PAPER • OPEN ACCESS

Comparison between multiplicative Holt Winter and decomposition method in predicting the number of incoming international tourists to Indonesia

View the article online for updates and enhancements.

Comparison between multiplicative Holt Winter and decomposition method in predicting the number of incoming international tourists to Indonesia

A Supriatna[1], E Lesmana[1], L Aridin[1], Sukono[1], H Napitupulu[1]

[1]Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran, Bandung, INDONESIA

Corresponding author: sukono@unpad.ac.id

Abstract. Indonesia has a remarkable potential in tourism sector, hence government should regulate all matters related with tourism and pay more attention to the developments happening in the tourism sector, including policy-making and planning. One way to aid the government in policy making and planning is by conducting a prediction about the number of incoming international tourists to Indonesia. This paper will elaborate the analysis about the comparison between multiplicative Holt-Winter and decomposition method in predicting the number of incoming international tourists to Indonesia. This paper aims to determine the appropriate forecasting method suitable for the available data pattern and provides more accurate forecasting result. Forecasting could be conducted using multiplicative Holt-Winter method and decomposition method. Meanwhile to determine the error level and forecast accuracy, mean absolute percentage error (MAPE) is used. Analysis result showed that prediction using Holt-Winter method provides MAPE of 4.7098%, meanwhile the MAPE for decomposition method is 3.3254%. It could be concluded that to determine the number of incoming international tourist to Indonesia, decomposition method is more appropriate.

1. Introduction

Geographically, Indonesia has shoreline length of more than 95,181 km, consisted of 13,446 islands and ocean area about 3.1 million km^2. Indonesia is known for its diversity either in its natural or human resources. In terms of human resources, Indonesia owns 1128 ethnicities, 746 languages and dialects alongside various cultural expressions and their traditional customs [1]. These properties and cultural heritages have been globally acknowledged as world cultural heritage sites (8 cultural heritage). Meanwhile, in natural resource sector, Indonesia owns 51 national parks with their own biodiversity, 35 primate species, 25% endemic species, habitat for 16% of reptiles and amphibians existing in the world, and also a habitat for 17% of all known birds species in the world. All these wealth and diversity are a potential for Indonesia to excel in tourism sector [1].

The contribution of tourism sector towards world gross domestic product (GDP) is 9%, 1 out of 11 job vacancies are created by tourism sector and its contribution towards world export value is USD 1.4 trillion or approximately 5% of all current exports in the world [2][3][4]. On national scale, the tourism sector ranked fourth in the highest foreign exchange income after oil and gas, coal and palm [1]. Though the tourism potential in Indonesia is currently up to par, this does not necessarily mean to hold back development measures. The role of the government as a facilitator and dynamist essentially means that the government has a task to create policy and planning. In terms of tourism policy and planning, Veal [5], described this framework of tourism as a system which is not to be separated from

one another. There are five interconnected elements involved in policy making and planning related to tourist destination; those elements are: man or society, organization, facility and service related to tourism, environment and process. Hence, in policy making and planning, the government should pay a better attention towards those five elements. For policy making and planning in tourism, the role of tourism arrival forecasting is highly necessary [6][7][8].

Rosy and Ponnusamy [9], applied Holt-Winter method in their study to forecast hotel room availability. This forecasting is based on a problem about the fluctuating hotel room request on day of arrival and has a tendency to be uncertain. The forecasting method on the study is a quantitative method, and its result showed that the applied forecasting method could express actual data pattern. The authors agreed that in the uncertainty of the economy variable, forecasting method could be applied in planning and policy making on hotel room availability. Similar studies which applied Holt-Winter method had also been done by Rajchakit [10], Mamula & Duvnjak [7], Blagojevic et al. [11] and Tratar [12]. Konarasinghe [3] conducted forecasting method review for tourist arrival growth incoming from Western Europe countries to Sri Lanka. The forecasting method is conducted using additive decomposition and multiplicative method. Residual plot and Anderson-Darling statistics are applied as goodness of fit test in model validation. Among those two forecasting techniques, the method which yield the least error is selected. Analysis result showed that additive decomposition method is the most suitable method to forecast incoming tourist arrival from Western Europe countries. The author also stated that tourist arrival forecasting is a very necessary discipline in planning, resources management and other decision making process in either micro or macro level. Another study which applied this decomposition method is also conducted by Yahya et al. [13], Rajchakit [10] and Çuhadar [14].

