FORECASTING THE NUMBER OF PASSENGERS SERVICED AT THE MARITIME PORTS IN BULGARIA

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Abstract: The maritime transport in Bulgaria is controlled and coordinated by the Executive Agency "Maritime administration". This institutionis a legal entity on budget support to the Ministry of transport, information technology and communications, a second level user of budget credits, based in Sofia with regional offices in Bourgas, Varna, Lom and Rousse (where are the Bulgarian major ports). EAMA status is regulated by the Merchant Shipping Code – Art. 360, para. 1. The problem of forecasting in the new strategic documents is crucial to the formation of proper infrastructure policy which has to be innovative and for the future strategic development of the tourism in the country.

This paper is aimed at presenting the lack of real forecasting in many of the strategic documents and projects adopted for the development of the maritime transport in Bulgaria (i.e. Directive2008/106/EC of European Parliament and Council on the minimum level of training of sea farers; Ordinance No. 9 of 2013 on the requirements for operational suitability of ports and specialised port facilities; Ordinance No. 10 of 2014 on the scope and content, preparation, approval and amendment of the general plans of the public transport ports). There are also many Mutual Agreements for Recognition of Seafarers" certificates**.**

The paper provides a practical example for the use of the so called single or simple exponential smoothing without the presence of any seasonality and the lack of cyclicity on the number of passengersarrivals at the Bulgarian maritime ports.

Keywords: maritime transport, forecasting passengers, sea ports, single or simple exponential smoothing method, strategic documents.

1. Introduction

The maritime transport in Bulgaria is controlled and coordinated by the **Executive Agency "Maritime administration"**. This transport and its infrastructure are put under serious pressure in connection with the membership of Bulgaria in the European Union. The problem of forecasting in the new strategic documents is crucial tothe formation ofproper innovation infrastructure policyfor thefuturedevelopment of thetourism in the country. This paper is aimed at presenting the lack of real forecasting in many of the strategic documents and projects adopted for the development of the maritime transport in Bulgaria. A possible solution can be

found in the group of the exponential forecasting methods and in particular in the face of the Single or simple exponential smoothing method. This method is explicitly suitable for forecasting and planning of the maritime transport infrastructure, as it can provide considerably reliable forecast values on the number of passenger arrivals of some of the country's major maritime ports, such as the Varna and Burgas ports which are under review in the present article. As it is seen from the statistical yearly records of the passengers flows on the Bulgarian maritime ports, the number of passengers is slowly decreasing within the period from 1999 to 2007 (Table 1). This decrease however is accompanied with the lack of any cyclicity and seasonality (Fig. 1). Forecastofthe number ofpassengers servedbyBulgarianmaritime portsbymaritime transport applying the methods described in this article is presented in fig. 1 and table 1.

Table 1.
Number of passengers served by Bulgarian maritime transport

Years	Number of passengers-thousands
1990	26
1991	13
1992	11
1993	11
1994	10
1995	10
1996	11
1997	60
1998	86
1999	121
2000	76,0
2001	67,0
2002	60,0
2003	73,0
2004	81,0
2005	80,0
2006	75,0
2007	232,0
2008	246,0
2009	237,0
2010	149,0
2011	162,0
2012	175,0
2013	143,0
2014	90.0

Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

As is clear from the presented graphically time series corresponds to the same forecast profile with a lack of any trend and no cyclicity and seasonality that is the so called forecast profile type (N, N model) corresponding to the Single exponential smoothing method, also known as Simple exponential smoothing method.

