

FORECASTING OF THE NUMBER OF THE INTERNATIONAL TOURISM ARRIVALS FOR THE NEEDS OF THE BULGARIAN INTERNATIONAL AIRPORTS

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Abstract:

The international airports in Bulgaria are put under serious pressure by the low cost carriers to make innovations that would allow them to attract a greater passenger flow. The problem of forecasting of the international tourism arrivals on place is crucial to the formation of proper innovation infrastructure policy for the future development of the airports.

This paper proposes present paper regards several major problems in the application of exponential smoothing methods for the purpose of the international tourism arrivals on the Bulgarian international airports (the Sofia International Airport in particular), such as: (i) the problem of determining the time series pattern; (ii) the selection of a suitable forecasting method; (iii) Calculating of short-run and long-run forecasts; and (iv) the comparison of the results of the forecast techniques on the basis of the errors in the forecasts. In regards to the time series available the Holt-Winters smoothing method is being suggested as the most appropriate for the needs of the Bulgarian airports and the process of planning of their infrastructure. The paper also provides some conclusions and recommendations for the innovation infrastructure policy of the Bulgarian international airports on the attraction of the budget, low-cost carriers Suggestions are also given for the necessary improvements in the airport infrastructure.

Key words: international tourism arrivals, international airports, innovation infrastructure policy, exponential smoothing, forecasting

1. INTRODUCTION

Most of the Bulgarian international airports are located in the central part of the country like the Sofia airport and Plovdiv airport. The Varna airport and Burgas airport are located on the Bulgarian Black seaside in the largest resort cities Varna and Burgas. Bulgaria is part of the rapid aviation growth during the 20s and 30s of 20th century, the first aircraft flights being performed from natural surfaces. The first airfield in the city of Sofia could be found on the territory of present Central Railway Station. 1922 marked the first commercial air transport service in Bulgaria. Bulgaria was among the first states to sign the Chicago Convention which established civil aviation rules.

Since the early 30s of 20th century, all flights were operated from the unpaved runway in the village of Vrazhdebna region, later chosen for the construction of a civil airport by a Decree of Tzar Boris III, dated 16 September 1937. This is considered to be the birth date of Sofia Airport. Airport construction was carried out under the governance of the Directorate of Civil Aviation to the Ministry of Railways, Posts and Telegraphs. In 1939 Sofia Airport opened its first passenger waiting-room, and two years later it was followed by a completely finished airfield with a paved runway. Nine years later, the first concrete runway was constructed of 1050 meters in length. On the 29-th June 1947 the first scheduled passenger flight from Sofia to Burgas was launched officially. In 1949 Bulgarian-Soviet Transport Aviation Corporation TABSO was established to merge together civil aircraft stock and commercial airports. TABSO set the beginning of scheduled international flights operating on routes connecting Sofia to other European capital cities. From 1951 to 1965 the passenger terminal and the runway were renovated by stages, the runway being extended to 2720 m to accommodate modern large turbo-jet aircraft.

The years that followed were characterized by rapid air traffic growth which required multifold capacity increase – a separate terminal was appointed for domestic flights to Varna, Burgas, Ruse, Gorna Oryahovitsa, Vidin, and Targovishte, and later a new building was constructed to accommodate passengers arriving from international flights. Meanwhile, the runway underwent repair works several times, new aeronautical equipment was installed corresponding to the dynamically changing requirements of modern turbo-jet civil aviation. In 1985 passenger halls were reconstructed and expanded, and a zone for transfer passengers was separated, who at that time formed about 20 % of Sofia Airport traffic.

The early 90s saw economic transformations in Bulgaria oriented to the economic principles of the free market. By a Decision of Council of Minister of the Republic of Bulgaria Sofia Airport EOOD was established as an independent entity, and later it was transformed into a sole owner joint stock company (EAD) with 100 % state participation. At the dawn of the new century, a new Master Plan for the extension and modernization of Sofia Airport existing infrastructure was adopted, with a main objective to prepare Sofia Airport for new market challenges and ensure the capacity necessary for the rapid aviation industry development through providing a contemporary airport services standard and high level of safety and security of flights.

