Short- Term Forecasting of Tourist Arrivals to Sri Lanka from Asian Region

K.M.U.B Konarasinghe[1]

Introduction

Tourism has existed since the beginning of the time, motivated at first by food, water, safety, or acquisition of resources (trade). Today, tourism is a collection of activities, services, and industries which deliver a travel experience, including transportation, accommodations, eating and drinking establishments, retail shops, entertainment businesses, and other facilities and hospitality services provided for individuals or groups traveling away from home.

Tourism is one of the largest and fastest-growing industries in the world. According to World Travel and Tourism Council Reports (WTTC), the total contribution of travel and tourism to world GDP was 9.8% in 2014. Sri Lanka has a long history, as a highly attractive tourist destination due to various reasons. The Sri Lankan tourism industry has experienced a boom since 2008. The contribution of travel and tourism to the Sri Lankan GDP were LKR 462.1billion: 4.8% of the total in 2014 (WTTC, 2014). The Sri Lankan market receives tourists from all regions of the world, but is dominated by the Asian region.

Research Problem

Short term forecasting plays a vital role in the process of operational decision making in the tourism industry. Nisantha and Lelwala, (2011) (2011); Diunugala (2012); Konarasinghe (2015) and Konarasinghe (2016-a) have attempted to forecast total number of international tourist arrivals to Sri Lanka in the short-term. It is a known fact that expectations of tourists are not same for all regions. As such it is necessary to forecast the number of arrivals regionally, in order to satisfy the expectations of customers and to obtain the optimum benefits to the country. However, it was difficult to find any study which focused on regional forecasting of short-term arrivals.

Konarasinghe (2016-a, and 2016-b) confirmed that there is an increasing trend of tourist arrivals from the Asian region. Also, Konarasinghe (2016-b) has shown that the number of arrivals from the Asian region is significantly different to other regions.

[1] *Institute of Mathematics and Management, Nugegoda, Sri Lanka udaya35@yahoo.co.uk*

Objective of the Study

In view of the above, the study was focused on identifying suitable short term forecasting techniques to arrivals from Asian region to Sri Lanka.

Significance of the Study

Tourism is the third highest foreign income generator to the Sri Lankan economy (SLTDA, 2014). It provides diverse benefits to the country. The Sri Lankan economy can expect more benefits from the Asian arrivals due to the high headcount. However, these benefits will depend on effective forecasting. The results of this study could be applied to forecast arrivals from the Asian region. It will be a lighthouse for supply and demand management and policy development, and facilitates the satisfaction of customer needs and wants with optimum benefits.

Methodology

Monthly tourist arrival data from Asian region for the period from, January 2008 to December 2014 was obtained from Sri Lanka Tourism Development Authority (SLTDA). The Smoothing techniques; Moving Average (MA), Exponential Smoothing (ES) and Winter's Methods were tested in the model fitting process. The Residual plots, Anderson-Darling test and Auto-Correlation Function (ACF) were used as a model validation criterion. Mean Absolute Percentage Errors (MAPE) were used to select a suitable fitting model.

Results

Data analysis of the study consists six parts;

I Test Moving Average (MA) models
II Test Exponential smoothing models
Single Exponential Smoothing (SES)
Double Exponential Smoothing (DES)

Test Holts Winters three parameter model

Test Moving Average (MA) Model

The MA model is;

$$F_{t+1} = \frac{1}{n}\sum_{i=t+1-n}^{t} Y_i \qquad (1)$$

Where; Y_t = Observed value of time t, F_t= Forecasted value of time t

The model fitting process begins with Moving Average (MA) models. Single and centered MA were tested in various lengths. Table 1 shows the summary of output results. The MAPE of all the models is around 1.2%. The residuals of the models were normally distributed but not independent (Correlated), as such MA does not meet the validation criterion.

Table 1: Model Summary of Moving Average Models

Model	MAPE	Normality (P–value)	Independence of Residuals
MA 2	1.21157	0.520	No
MA 4	1.20534	0.117	No
MA 2*3	1.25048	0.608	No
MA 2*4	1.26312	0.085	No

Test Exponential Smoothing Model The SES model is;

$$F_{t+1} = \alpha Y_t + (1-\alpha)F_t \qquad (2)$$

Where, Y_t = observed value for time period t , F_t= fitted value for time period t, α = weighting factor.

The DES model is;

$$\begin{aligned} L_t &= \alpha Y_t + (1-\alpha)(L_{t-1} + T_{t-1}) \\ T_t &= \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1} \\ \hat{Y}_t &= L_{t-1} + T_{t-1} \\ F_{t+m} &= L_t + mT_t \end{aligned} \qquad (3)$$

Where, L_t : is the level at the end of period t , α is the weight of level, T_t = is the estimated trend at the end of period t, β is the weight of trend, m = is the forecast horizon. The SES and DES models were tested for various levels of the model parameters. The seasonal length is taken as 2.

Testing SES models are the second step of the smoothing techniques. SES models were tested for various α (level) values. The seasonal length is taken as 2. The residuals of each model were tested for normality and independence by Anderson-Darling test and ACF respectively.

Table 2: Model Summary of Single Exponential Smoothing Models

Model (α)	MAPE	Normality (P-Value)	Independence of Residuals
0.3	1.28653	0.327	No
0.4	1.23858	0.371	No
0.5	1.23793	0.537	No

Table 2 shows the summary of output results. MAPE of all the models is around 1.4%. The residuals of the models were normally distributed but not independent (Correlated).