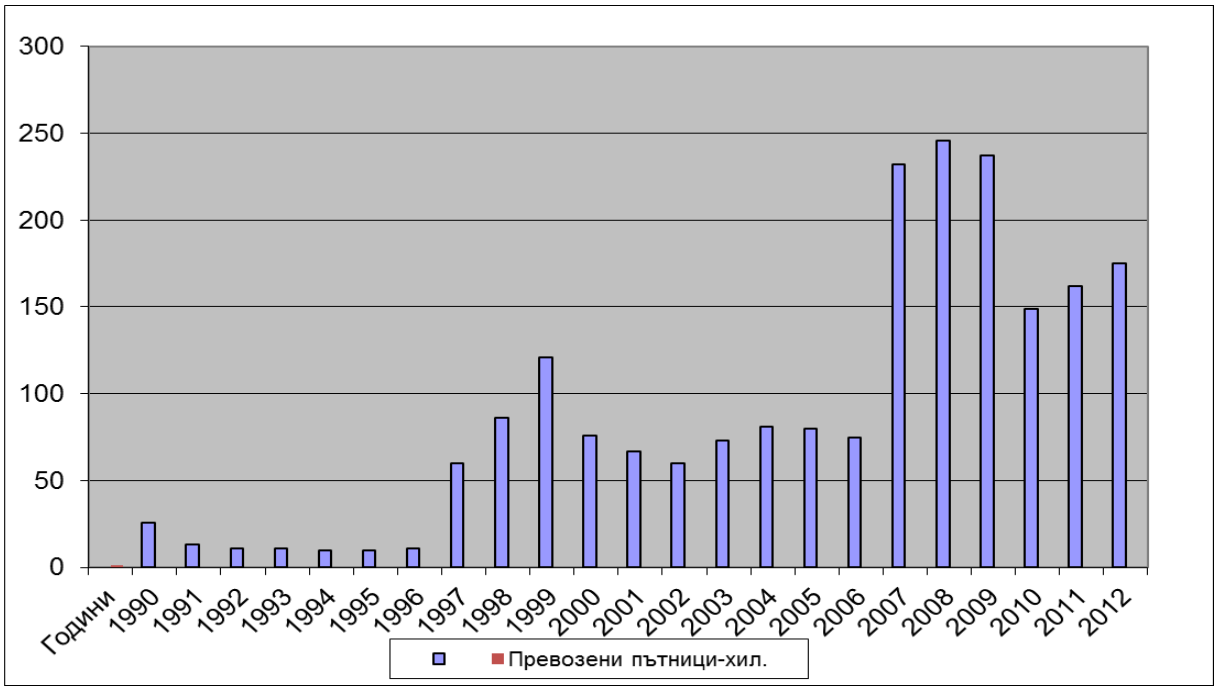

Figure 1. Number of passengers served at the Bulgarian maritime ports. Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

2. Objectives

As P. Dimitrov (2011, 2012) points out the task of creating an exponential smoothing forecast model for the long-run development of the tourism industry, and in a particular for the Bulgarian maritime ports, meets with solving of several major problems:

1. Finding of a suitable general indicator, on the basis of which to build the long-run forecasts (the forecast for periods longer than 5 years).
2. Determining the time series pattern, or the so-called "forecast profile" (Gardner, 1987, p. 174-175) (Hyndman, Koehler, Ord, and Snyder, 2008, p. 11, 23) and the quality of the data in the pattern, on the basis of which to select the suitable forecasting exponential smoothing model.
3. Selecting and using of suitable forecasting techniques.
4. Calculating of long-run forecasts for the value of the above-mentioned general indicator (up to the year 2025).

3. Methodology and main results

With regards to the first problem, i.e. the finding of a general suitable indicator, on the basis of which to make the forecast, it can be pointed out that the Bulgarian maritime ports have published their yearly statistical records of serviced passengers, already presented in point 1 of the present article.

The second 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 from them forecast profiles in terms of development curves. As Hyndman, Koehler, Ord and Snyder point out (Hyndman et al., 2008, p. 11-12), this classification of smoothing methods originated with Pegles' taxonomy (Pegles, 1969, p. 311-315). This was later extended by Gardner (Gardner, 1985, p. 1-28) and modified by Hyndman et al. (2002, 2008) and extended by Taylor (Taylor, 2003, p. 715-725) giving a classification set of fifteen models. In the regarded time series, as it will become later clear, the Gardner's much simplified classification can also be successfully used for finding the best fit forecasting method or forecast profile. The finding that the time series of the number of the passengers serviced at the Bulgarian maritime ports for the time period 2000-2014 corresponds to the "exponential trend, no seasonality" profile and requires the "A, N" variation of exponential forecasting methods makes the third problem, the one of selecting and using of a suitable forecasting exponential smoothing method much more predetermined and easier to solve. This profile corresponds to the method of single exponential smoothing with a lack of a ciclicity and seasonality, also known as the Simple exponential method.