Referring to the commentary above, this paper analyzes the comparison between two methods, i.e. the multiplicative Holt-Winter method and decomposition method to predict the number of international tourist arrival to Indonesia. This study aims to obtain an appropriate forecasting method suitable for the available international tourist arrival data pattern and obtain a more accurate forecast result, i.e. one with least error level. This forecasting is necessary in aiding stakeholders to arrange tourism plan and policy in Indonesia.

2. Materials and methods
This section will elaborate the material and method involved in this study. Material refers to the data being used in this study including the source of the data. Meanwhile, method refers to the model and approach to analyze the data.

2.1. Materials
The object of this study was international tourists arriving in Indonesia through 19 main entries. The analyzed data were data comprising international tourist's arrival from July 2013 to June 2017. This tourist arrival data was a secondary data obtained from Statistics Indonesia (https://www.bps.go.id). The international tourist arrival data was shown on Table 1 and charted on Figure 1. The forecasting techniques being used in this study were Holt-Winter and decomposition. The data were analyzed using software Microsoft[®] Excel and Minitab[®] 16.

Table 1. Data of international tourist's arrival to Indonesia

Period (t)	Month	Data	Period (t)	Month	Data
1	Jul-13	681,092	25	Jul-15	775,552
2	Aug-13	735,043	26	Aug-15	813,185
3	Sep-13	734,055	27	Sep-15	822,922
4	Oct-13	682,006	28	Oct-15	790,162
5	Nov-13	765,857	29	Nov-15	723,069
6	Dec-13	802,586	30	Dec-15	862,556
7	Jan-14	716,419	31	Jan-16	698,057
8	Feb-14	662,260	32	Feb-16	768,118
9	Mar-14	724,901	33	Mar-16	806,118
10	Apr-14	689,157	34	Apr-16	811,233
11	May-14	714,353	35	May-16	841,723
12	Jun-14	815,011	36	Jun-16	784,155
13	Jul-14	742,843	37	Jul-16	931,694
14	Aug-14	793,740	38	Aug-16	944,455
15	Sep-14	755,664	39	Sep-16	922,608
16	Oct-14	768,787	40	Oct-16	913,589
17	Nov-14	723,456	41	Nov-16	855,545
18	Dec-14	860,394	42	Dec-16	957,828
19	Jan-15	671,939	43	Jan-17	902,975
20	Feb-15	743,498	44	Feb-17	838,686
21	Mar-15	739,821	45	Mar-17	909,182
22	Apr-15	708,818	46	Apr-17	966,936
23	May-15	751,627	47	May-17	938,638
24	Jun-15	778,056	48	Jun-17	910,931

The data presented in table 1 can also be presented in graphical form as given in Figure 1.
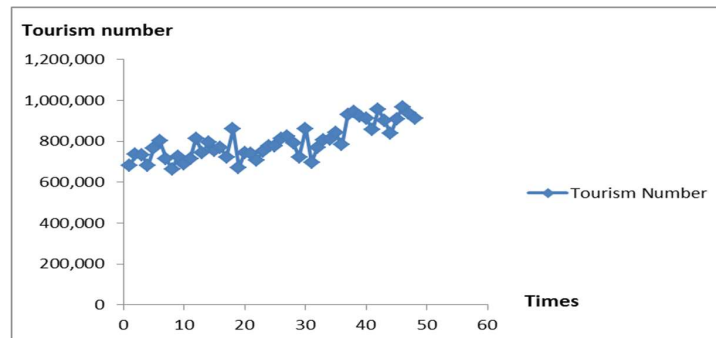
Figure 1. Data of international tourist's arrival to Indonesia

2.2. Methods

This section will comprise applied techniques in data analysis for international tourist arrival to Indonesia forecasting.