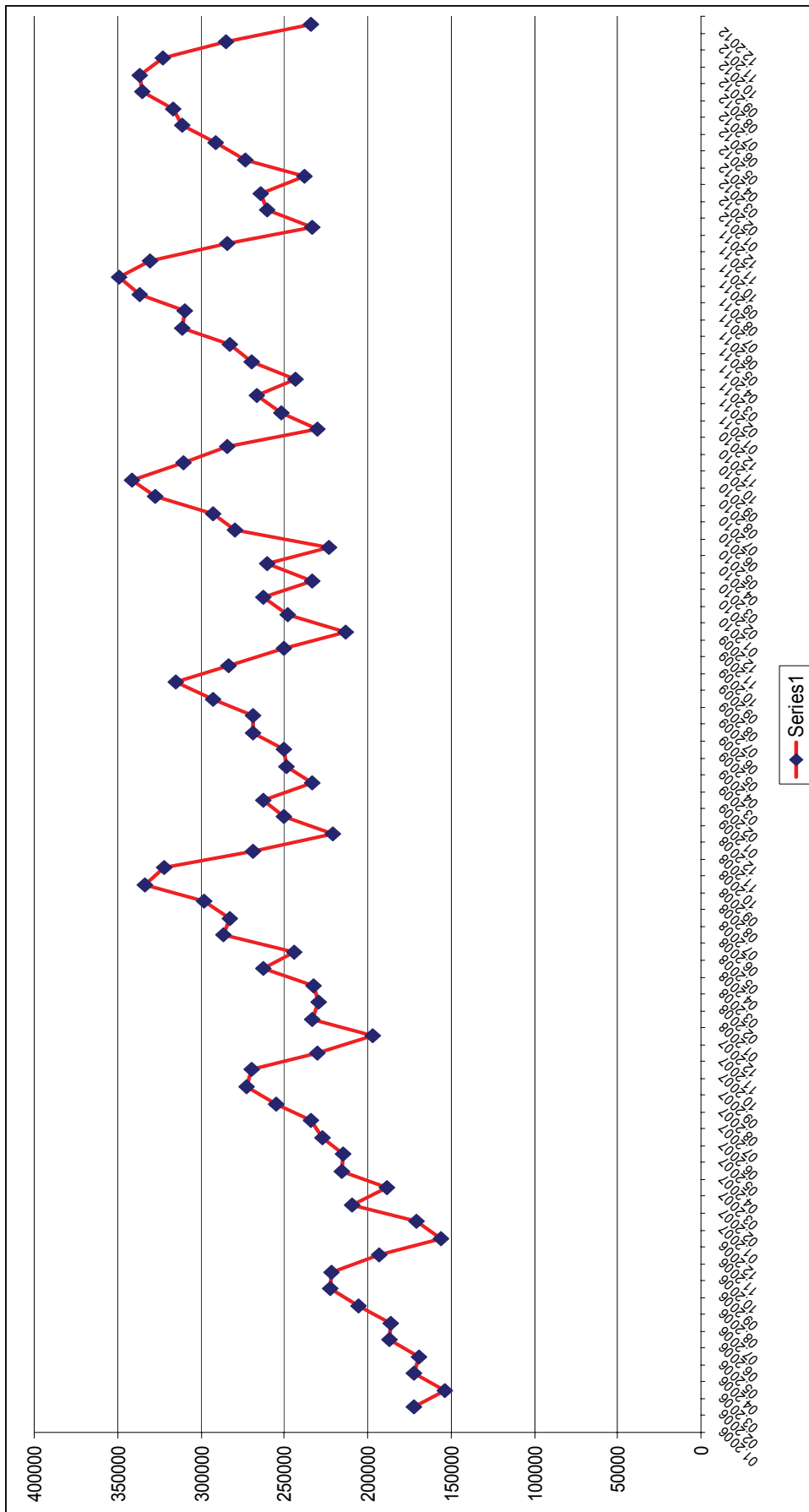
In 2011, on the territory of Sofia Airport, the construction of a new control tower of Directorate Generale “Air Traffic Control” began, the tower being located in near vicinity to Terminal 2. The opening of the tower, which should happen by the end of 2012, will result in the improvement of aeronautical services quality and efficiency in the airport zone. The 50 m high tower is characterized not only by great functionality, but also by a modern architectural design. Future infrastructure plans of Sofia Airport include the construction of new taxiways, aiming at aircraft movement optimization and reducing taxiing time after landing and before take-off, the extension of apron area, the delivery and installation of two additional passenger boarding bridges, some interior re-organization, such as Terminal 2 passenger gallery extension and building new bus exits, increasing the space for commercial purposes. The infrastructural modernization and improvements have resulted in a follow up increase in the number of the passengers serviced though, of course, this increase has been affected also by other factors.

As it is seen from the statistical monthly records of the passengers flows on the Sofia airport, the number of passengers is slowly but steadily increasing within the period from 2006 to 2012 (Table 1). This increase however is accompanied with a strongly expressed multiplicative seasonality (Chart 1).