Table 2.
Description of the parameters of the prediction model used to calculate the estimates for the total number of passengers served by maritime transport Single exponential method calculated with software "STATISTICA" ®

	Exp. smoothing: S0=36,77 T0=,5000 (Spreadsheet1MOrs Expon.trend,no season; Alpha= 1,00 Gamma=,041 VAR2
Summary of error	Error
Mean error	15,44513740
Mean absolute error	24,89289379
Sums of squares	44168,5118182
Mean square	1920,3700790
Mean percentage error	22,69318610
Mean abs. perc. error	30,61354570

Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

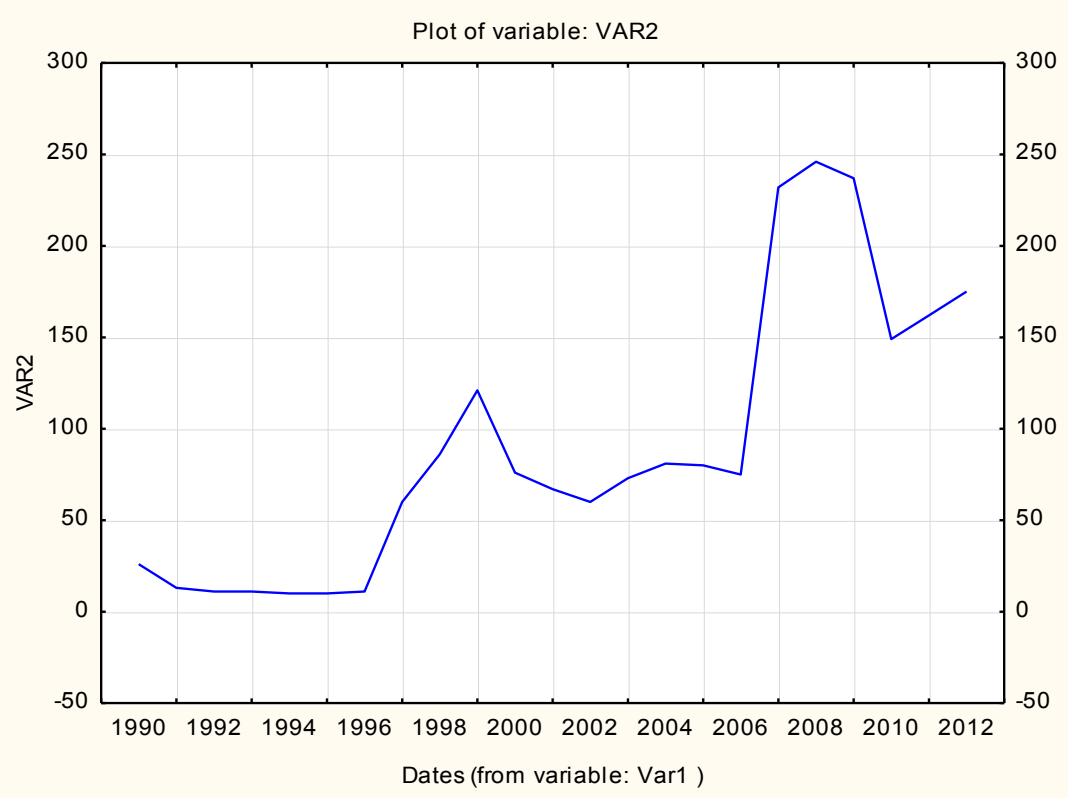

Figure 2. Graphical representation of the time series for the total number of passengers served by maritime transport. Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