2.2.1. Holt-Winter Method

According to Sood & Jain [15], Cankurt & Subasi [16], and Padhan [17], forecasting is a branch of statistics which resembles an important element in decision making. Rosy and Ponnusamy [9] suggested that statistically, multiplicative Holt-Winter forecasting method has three equations which were slightly different with additive Holt-Winter method. The three equations in multiplicative Holt-Winter method are as follows:

- Determine the overall smoothing value using the equation below:

$$F_t = \alpha \frac{X_t}{I_{t-1}} + (1-\alpha)(F_{t-1} + T_{t-1}).$$ (1)

- Determine the trend smoothing value using the equation below:

$$T_t = \beta(F_t - F_{t-1}) + (1-\beta)T_{t-1}.$$ (2)

- Determine the seasonal smoothing value using the equation below:

$$S_t = \gamma \frac{X_t}{F_{t-1}} + (1-\gamma)S_{t-1}.$$ (3)

- In the end of period t, the forecasting value for the period of $t+k$ is determined using the equation below:

$$\hat{Y}_{t+m} = (F_t + T_t m)S_{t-L+m}.$$ (4)

With F_t as the forecasting smoothing value for the period of t; X_t as the actual value for the period of t; T_t as the trend smoothing value for the period of t; S_t as seasonality component value for the period of t; $\hat{Y}_t$ as forecasting value on period t for the m consecutive periods; m as the number of forecasted periods. The α as the smoothing parameter for trend ($0<\alpha<1$); β as the smoothing parameter for trend ($0<\beta<1$); γ as the number of forecasted periods. The α as the smoothing parameter for trend ($0<\gamma<1$); and L as the number of period within a seasonal cycle.

2.2.2. Decomposition method
Konarasinghe [3] and Petrevska [18] suggested that the decomposition method is a forecasting method which requires four main components to forecast future values. Those four components are trend, seasonality, cycle and error. The decomposition method is based on the assumption that the present data are a combination of several components which could be simplified into:

$$X_t = f(T_t, S_t, C_t, E_t).$$

Simple moving data average decomposition method (classic decomposition) assumes that the multiplication could be written mathematically as follows:

$$Y_t = T_t \times S_t \times C_t \times E_t,$$ (5)

with X_t as periodic sequence value (actual data) during period of t; T_t as trend component value during the period of t; S_t as seasonality component value during the period of t; C_t as cycle component value during the period of t; E_t random (irregular) error component value during the period of t; $\hat{Y}_t$ as prediction value for the period of t.

To solve equation (5), several steps should be followed as shown below:
- On actual data X_t, the calculation of moving average which length was represented as p equals to the length of seasonality (e.g.: 12 months, 4 quarters or 7 days). This is to assume the association with trend and cycle. Hence, an equation is known as:

$$M_t = T_t \times C_t.$$ (6)

- To determine the effect of seasonality S_t, equation (5) is divided by equation (6), thus a new equation is obtained as below:

$$\frac{Y_t}{M_t} = S_t \times E_t.$$ (7)

- Identify the appropriate trend effect towards the data using the smallest regression and quadratic method, thus, an equation is obtained as follows:
Linear trend is shown below:

$$\hat{T}_t = a + bt,$$

Quadratic trend is shown below:

$$\hat{T}_t = a + bt + ct^2,$$

Cubic trend is shown below:

$$\hat{T}_t = a + bt + ct^2 + dt^3,$$ (8)

with a as intercept constant parameter and b, c, and d as coefficient parameter.
- To determine the effect of cycle C_t is by obtaining the division result of equation (6) with trend T_t, hence, an equation obtained is as follows:

$$\frac{M_t}{T_t} = C_t .\tag{9}$$

- To obtain forecasting result, the equation below is used:

$$\hat{Y}_t = T_t \times S_t \times C_t .\tag{10}$$

The residual value obtained by subtracting actual data and forecasting result on the period of t could be used to determine the accuracy of the prediction.

2.2.3. Forecasting accuracy

Forecasting (prediction) is conducted because of the presence of complexity and uncertainty faced by the forecasting model maker. A forecasting model is said to be highly accurate if the said model has the least error level [19; 20]. Several methods exist to measure the accuracy of a forecasting model, one of which is Mean Absolute Percentage Error (MAPE). The MAPE could be determined using the equation below:

$$MAPE = \left(\frac{1}{n} \sum_{t=1}^{n} \frac{|X_t - \hat{Y}_t|}{X_t} \right) \times 100\%,\tag{11}$$

With X_t as periodic sequence value (actual data) on the period of t, F_t as the forecasting value (data goodness of fit value) during the period of t and n as the number of forecasting periods [19; 20].

3. Result and analysis

This section will be displaying results which includes: forecasting using multiplicative Holt-Winter method and forecasting using multiplicative decomposition method.