Table 1: Passengers Traffic on the Sofia Airport within the period from 2006 to 2012

Months	Passengers						
	Years						
	2006	2007	2008	2009	2010	2011	2012
January	172 220	209 106	229 704	262 506	262 596	266 522	264 225
February	153 359	188 575	232 048	233 107	233 319	243 107	237 600
March	172 388	215 823	262 418	249 018	260 452	269 332	273 463
April	169 119	214 766	244 359	249 904	223 114	282 694	291 272
May	187 177	227 006	286 702	269 060	279 583	310 866	311 394
June	186 397	233 989	282 535	268 440	292 618	309 792	316 774
July	205 708	254 468	297 873	292 752	327 101	336 506	335 292
August	222 481	272 764	333 230	314 785	341 635	349 016	336 422
September	221 577	269 776	322 077	283 070	310 121	330 316	322 690
October	192 742	230 087	268 626	250 478	284 546	283 829	285 216
November	155 938	196 877	220 554	213 218	229 806	233 050	234 168
December	170 498	233 093	250 570	247 766	252 045	259 969	258 939
Monthly average	184134	228861	269225	261175	274745	289583	288955

Chart 1: Number of passengers serviced on the Sofia International Airport



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 an international airport, meets with solving of several major problems:

- (i) 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);
- (ii) Determining the time series pattern, or the so-called "forecast profile"(Gardner, 1987:174-175) (Hyndman, Koehler, Ord and Snyder, 2008:11:23) and the quality of the data in the pattern, on the basis of which to select the suitable forecasting exponential smoothing model.
- (iii) Selecting and using of suitable forecasting techniques;
- (iv) Calculating of long-run forecasts for the value of the above-mentioned general indicator (up to the year 2022).

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 Sofia International Airport has published its monthly statistical records of serviced passengers, already presented in point 2 of the present paper.

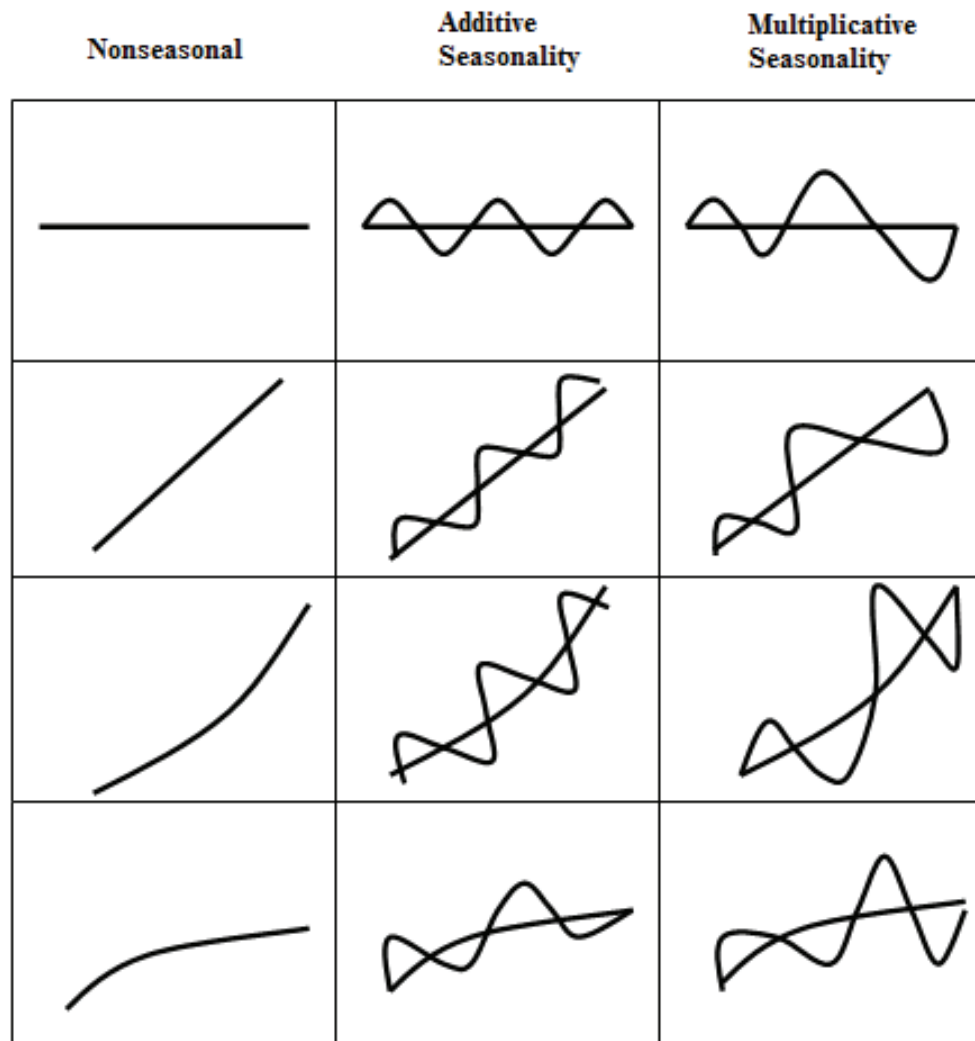
The second problem of determining the times series pattern, or the so-called times series' "forecast profile" is usually solved by comparing the times series in regard with a pre-set classification of exponential smoothing methods or the derived form them forecast profiles in terms of development curves. As Hyndman, Koehler, Ord and Snyder point out (Hyndman et al., 2008:11-12), this classification of smoothing methods originated with Pegles' taxonomy (Pegles, 1969:311-315). This was later extended by Gardner (Gardner, 1985:1-28) and modified by Hyndman et al. (2002, 2008) and extended by Taylor (Taylor, 2003:715-725) giving a classification set of fifteen models (Table 2). 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 (Chart 6).