Testing DES models is the third step of the smoothing techniques. DES models were tested for various α (level) and γ (trend) values using trial and error methods. The seasonal length is taken as 2. Residuals of each model were tested for normality and independence by Anderson-Darling test and ACF respectively. Table 3 shows the summary of output results. MAPE of all the models is below 1.6 %. The residuals of models, $\alpha = 0.77$ and $\gamma = 0.77$ are not normally distributed $P = 0.039$ ($P < \alpha$). But residuals are independent. The residuals of models, $\alpha = 0.72$ and $\gamma = 0.72$ are normally distributed $P = 0.079$ ($P < \alpha$) and residuals are independent too. Similar results shown by the model of $\alpha = 0.73$ and $\gamma = 0.73$.

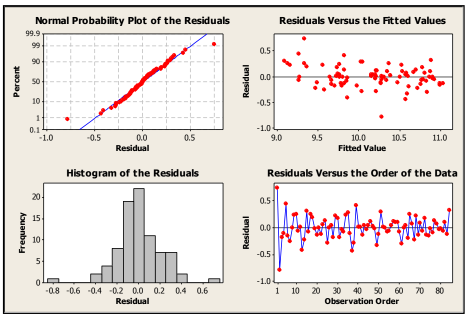
Table 3: Model Summary of Double Exponential Smoothing (DES)

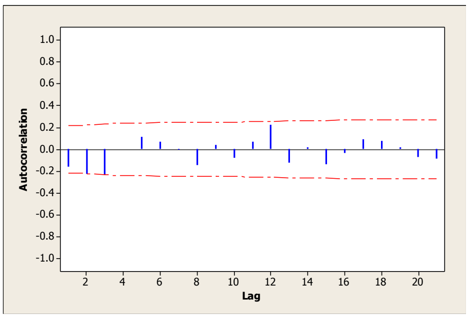
Model (α)	Model (γ)	MAPE	Normality (P – Value)	Independence of Residuals
0.77	0.77	1.58463	0.039	Yes
0.72	0.72	1.54457	0.079	Yes
0.73	0.73	1.54890	0.067	Yes

The residual plots and ACF were obtained to test the modeling assumptions. Figure 3 is the of the residual plots and Figure 4 is the ACF belongs to the DES model with least MAPE. Histogram of the residual plot of figure 3 looks symmetrical, errors are symmetrically distributed. Normal probability plot of residuals and Anderson-Darling test confirm that errors normally distributed. The graph of residual versus fitted values shows that they are uncorrelated. The plot of the residuals versus order of the data shows residuals are random. ACF of figure 4 shows the spikes are not significant. It is another evidence for independence of the residuals. It is very clear that DES with $\alpha = 0.72$ and $\gamma = 0.72$ is suitable for forecasting arrivals in the short term.

Figure 3: Residual Plots for DES model   Figure 4: Autocorrelation Function for

DES model**Test Holt's Winters Three-Parameter Model**





The Holt's Winter's three parameter multiplicative and additive models were tested for various α (level), γ (trend) and δ (seasonal) values using trial and error methods. The seasonal length is taken as 2. The measurement errors of all the fitted models were small, but assumptions of the residuals were not met.

Table 4 : Model Summary of Holt's Winters three parameter multiplicative models

Model (α)	Model (γ)	Model (δ)	MAPE	Normality (P–value)	Independence of Residuals
0.6	0.7	0.7	1.54322	0.132	No
0.8	0.28	0.28	1.30114	0.527	No
0.9	0.2	0.2	1.31861	0.845	No

The residuals of each model were tested for normality and independence by Anderson-Darling test and ACF respectively. Table 4 shows the summary of output results of Holt's Winters three parameter multiplicative models. MAPE of all models is below 1.5%. The residuals of the models were normally distributed but not independent (Correlated). Winter's additive models were tested after multiplicative models.

Table 5 shows the results of additive models. The MAPE of all models is around 1.3%. The residuals of the models were normally distributed but not independent (Correlated) as multiplicative models. It is clear that Holt's Winters three parameter models do not meet all model validation criterion.

Table 5: Model Summary of Holt's Winters three parameter additive models

Model (α)	Model (γ)	Model (δ)	MAPE	Normality (P–value)	Independence of Residuals
0.7	0.2	0.2	1.30491	0.322	No
0.82	0.22	0.22	1.30004	0.429	No
0.9	0.2	0.2	1.31465	0.820	No

Conclusion and Discussion

The study was a model based analysis on forecasting tourist arrivals to Sri Lanka. Smoothing techniques; Moving Average, Exponential, and Winter's Methods were tested in the model fitting process. The results of this study conclude that DES model with α = 0.72 and γ =0.72 have 1.5% of MAPE. Therefore, DES is the most suitable model for forecasting tourist arrivals from the Asian region. However, smoothing techniques can be accurately used only for short-term forecasting. Considering the non-stationary data series of this study ARIMA and SARIMA cannot be used. It is recommended to test non-liner models and Circular model for better forecasting. Further, it is better to concern forecasting Western and Eastern Europe as well.

Keywords: Short- Term Forecasting, Smoothing Techniques

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