3.1. Forecasting using multiplicative Holt-Winter method

By using the data on Table 1, referring to the discussion about Holt-Winter method, it was known that the prediction of the number of international tourist arrival could be conducting by following these steps: to determine overall smoothing value, equation (1) was used; to determine trend smoothing value, equation (2) was used; and to determine seasonal smoothing value, equation (3) was used. Hence, on the end of period t, the forecasting value for period $t + k$ was determined by using equation (4).

Meanwhile, the accuracy of the forecast was measured by using equation (10). Using Microsoft Excel software, parameter value which minimized the MAPE was obtained $\alpha = 0.143$, $\beta = 0.636$, and $\gamma = 0.94$. Forecasting result using multiplicative Holt-Winter method was presented on Table 2.

Table 2. Forecasting result using multiplicative Holt-Winter method

Month	$\hat{Y}_t$	Month	$\hat{Y}_t$	Month	$\hat{Y}_t$
Jul-14	683,156	Jul-15	737,535	Jul-16	892,039
Aug-14	754,606	Aug-15	774,094	Aug-16	952,440
Sep-14	770,908	Sep-15	732,836	Sep-16	955,799
Oct-14	723,681	Oct-15	744,308	Oct-16	906,907
Nov-14	835,308	Nov-15	723,936	Nov-16	828,869
Dec-14	863,882	Dec-15	859,799	Dec-16	990,174
Jan-15	775,225	Jan-16	694,630	Jan-17	792,520
Feb-15	698,363	Feb-16	768,337	Feb-17	895,362
Mar-15	771,060	Mar-16	783,189	Mar-17	926,257
Apr-15	725,596	Apr-16	769,945	Apr-17	918,149
May-15	744,715	May-16	841,663	May-17	958,946
Jun-15	845,977	Jun-16	907,931	Jun-17	910,851

The forecasting result presented on Table 2 could also be presented in forms of graph or chart as presented on Figure 2. This forecast using multiplicative Holt-Winter method yields MAPE error of 4.7098%, and thus, gave forecast accuracy of 95.2902%.
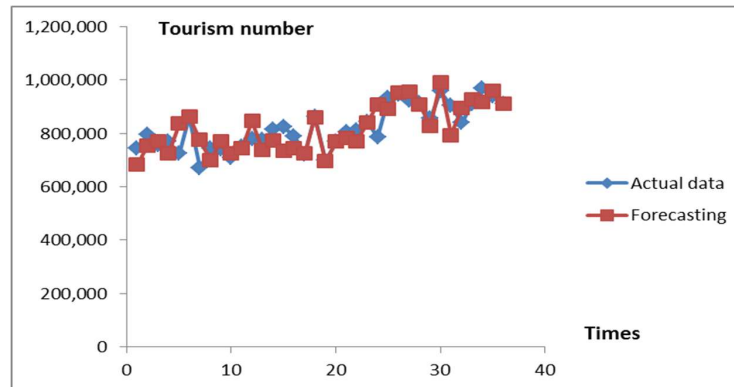
Figure 2. Actual data and forecasting using multiplicative Holt-Winter method

3.2. Forecasting using multiplicative decomposition method

By using data on Table 1 and referring to the discussion about multiplicative decomposition method, it was known that the prediction of the number of international tourist arrival could be conducted by following these steps: assumed effect of trend and cycle was obtained by using equation (6); seasonality effect S_t was determined using equation (7); the appropriate trend effect was identified by using equation (8), where a new equation was obtained as follows:

$$\hat{T}_t = 722031.313 + 385.303t + 50.082t^2 + 0.894t^3 ; \qquad (12)$$

Hence, cycle effect C_t was obtained by using equation (9). While forecast result could be obtained by using equation (10). The final forecasting result using multiplicative decomposition method was presented on Table 3.