Table 2: Classification of forecasting methods

Trend component	Seasonal component		
	N (None)	A (Additive)	M (Multiplicative)
N (None)	N,N	N,A	N,M
A (Additive)	A,N	A,A	A,M
A _d (Additive damped)	A _d ,N	A _d ,A	A _d ,M
M (Multiplicative)	M,N	M,A	M,M
M _d (Multiplicative damped)	M _d ,N	M _d ,A	M _d ,M

Source: Hyndman et al. (2008), p.12, cited by Dimitrov, P. (2012, pp.104-114)

Chart 2: Forecast profiles from Exponential Smoothing Models by Gardner (1987), cited by Dimitrov (2012, pp.104-114)



A simple visual comparison of the time series of the passengers serviced on the Sofia International Airport for the time period 2006 – 2012 with the Gardner’s classification shows out that these particular time series comes into the “linear trend, multiplicative seasonal” profile. Of course with the help of more sophisticated statistical analysis, such as the linear trend estimation by the use of the least squares method and etc., it can be also proved that these very same time series comes into the “A,M” variation of Taylor’s patterns of forecasting methods that requires the presence of a trend but with no seasonal components.

The finding that the time series of the number of the passengers serviced on the Sofia International Airport for the time period 2006 – 2012 correspond to the “linear trend, multiplicative seasonal” profile and require the “A,M” 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. As both Gardner and Hyndman et al. point out this profile corresponds to the method of **triple exponential smoothing** in the presence of a linear trend and multiplicative seasonality, known as **the Holt-Winters method**. The mathematical notation of this method is as follows:

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

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

- The smoothing of the **trend** – “**T**”:

$$(2) \quad T_t = \beta(B_t - B_{t-1}) + (1 - \beta)T_{t-1} \quad 0 \leq \beta \leq 1$$

- The smoothing of the **seasonal factor** – “**S**”:

$$(3) \quad S_t = \gamma \frac{Y_t}{B_t} + (1 - \gamma)S_{t-m} \quad 0 \leq \gamma \leq 1$$

- The achieving of the **final forecast** “**F_{t+m}**” for “**t+m**” periods ahead in the future:

$$(3) \quad F_{t+k} = (B_{t-1} + kT_{t-1})S_{t+k-m},$$

Where:

„ α ”, „ β ” and „ γ ” are the smoothing constants for the level, the trend and the seasonality respectfully which could take values between 0 and 1.

In this situation, one can point out the most widely used values of the smoothing constants in the Holt-Winters method are: $\alpha=0.2$, $\beta=0.4$ and $\gamma=0.6$. Of course they could be determined on the basis of testing of different sets of values in order to achieve a minimum mean absolute percentage of error (MAPE).

Further to the general mathematical notation of the Holt-Winters method, it is need to present the **possible ways of achieving of the initial values (“t zero” values) of the level (the base) “B”, the trend “T” and the seasonal factor “S”.**

- **The initialization of the values of the level (the base) “B”** can be done by following the principle that:

$$B_{0+L} = Y_{1+L}, \text{ i.e.}$$

the initial value of level (the base) “B” correspond to the values of the sub-periods in the for the first recorded period (first recorded year).

- **The initialization of the trend “T”** is done through the use of the following equation (NIST, 2012):

$$(4) \quad T_0 = \frac{1}{L} \left(\frac{Y_{L+1} - Y_1}{L} + \frac{Y_{L+2} - Y_2}{L} + \dots + \frac{Y_{L+L} - Y_L}{L} \right),$$

Using equation (4) it can be computed that the T_0 for the regarded time series is equal to 3727.264.