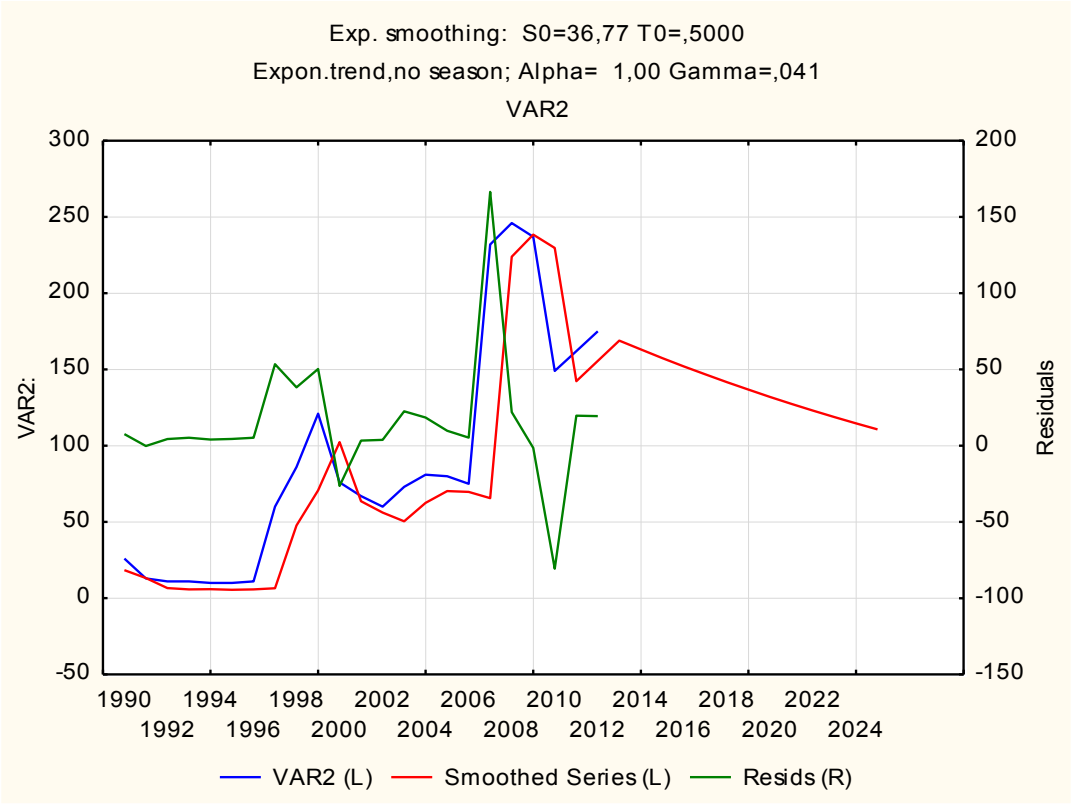

Figure 3. Graphical representations of time series for the total number of passengers served by maritime transport, projected results and the absolute amount of errors in forecasts. Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

Table 3.
Estimated value and errors in estimates of the number of passengers served by maritime transport for the period 1990-2025, with software "STATISTICA" ®.

	Exp. smoothing: S0=36,77 T0=,5000 (Spreadsheet1MOrs Expon.trend,no season; Alpha= 1,00 Gamma=,041 VAR2		
Var1 (Dates)	VAR2	Smoothed Series	Resids
1990	26,000(	18,384	7,6152
1991	13,000(	13,220	-0,2208
1992	11,000(	6,605	4,3941
1993	11,000(	5,742(	5,258(
1994	10,000(	5,957	4,0424
1995	10,000(	5,5667	4,4333
1996	11,000(	5,7484	5,2516
1997	60,000(	6,5601	53,439
1998	86,000(	47,733	38,2664
1999	121,000(	70,666	50,3331
2000	76,000(	102,330	-26,3302
2001	67,000(	63,595	3,4045
2002	60,000(	56,187	3,8125
2003	73,000(	50,4571	22,542
2004	81,000(	62,514(	18,486(
2005	80,000(	70,205	9,7941
2006	75,000(	69,7357	5,2643
2007	232,000(	65,579	166,420
2008	246,000(	223,966	22,033
2009	237,000(	238,439	-1,4392
2010	149,000(	229,659(	-80,659(
2011	162,000(	142,305	19,6943
2012	175,000(	155,599	19,4005
2013		168,945	
2014		163,099	
2015		157,456	
2016		152,008	
2017		146,749	
2018		141,672(	
2019		136,770	
2020		132,038	
2021		127,469	
2022		123,059	
2023		118,801	
2024		114,691	
2025		110,722	

Note. Mirchova, S. (2014) from the NSI (National Statistical Institute).

As we apply the methodology for forecasting with the single exponential smoothing without the seasonality and the absence of cycling seems highly negative trend to reduce future projections. After 2015 they became negative. The case is to score the number of serviced passengers so it cannot take negative values. We can reach the conclusion that if the existing processes and factors affecting the development of time series continue, it is possible to reach

out a drastic reduction in the number of passengers served and practically the sub-sector will collapse in the long run period.

It is clear also that the – lowest estimate in the forecast model in 2015 is 157.4566 persons served passengers. And the last realistic value for the previous 2014 shows that the number is 163.0998. Reported estimated value for 2025 is 110.7229.