Table 3. Forecasting result using multiplicative decomposition method

Month	$\hat{Y}_t$	Month	$\hat{Y}_t$	Month	$\hat{Y}_t$	Month	$\hat{Y}_t$
Jul-13	740,226	Jul-14	758,673	Jul-15	779,898	Jul-16	876,827
Aug-13	779,559	Aug-14	798,182	Aug-15	821,035	Aug-16	932,859
Sep-13	771,317	Sep-14	791,513	Sep-15	813,797	Sep-16	927,783
Oct-13	754,185	Oct-14	773,046	Oct-15	800,554	Oct-16	915,483
Nov-13	702,439	Nov-14	720,300	Nov-15	751,212	Nov-16	860,307
Dec-13	809,210	Dec-14	827,468	Dec-15	867,376	Dec-16	998,569
Jan-14	653,182	Jan-15	675,648	Jan-16	714,472	Jan-17	821,753
Feb-14	700,466	Feb-15	721,743	Feb-16	772,400	Feb-17	885,189
Mar-14	728,910	Mar-15	751,173	Mar-16	809,647	Mar-17	927,172
Apr-14	692,974	Apr-15	713,244	Apr-16	773,725	Apr-17	885,713
May-14	735,283	May-15	755,840	May-16	829,448	May-17	947,628
Jun-14	761,748	Jun-15	782,373	Jun-16	868,210	Jun-17	991,319

The forecasting result presented on Table 3 could also be presented in forms of graph or chart as presented on Figure 3. This forecast using multiplicative Holt-Winter method yields MAPE error of 3.3254%, and thus, gave forecast accuracy of 96.6746%.
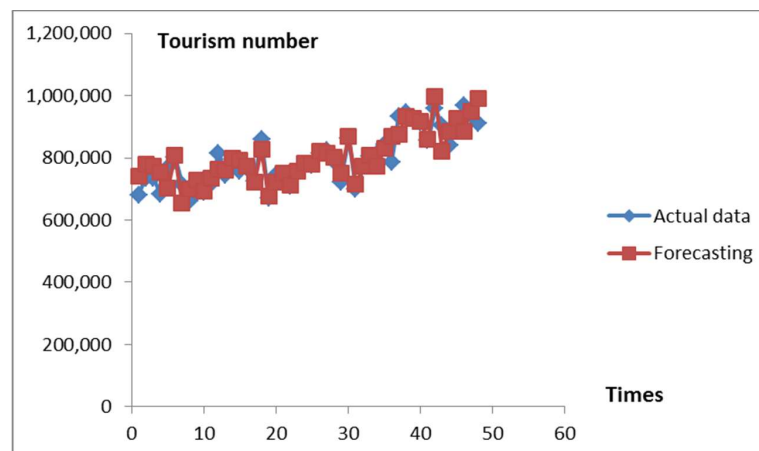
Figure 3. Actual data and forecasting result using multiplicative decomposition method

3.3. Discussion

Referring to the data presented on Table 1 and the graph on Figure 1, it was known that international tourist arrival to Indonesia during July 2013 to June 2017 was fluctuating each month; occasionally increased on certain month and decreased on the other. However, after paying a closer attention, Figure 1 showed that during the period of July 2013-June 2017, the tourist arrival trend had a tendency to increase. This showed that the tourist arrival to Indonesia was gradually increasing. Since tourism sector was a prime sector in economic growth in Indonesia, the tourism sector should be managed carefully. To be managed well, the tourism sector should be supported with proper planning and policies as well. Forecasting the international tourist arrival was one of the basic ways to plan and make certain policies in the tourism sector. The forecasting on this study was conducted using two approaches, i.e. the multiplicative Holt-Winter method and multiplicative decomposition method.

The forecasting using multiplicative Holt-Winter method was based on in sample data, with the result being presented on Table 2 and graph being presented on Figure 2. Referring to Figure 2, it was known that the forecast data graph plot using multiplicative Holt-Winter method almost overlaps the actual data. This forecast result yields MAPE error of 4.7098%, hence the forecast accuracy using multiplicative Holt-Winter method was 95.2902%. This simply meant that the multiplicative Holt-Winter method yields a high accuracy result given that the result was able to express actual data with an accuracy of 95.2902%.

The forecasting using multiplicative decomposition method was based on in sample data, with the result being presented on Table 3 and graph being presented on Figure 3. Referring to Figure 3, it was known that the forecast data graph plot using multiplicative decomposition method also almost overlaps the actual data. This forecast result yields MAPE error of 3.3254%, hence the forecast accuracy using multiplicative Holt-Winter method was 96.6746%. This simply meant that the multiplicative Holt-Winter method yields a high accuracy result given that the result was able to express actual data with an accuracy of 96.6746%.