- **The initialization of the seasonal indices “S”** is made by the use of the following 3 steps (NIST, 2012):

Step 1: Computing the yearly averages for each of the 7 years in the time series:

$$(5) \quad A_p = \frac{\sum_{i=1}^{12} Y_i}{12}, \quad p = 1, 2, \dots, 7$$

Step 2: Dividing the observed values in the time series by the appropriate yearly mean:

Y_1/A_1	Y_{13}/A_2	Y_{25}/A_3	Y_{37}/A_4	Y_{49}/A_5	Y_{61}/A_6	Y_{73}/A_7
Y_2/A_1	Y_{14}/A_2	Y_{26}/A_3	Y_{38}/A_4	Y_{50}/A_5	Y_{62}/A_6	Y_{74}/A_7
Y_3/A_1	Y_{15}/A_2	Y_{27}/A_3	Y_{39}/A_4	Y_{51}/A_5	Y_{63}/A_6	Y_{75}/A_7
Y_4/A_1	Y_{16}/A_2	Y_{28}/A_3	Y_{40}/A_4	Y_{52}/A_5	Y_{64}/A_6	Y_{76}/A_7
Y_5/A_1	Y_{17}/A_2	Y_{29}/A_3	Y_{41}/A_4	Y_{53}/A_5	Y_{65}/A_6	Y_{77}/A_7
Y_6/A_1	Y_{18}/A_2	Y_{30}/A_3	Y_{42}/A_4	Y_{54}/A_5	Y_{66}/A_6	Y_{78}/A_7
Y_7/A_1	Y_{19}/A_2	Y_{31}/A_3	Y_{43}/A_4	Y_{55}/A_5	Y_{67}/A_6	Y_{79}/A_7
Y_8/A_1	Y_{20}/A_2	Y_{32}/A_3	Y_{44}/A_4	Y_{56}/A_5	Y_{68}/A_6	Y_{80}/A_7
Y_9/A_1	Y_{21}/A_2	Y_{33}/A_3	Y_{45}/A_4	Y_{57}/A_5	Y_{69}/A_6	Y_{81}/A_7
Y_{10}/A_1	Y_{22}/A_2	Y_{34}/A_3	Y_{46}/A_4	Y_{58}/A_5	Y_{70}/A_6	Y_{82}/A_7

Y_{11}/A_1	Y_{23}/A_2	Y_{35}/A_3	Y_{47}/A_4	Y_{59}/A_5	Y_{71}/A_6	Y_{83}/A_7
Y_{12}/A_1	Y_{24}/A_2	Y_{36}/A_3	Y_{48}/A_4	Y_{60}/A_5	Y_{72}/A_6	Y_{84}/A_7

Step 3: Achieving the seasonal indices by computing the averages by each row in the matrix presented in step 2:

$$S_1 = (Y_1 / A_1 + Y_{13} / A_2 + Y_{25} / A_3 + Y_{37} / A_4 + Y_{49} / A_5 + Y_{61} / A_6 + Y_{73} / A_7) / 12$$

$$S_2 = (Y_2 / A_1 + Y_{14} / A_2 + Y_{26} / A_3 + Y_{38} / A_4 + Y_{50} / A_5 + Y_{62} / A_6 + Y_{74} / A_7) / 12$$

$$S_3 = (Y_3 / A_1 + Y_{15} / A_2 + Y_{27} / A_3 + Y_{39} / A_4 + Y_{51} / A_5 + Y_{63} / A_6 + Y_{75} / A_7) / 12$$

$$S_4 = (Y_4 / A_1 + Y_{16} / A_2 + Y_{28} / A_3 + Y_{40} / A_4 + Y_{52} / A_5 + Y_{64} / A_6 + Y_{76} / A_7) / 12$$

$$S_5 = (Y_5 / A_1 + Y_{17} / A_2 + Y_{29} / A_3 + Y_{41} / A_4 + Y_{53} / A_5 + Y_{65} / A_6 + Y_{77} / A_7) / 12$$

$$S_6 = (Y_6 / A_1 + Y_{18} / A_2 + Y_{30} / A_3 + Y_{42} / A_4 + Y_{54} / A_5 + Y_{66} / A_6 + Y_{78} / A_7) / 12$$

$$S_7 = (Y_7 / A_1 + Y_{19} / A_2 + Y_{31} / A_3 + Y_{43} / A_4 + Y_{55} / A_5 + Y_{67} / A_6 + Y_{79} / A_7) / 12$$

$$S_8 = (Y_8 / A_1 + Y_{20} / A_2 + Y_{32} / A_3 + Y_{44} / A_4 + Y_{56} / A_5 + Y_{68} / A_6 + Y_{80} / A_7) / 12$$

$$S_9 = (Y_9 / A_1 + Y_{21} / A_2 + Y_{33} / A_3 + Y_{45} / A_4 + Y_{57} / A_5 + Y_{69} / A_6 + Y_{81} / A_7) / 12$$

$$S_{10} = (Y_{10} / A_1 + Y_{22} / A_2 + Y_{34} / A_3 + Y_{46} / A_4 + Y_{58} / A_5 + Y_{70} / A_6 + Y_{82} / A_7) / 12$$