4. Conclusions

The forecast results achieved through the Single exponential method for the annual data of the number of the passengers serviced at the Bulgarian maritime ports and the lack of a steady trend of annual decrease show out that there will be a constant decrease of the number of the passengers up to the end of the year 2025. Presented charts and tables also show that the lowest estimation in the forecast model in 2015 was 157.4566 passengers served. The last realistic value for the previous 2014 is 163.0998. The highest estimation to 2025 is 110.7229 passengers' served by Bulgarian maritime ports. Based on the achieved forecast values in Table 2 and fig. 3, we can conclude that the variation in the number of the serviced passengers on the Bulgarian maritime ports will remain steadily decreasing. This strongly requires a change in the policy of infrastructure investment of the maritime authorities, if they would like to achieve a steadier trend of increase and overcoming this trend they should take really serious actions. On the basis of the assessments made on the transport infrastructure in Bulgaria on different modes of transport, concrete actions can also be taken to increase their competitiveness. These actions can also be structured in the form of a strategy to increase competitiveness, and a key element in this strategy should be to increase the number of passengers. It is in this way that uniform distribution of passengers can be achieved and that congestion on one mode of transport will be avoided at the expense of other modes of transport. A strategy to increase competitiveness by increasing the number of passengers is also in line with the European Union policy to promote a balanced development in the transport sector in Bulgaria. The participation of Bulgaria in the TINA project is an important element of the development of the transport infrastructure. For Bulgaria, the network is specified on the sections of the five Trans-European Transport Corridors passing through the territory of the country. The value of matching the core network in Bulgaria to EU standards is estimated at EUR 4095 million, of which EUR 2165 million for the road network and EUR 1930 million for the rail network compared to the National Transport Strategy. The European Union finances projects for which Member States have agreed that together they can achieve better results at a lower cost. Under these conditions, the border regions of Bulgaria and Greece, Turkey, Romania, Serbia and Macedonia could implement a joint strategy to increase the number of passengers from different types of transport infrastructure through joint projects related to the development and improvement of the road,

rail, ports and airports infrastructure. In Bulgarian transport policy the maritime transport should be main priority to increase the number of passengers served by Bulgarian maritime ports. To achieve this goal there should be taken some actions:

Action 1. Improving the infrastructure of Bulgarian seaports through upgrade and modernization of the existing ones.
Step 1. Renovation of port complexes with piers and places that specialize in different types of cargo;
Step 2. Improving the system for traffic management of the vessels;
Step 3. Development of intermodal transport systems and modern logistics centers;
Step 4. Targeting the transport policy in development of maritime and river transport instead the road transport;
Step 5. Assistance by the new financial instrument "tool linked Europe" by the EU Cohesion Fund and by OP "Transport";
Step 6. Expand the number and capacity of ferry connections of our two major ports of Varna and Burgas;
Step 7. Completing the existing radar system;
Step 8. Expand the existing telecommunications subsystem;
Step 9. Purchase of hardware and software;
Step 10. Expanding the number and capacity of ferry connections of our two major ports of Varna and Burgas.

Note. Mirchova, S. (2014).

Following the logical framework of the strategy can be said that the vision of the strategy is the sustainable development of the transport sector in Bulgaria. The main strategic goal is to increase the number of serviced passengers from different types of infrastructure in Bulgaria by undertaking specific actions and steps for their realization. Even if only 1% of journeys, for example by road or bus transport, are replaced by a so-called "green transport" trip, this will increase the number of passengers and would mean reducing the bad environmental consequences. What would happen if a comprehensive transport infrastructure that offers development of all modes of transport attracts 10% or 20% of the number of pedestrians crossing Bulgarian terminals, railway stations, ports and airports?

STRATEGY FOR THE INCREASE IN THE NUMBER OF PERSONS OF THE DIFFERENT TYPES OF INFRASTRUCTURE IN BULGARIA:
1. Increasing the number of serviced passengers at the Bulgarian bus stations.
2. Increasing the number of passengers benefiting from road transport.
3. Increasing the number of serviced passengers on the Bulgarian railway stations.
4. Increasing the number of serviced passengers on Bulgarian river ports.
5. Increasing the number of serviced passengers on Bulgarian seaports.
6. Increasing the number of serviced passengers at the Bulgarian airports.

Note. Mirchova, S. (2014).

The current strategy to increase the number of passengers served by the different types of infrastructure in Bulgaria shows the need to implement a set of actions, some of which require a change of approach, a more efficient organization of work, new partnerships. However, other actions involve investing in technical equipment, equipment or human resources. The possible funding sources for these actions can be public, private and EU-funded. The expected main

results of the implementation of the strategy are increasing the number of serviced passengers from different types of infrastructure in Bulgaria, such as developing the local economy, improving and facilitating the access of local residents to transport services and attracting new passengers passing through the territory of Bulgaria and using the transport infrastructure of our country.

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