Comparison of these two forecasting method as applied for forecasting international tourist arrival within the period of July 2013-June 2017 showed that the method with higher accuracy level was multiplicative decomposition method. Thus, in the future, this multiplicative decomposition method was proposed to be applied for forecasting as a basis in planning and policy making in tourism sector of Indonesia. The forecasting using out sample data for the period of July 2017-June 2018 was presented on Table 4.

Table 4. Forecast result for out sample data using multiplicative decomposition method

Month	S_t	$\hat{T}_t$	C_t	Forecasting ($\hat{Y}_t$)
Jul-17	101.7854	966,342.25	1.0136	996,972
Aug-17	106.8588	978,257.46	1.0117	1,057,585
Sep-17	105.4039	990,541.04	1.0095	1,053,988
Oct-17	102.7501	1,003,198.35	1.0071	1,038,106
Nov-17	95.4320	1,016,234.75	1.0046	974,274
Dec-17	109.6324	1,029,655.60	1.0021	1,131,207
Jan-18	89.5433	1,043,466.28	0.9996	933,980
Feb-18	95.3706	1,057,672.14	0.9972	1,005,884
Mar-18	98,7941	1,072,278.54	0.9950	1,054,051
Apr-18	93.3512	1,087,290.86	0.9930	1,007,894
Mey-18	98.8069	1,102,714.46	0.9914	1,080,188
Jun-18	102.2713	1,118,554.69	0.9900	1,132,521
TOTAL				12,466,650

Where S_t were calculated using equation (6), $\hat{T}_t$ equation (11) and C_t equation (8)? Meanwhile, forecasting $\hat{Y}_t$ was calculated using equation (9). Based on the forecasting result on Table 4, it could be concluded that the international tourist arrival during the period of July 2017-June 2018 was approximately 12,466,650 tourists.

4. Conclusion

This paper had analyzed the comparison between multiplicative Holt-Winter method and multiplicative decomposition method and their application in forecasting the number of international tourist arrival to Indonesia. The analyzed data was the international tourist arrival data during the period of July 2013-June 2017. Analysis result showed that the MAPE error using multiplicative Holt-Winter method was 4.7098%, hence forecasting accuracy of 95.2902%. Meanwhile, forecasting using multiplicative decomposition method yielded MAPE error of 3.3254%, hence forecasting accuracy of 96.6746%. Thus, forecasting using multiplicative decomposition method was better and recommended to analyze the current international tourist arrival data. Out sample data forecast result using multiplicative decomposition method revealed that the international tourist arrival during the period of July 2017-June 2018 was approximately 12,466,650 tourists.

References

[1]   Ratman, D.R. 2015. *Laporan Akuntabilitas Kinerja Deputi Bidang Pengembangan Destinasi dan Industri Pariwisata (LAKIP) Tahun 2015*. Kementerian Pariwisata Republik Indonesia. http://www.kemenpar.go.id/userfiles/LAKIP%20DEPUTI% 20BPDIP%202015.pdf

[2]   Karimi, A., Faroughi, P., and Rahim, K.A. 2015. Modeling and Forecasting of International Tourism Demand in ASEAN Countries. *American Journal of Applied Sciences*, 2015, 12 (7):pp. 479-486. DOI: 10.3844/ajassp.2015.479.486.

[3]   Konarasinghe, K.M.U.B. 2016. Decomposition Techniques on Forecasting Tourist Arrivals from Western European Countries to Sri Lanka. *Working Paper*, 13th International Conference on Business Management 2016. Institute of Mathematics and Management, Sri Lanka.

[4]   Konarasinghe, K.M.U.B. 2017. Model Comparison on Forecasting Tourist Arrivals to Sri Lanka from Western Europe. *International Journal of Novel Research in Physics Chemistry & Mathematics*, Vol. 4, Issue 2, pp: (28-35), Month: May- August 2017, Available at: www.noveltyjournals.com

[5]   Veal, A. J. 2002. *Leisure and tourism policy and planning*, 2nd Edition. Wallingford, UK: CABI Publishing.

[6]   Akuno, A.O., Otieno, M.O., Mwangi, C.W., and Bichanga, L.A. 2015. Statistical Models for Forecasting Tourists Arrival in Kenya. *Open Journal of Statistics*, 2015, 5, pp. 60-65. Published Online February 2015 in SciRes. http://www.scirp.org/journal/ojs. http://dx.doi.org/10.4236/ojs.2015.51008

[7]   Mamula, M. and Duvnjak, K. 2017. Modelling the Employment in Tourism–Case Study of Croatia. *International Journal of Business Administration*, Vol. 8, No. 3; 2017; pp. 37-444. oi:10.5430/ijba.v8n3p37 ; URL: https://doi.org/10.5430/ijba.v8n3p37.