$$S_{11} = (Y_{11} / A_1 + Y_{23} / A_2 + Y_{35} / A_3 + Y_{47} / A_4 + Y_{59} / A_5 + Y_{71} / A_6 + Y_{83} / A_7) / 12$$

$$S_{12} = (Y_{12} / A_1 + Y_{24} / A_2 + Y_{36} / A_3 + Y_{48} / A_4 + Y_{60} / A_5 + Y_{72} / A_6 + Y_{84} / A_7) / 12$$

Based on these three steps, the seasonal indices for the regarded time series can be calculated (Table 3).

Table 3: Matrix of calculating of the initial seasonal indices

time period	2006	2007	2008	2009	2010	2011	2012	S	
1	0,935299	0,913682	0,853206	1,005095	0,955782	0,920364	0,914417	0,928263	S1
2	0,832868	0,823972	0,861912	0,892531	0,849221	0,839506	0,822275	0,846041	S2
3	0,936211	0,943032	0,974718	0,953451	0,947978	0,930068	0,946387	0,947406	S3
4	0,918458	0,938413	0,90764	0,956844	0,812078	0,97621	1,00802	0,931095	S4
5	1,016528	0,991895	1,064917	1,030189	1,01761	1,073494	1,077657	1,038899	S5
6	1,012292	1,022407	1,04944	1,027815	1,065054	1,069786	1,096276	1,04901	S6
7	1,117167	1,11189	1,106411	1,120902	1,190564	1,162035	1,160362	1,138476	S7
8	1,208258	1,191833	1,237739	1,205263	1,243464	1,205235	1,164273	1,208009	S8
9	1,203349	1,178777	1,196313	1,083831	1,128761	1,14066	1,11675	1,149777	S9
10	1,04675	1,005358	0,997776	0,959042	1,035674	0,980129	0,987062	1,001684	S10
11	0,846874	0,860248	0,819219	0,816379	0,836435	0,804777	0,810397	0,827761	S11
12	0,925947	1,018492	0,93071	0,948658	0,917379	0,897735	0,896124	0,933578	I12

Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013)

Having the initial values of the level (the base) “B”, the trend “T” and the seasonal factor “S”, one can proceed to the calculation of the forecast values themselves.

For the purpose of visualization of the results from the proposed forecast method for past and future periods, as well as the extent of achieved error, these results are presented in table and graphic form in Table 4 and Chart 3.

Table 4 and Chart 3 provide also a solution for the third and the fourth problems set for solving in the present paper, i.e. iii **“Calculating of long-run forecasts for the value of the above-mentioned general indicator (up to the year 2022)”**; and iv **“Comparing the results of the forecast techniques (the forecast models) on the basis of the errors in the forecasts”**.

