with lowest MAPE) one can proceed further with the solving of the fourth of the above set tasks, i.e. with the drawing of conclusions on the results of the achieved forecasts. 

5. Conclusions

Based on the results in Table 2, as well as in Graph 3 and 4, one can outline that the forecasts achieved with best-fit model is that the trend of increase is preserved. Moreover, the best fit model achieved through the SPSS statistical package with smoothing constants α=0.001, β=0.260 and γ=0.988 tends to produce, as it should be expected, multiplicatively increasing cyclical fluctuations for the monthly volume of the tourism receipts in Bulgaria. The highest forecast monthly values, as well as the statistically recorded ones, however, do not refer to the months of March and April and September and
October, when the internal compensating changes in the state budget are being made by the Bulgarian Ministry of Finance. The highest forecast values for the winter season are produced for the months of November and December and for the summer season, respectfully for the months of June and July. The lack of overlapping can be easily explain with the lag of one to two months that is needed for the tourism receipts in Bulgaria to produce the necessary Value Added Tax turnovers in the tourism companies which can be consequently captured as tax revenues by the National Revenue Agency (a branch agency of the Bulgarian Ministry of Finance). This means that, intentionally or not that, if the Bulgarian state in the face of its Ministry of Finance continues the practice of the “Internal compensating changes in the budget credits”, based on both recorded data and produced forecast, the hidden policy of harvesting on the back of the Bulgarian tourism industry will also continue. And there will not be any public notion about it as it will be covered up as a routine bureaucratic state accounting procedure that is either “too complex” or “too routine and insignificant” to explain.

This policy of hidden harvesting, however, has an explicit downturn effect on the development of the Bulgarian tourism and prevents the increase in its competitiveness (Filipova, 2010) (Dimitrova, 2013) (Stankova, 2010; 2014) (Gantchev, 2014). And the main reason for this is the fact that the Bulgarian national tourism administration for the last 25 years has always been either a part of a certain “mega” ministry (like the former Ministry of Economy, Energy and tourism) has possessed a rank of Government agency but without any power of being directly presented in the government with the right to coordinate the preparation and adoption of the state budget and to spend directly its budget without a prior approval from a supervising minister from a ministry which incorporates it. In more simple words this long lasting situation has contributed either for an ever decreasing, or for an insufficient return of the collected taxes in the tourism industry in the form of public investments.

The fact that the forecasts for monthly volume of the tourism receipts in Bulgaria point a continuous increase in both the fluctuations and their yearly volume by March 2025 should result in a greater pressure form the Bulgarian tourism industry in the form of public investments.

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