[8]   Xiaoxuan, L., Qi, W., Geng, P., and Benfu, L. 2016. Tourism Forecasting by search Engine Data withNoise-Processing. *African Journal of Business Management*, Vol. 10(6), pp. 114-130, 28 March, 2016, pp. 114-130. DOI: 10.5897/AJBM2015.7945. Article Number: 9217D8757660. ISSN 1993-8233. Copyright © 2016Author(s) retain the copyright of this article. http://www.academicjournals.org/AJBM

[9]   Rosy, C.P. and Ponnusamy, P. 2017. Evaluating and Forecasting Room Demand in Tourist Spot using Holt-Winters Method. *International Journal of Computer Applications* (0975 – 8887), Volume 172 – No.2, August 2017, pp. 22-25. IJCA[TM]: www.ijcaonline.org.

[10] Rajchakit, M. 2017. A New Method for Forecasting via Feedback Control Theory. *Proceedings of the International MultiConference of Engineers and Computer Scientists*, 2017, Vol I, IMECS 2017, March 15 - 17, 2017, Hong Kong, pp. 1-6. ISSN: 2078-0958 (Print); ISSN: 2078-0966 (Online).

[11] Blagojevic, N.P., Vujko, A., and Gajic, T. 2016. Comparative Analysis of Exponential Smoothing Models to Tourists Arrivals in Serbia. *Economics of Agriculture*, 2016 (63) 3, pp. 835-845.

[12] Tratar, L.F. 2013. Improved Holt-Winters Method: A Case of Overnight Stays ofTourists in Republic of Slovenia. *Economic And Business Review*, VOL. 16, No. 1, 2013, pp. 5–17.

[13] Yahya, N.A., Samsudin, R., and Shabri, A. 2017. Tourism Forecasting using Hybrid Modified Empirical Mode Decomposition and Neural Network. *Int. J. Advance Soft Compu. Appl,* Vol. 9, No. 1, March 2017, pp. 14-31. ISSN 2074-8523.

[14] Cuhadar, M. 2014. Modelling and Forecasting Inbound Tourism Demand to Istanbul: A Comparative Analysis. *European Journal of Business and Social Sciences*, Vol. 2, No.12, pp. 101-119, March 2014, pp. 101 – 119. URL: *http://www.ejbss.com/recent.aspx*. ISSN: 2235-767X.

[15] Sood S, Jain K. 2017. Comparative Analysis of Techniques for Forecasting Tourists. Arrival. *Journal of Tourism Hospit* 6: 285, pp. 1-4. doi: 10.4172/21670269.1000285

[16] Cankurt, S. and Subasi, A. 2015. Developing tourism demand forecasting models using machine learning techniques with trend, seasonal, and cyclic components. *Balkan Journal of Electrical & Computer Engineering*, 2015, Vol.3, No.1, pp. 42-49. http://www.bajece.com.

[17] Padhan, P.C. 2011. Forecasting International Tourists Footfalls in India: An Assortment of Competing Models. *International Journal of Business and Management*, Vol. 6, No. 5; May 2011, pp. 190-202. www.ccsenet.org/ijbm.

[18] Petrevska, B. 2013. Empirical Analysis of Seasonality Patterns in Tourism. *(JPMNT) Journal of Process Management – New Technologies, International,* Vol. 1, No.2, 2013, pp. 87-95.

[19] Sukono, Sholahuddin, A., Mamat, M., Prafidya, K. 2014.Credit Scoring for Cooperative of Financial Services Using Logistic Regression Estimated by Genetic Algorithm. *Applied Mathematical Sciences*, Vol. 8, 2014, no. 1, 45 – 57. doi: 10.12988/ams.2014.310600.

[20] Sukono, Nahar, J., Mamat, M., Putri, F.T., and Supian, S. 2016. Indonesian Financial Data Modeling and Forecasting by Using Econometrics Time Series and Neural Network. *Global Journal of Pure and Applied Mathematics*. Vol.12, No.4, pp. 3745-3757.