4. CONCLUSIONS

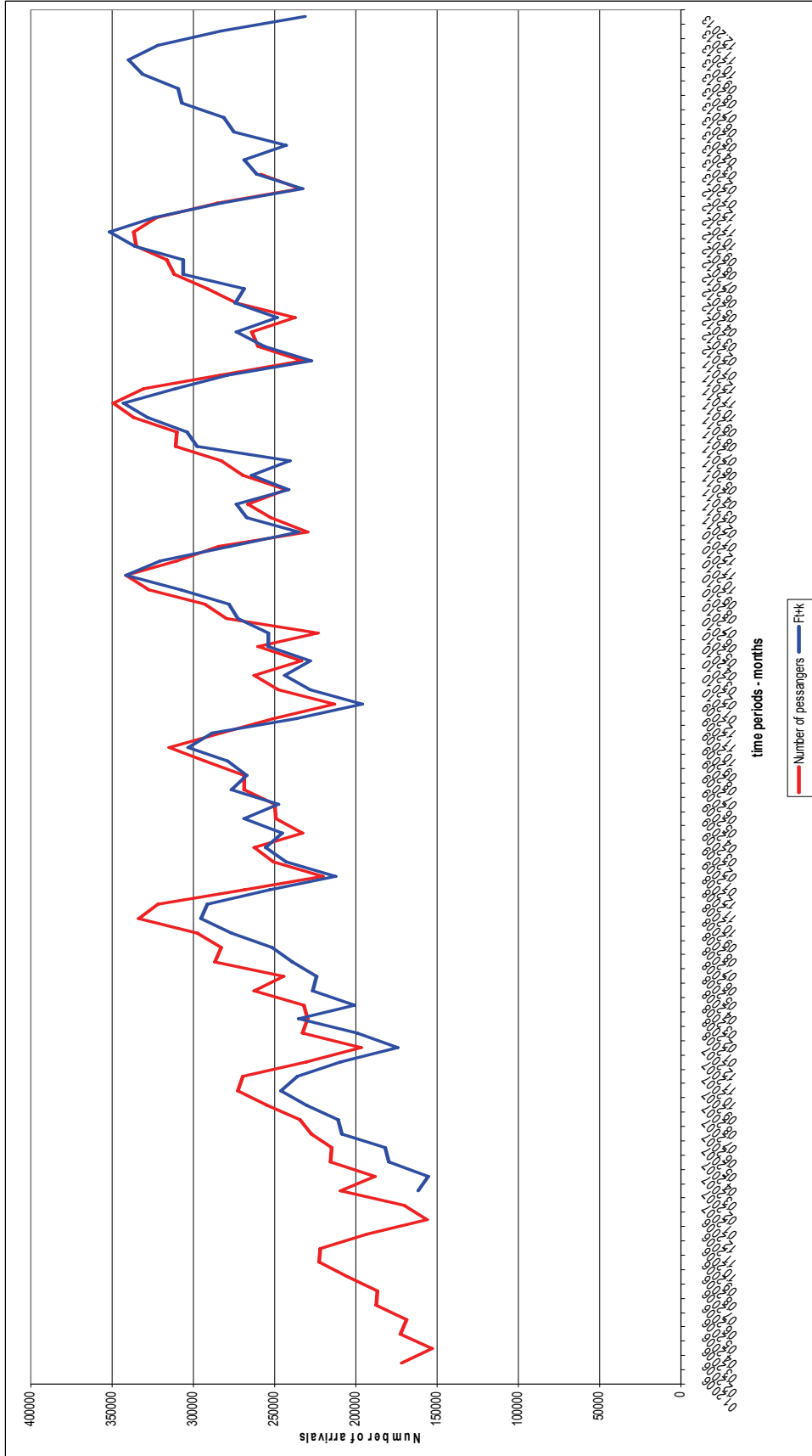
Based on the achieved forecast values in Table 4 and Chart 3, one can conclude that the seasonal variation in the number of the serviced passengers on the Sofia International Airport will remain approximately unaltered. This strongly requires a change in the policy of infrastructure investment of the airport authorities, if they would like to achieve a steadier trend of increase and overcoming of the high seasonal fluctuation.

Table 2: Calculating of the forecasts – through the use of a triple exponential smoothing (the Holt-Winters method)

(α=0.2, β=0.4, γ=0.6)		T0		3727,264	
Time periods (months)	Number of passengers	Bt	Tt	St	Ft+k
1.2006	172 220	172220	3727,264	0,928263	
2.2006	153 359	153359	3727,264	0,846041	
3.2006	172 388	172388	3727,264	0,947406	
4.2006	169 119	169119	3727,264	0,931095	
5.2006	187 177	187177	3727,264	1,038899	
6.2006	186 397	186397	3727,264	1,049010	
7.2006	205 708	205708	3727,264	1,138476	
8.2006	222 481	222481	3727,264	1,208009	
9.2006	221 577	221577	3727,264	1,149777	
10.2006	192 742	192742	3727,264	1,001684	
11.2006	155 938	155938	3727,264	0,827761	
12.2006	170 498	170498	3727,264	0,933578	
1.2007	209 106	178469,7	5425,057	1,074302	161727
2.2007	188 575	184372,2	5616,023	0,952093	155582
3.2007	215 823	190076,8	5651,433	1,060234	179996
4.2007	214 766	195211,5	5444,771	1,03254	182241
5.2007	227 006	196888,7	3937,724	1,107339	208462
6.2007	233 989	199140,5	3263,372	1,124601	210669
7.2007	254 468	201033,9	2715,367	1,214868	230432
8.2007	272 764	203004,6	2417,483	1,289385	246131
9.2007	269 776	206348,5	2788,062	1,244339	236190
10.2007	230 087	208037	2348,24	1,064268	209489
11.2007	196 877	211016,3	2600,678	0,890901	174149
12.2007	233 093	215766,7	3460,546	1,021612	199428
1.2008	229 704	211036,7	184,3351	1,082794	235516
2.2008	232 048	213081,3	928,458	1,034244	201102
3.2008	262 418	215445,8	1502,877	1,154907	226900
4.2008	244 359	215332,5	856,38	1,093895	224008
5.2008	286 702	220898	2740,016	1,221672	239394
6.2008	282 535	224353,9	3026,408	1,205436	251503
7.2008	297 873	226348,8	2613,777	1,275542	276237
8.2008	333 230	230833,3	3362,057	1,381912	295221
9.2008	322 077	234202,9	3365,095	1,322859	291418
10.2008	268 626	235964,6	2723,74	1,108757	252836
11.2008	220 554	236203,7	1729,887	0,916607	212648
12.2008	250 570	235248,4	655,8029	1,047722	243076
1.2009	262 506	236538	909,3388	1,098988	255436
2.2009	233 107	233665,4	-643,4464	1,01252	245579
3.2009	249 018	228773,5	-2302,837	1,115058	269003
4.2009	249 904	228024,4	-1681,358	1,09513	247735
5.2009	269 060	224275,3	-2508,433	1,20848	276517
6.2009	268 440	221537,3	-2600,245	1,209203	267326
7.2009	292 752	221041,2	-1758,596	1,30487	279263
8.2009	314 785	219701,2	-1591,151	1,412437	303029
9.2009	283 070	215865,6	-2488,936	1,315938	288529
10.2009	250 478	215695,3	-1561,505	1,140258	236583
11.2009	213 218	217695,6	-136,7664	0,954302	196277
12.2009	247 766	220928	1210,881	1,091976	227941
1.2010	262 596	223803,6	1876,787	1,143594	244128
2.2010	233 319	225644,4	1862,403	1,025415	228506
3.2010	260 452	229073,2	2488,965	1,128212	253683
4.2010	223 114	225350,3	4,185834	1,032098	253591
5.2010	279 583	228557,1	1285,259	1,217343	272336
6.2010	292 618	233324,4	2678,056	1,236156	277926
7.2010	327 101	238201,8	3557,794	1,345874	307953
8.2010	341 635	240209,6	2937,81	1,418317	341470
9.2010	310 121	241291,9	2195,598	1,297527	319967
10.2010	284 546	244191,8	2477,31	1,155257	277639
11.2010	229 806	243624,9	1259,655	0,947687	235397
12.2010	252 045	240094,3	-656,4465	1,066655	267408
1.2011	266 522	237185,3	-1557,475	1,13165	273820
2.2011	243 107	235674,7	-1538,756	1,029088	241616
3.2011	269 332	234293,5	-1475,722	1,141015	264155
4.2011	282 694	242211,9	2281,934	1,11312	240291
5.2011	310 866	243814,2	2010,066	1,251945	297633
6.2011	309 792	243030,7	892,653	1,259284	303877
7.2011	336 506	241583,9	-43,12857	1,374099	328290
8.2011	349 016	240132,4	-606,4799	1,439386	342581
9.2011	330 316	241264,1	88,8125	1,340474	310791
10.2011	283 829	240166,4	-385,8046	1,171184	278825
11.2011	233 050	240308,3	-174,7325	0,960953	227237
12.2011	259 969	241516,5	378,4423	1,072504	256140
1.2012	264 225	241156,5	83,06202	1,110055	273740
2.2012	237 600	240333	-279,5542	1,004812	248257
3.2012	273 463	241380,3	251,1803	1,136154	273904
4.2012	291 272	243613	1043,799	1,162628	268965
5.2012	311 394	243028	392,2776	1,269563	306297
6.2012	316 774	244018,4	631,5398	1,282607	306535
7.2012	335 292	244051	391,9393	1,373956	336173
8.2012	336 422	242471,2	-396,7533	1,408238	351848
9.2012	322 690	242051,6	-405,903	1,336077	324494
10.2012	285 216	242655,5	-1,969703	1,17371	283011
11.2012	234 168	243000,8	136,95	0,962572	233179
12.2012	258 939	242384,7	-164,2675	1,06998	260766
01.2013					268878
02.2013					243221
03.2013					274826
04.2013					281039
05.2013					306680
06.2013					309620
07.2013					331446
08.2013					339485
09.2013					321869
10.2013					282561
11.2013					231573
12.2013					257238

Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013)

Chart 3: Plotting of the forecasts – through the use of a triple exponential smoothing (the Holt-Winters method)



Source: Mirchova, S. (2013) based on data provided by the Sofia International Airport, calculations made by Dimitrov, P. (2013)

One possible solution in this regard can be improvements aimed at attracting more low-cost budget carriers, such as: (i) providing of direct access of the passengers to the aircrafts without the use of transfer busses and/or gate connection arms; (ii) low-cost restaurants and food selling points; (iii) waiting areas furnished with armchairs and semi-folded beds and etc. and (iv) creation of a marketing department that will have a s a main task to attract the low-cost budget airlines to the Sofia International Airport.

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