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Forecasting Tourist Arrivals to Sri Lanka: Post-War Period

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Abstract: **Forecasting plays a major role in tourism planning at all levels in both private and public sectors. Hence, finding appropriate forecasting techniques is essential. The current study was focused on modelling international tourist flows to Sri Lanka by considering the post-war period. Monthly arrival data from January 2010 to December 2014 was obtained from Sri Lanka Tourism Development Authority. Smoothing techniques were tested during the study. Model selection criteria were Mean Absolute Percentage Errors (MAPE's). According to descriptive statistics, mean arrivals were 88217.The distribution of the tourist arrivals is normally distributed. Winter's three parameter multiplicative model; length 4, $\alpha = 0.9$, $\beta = 0.1$, $\gamma = 0.1$ and additive model; length 4, $\alpha = 0.9$, $\beta = 0.2$ and $\gamma = 0.5$ have least MAPE (13%). Residuals of all the models were normally distributed. Mean Absolute Deviation and Mean Squared Deviation also agreed with MAPE's. It was concluded that Holt's Winter's three parameter model is the suitable model for forecasting international tourist arrivals to Sri Lanka. It is recommended to test Decomposition techniques, Box-Jenkins ARIMA model, GARCH and ARCH models etc, for better forecasting.**

Keywords: **Forecasting, Smoothing techniques, Tourist arrivals, Post-war.**

I. INTRODUCTION

Tourism had begun at the beginning of the time. Food, water, safety or acquisition of resources (trade) was the early travel motivations. But the idea of travel for pleasure or exploration soon emerged. Tourism is a collection of activities, services and industries that deliver a travel experience, including transportation, accommodations, food and beverage business, retail shops, entertainment businesses, activity facilities and other hospitality services provided for individuals or groups travelling away from their destinations. Tourism is one of the largest and fast growing industries in the world. The total contribution of travel and tourism to world GDP was USD6, 990.3 billion (9.5% of GDP) in 2013, and is forecast to rise by 4.3% in 2014, and to rise by 4.2% pa to USD10, 965.1 billion (10.3% of GDP) in 2024 (WTTO, 2014). It is one of the most significant economic sectors (Srinivasan, Santhosh, and Ganesh, 2011). Sri Lankan tourism shows the remarkable growth of tourist arrivals after the year 2009. Tourist arrivals grew by 5.1% in 2013 to a total 1,087 million, up from 1,035 million in 2012. The year 2013 recorded the highest number of tourist arrivals of 1,274,593 (SLTDA, 2013). There were some impacts on tourism arrivals due to security issues. Figure 1 shows the variations of tourism arrivals in three stages; Pre-war (January 1968 – June 1983), war period (July 1983 – May 2009) and post-war (January 2010 – December 2014) are the classifications of the time period between January 1968 to December 2014.The graph shows the increasing of arrivals during the pre-war period and some fluctuations during the period of civil war. After the year 2009, there is an increasing of tourist arrivals to Sri Lanka.

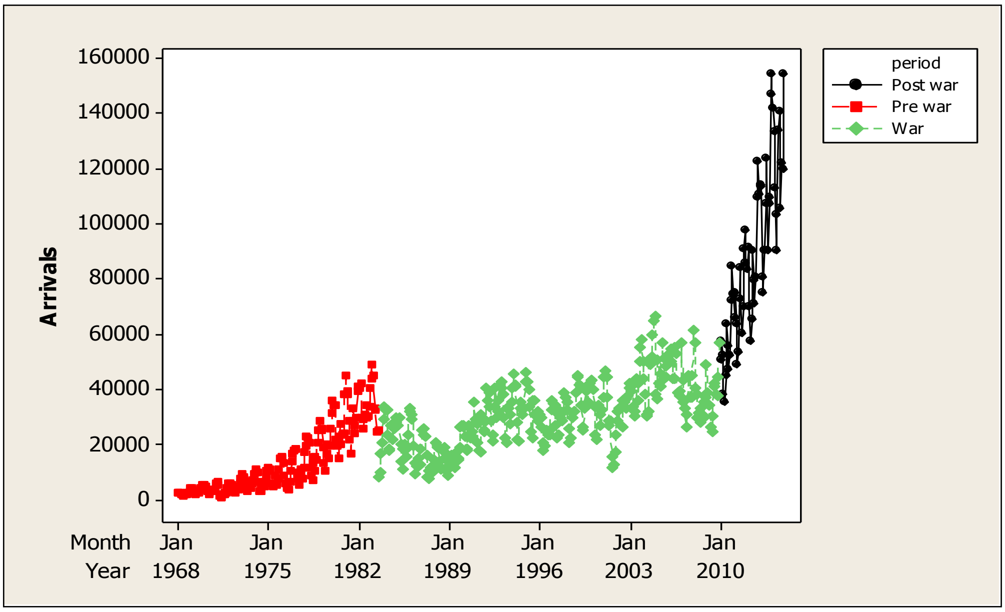

Figure 1: Time Series Plot of Tourist Arrivals (1968 -2014)

PROBLEM STATEMENT:

Forecasting is an essential planning tool that helps any industry to cope with the uncertainty of the future. Finding appropriate forecasting techniques is essential for planning at all levels in any organization (Witt and Witt, 1995), (Song and Li, 2008) and (Song and Witt, 2006). Increasing of tourist arrivals shows the increasing of demand. Effective forecasting technique is an essential to managing the supply and demand. In view of the above, the current study was focused on identifying the best fitting, statistical model for forecasting international tourist arrivals to Sri Lanka

II. METHODOLOGY

Monthly international tourist arrival data for the period, January 2010 to December 2014 was obtained from Sri Lanka Tourism Development Authority (SLTDA). Figure 1 shows a clear jump in arrivals from the year 2009 to 2010 and have continued afterwards. In other words, number of arrivals after the year 2009 have come to a higher phase. Therefore arrival data of the postwar period: the year 2009 to 2014 has been used in the model fitting process. Descriptive statistics of the data was obtained at first. Moving Average (MA) techniques, Exponential Smoothing (ES) techniques and Winter's Methods were tested in the model fitting process. Residual plots and Anderson-Darling test were used as a model validation criterion. Mean Absolute Percentage Errors (MAPE) were used to select a best fitting model.

MOVING AVERAGE (MA) SMOOTHING MODELS:

The first step of the analysis was moving average techniques. Moving Average (MA) smoothers data by averaging consecutive observations in a series and provides short-term forecasts.

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

Where;

Y_t = Observed value of time t

F_t= Forecasted value of time t

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SINGLE EXPONENTIAL SMOOTHING MODELS:

Single exponential smoothing smoothes data by computing exponentially weighted averages and provides short-term forecasts. The forecast for the previous period and adjust it using the forecast error. [Forecast error = (Y_t – F_t)]. This technique is found using one smoothing constant α (with values between 0 and 1). Formulae of single smoothing technique are;

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

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

DOUBLE EXPONENTIAL SMOOTHING MODELS:

Double exponential smoothing provides short-term forecasts as previous methods. This procedure can work well when a trend is present, but it can also serve as a general smoothing method. This method is found using two dynamic estimates, α and β (with values between 0 and 1).It represents level and trend respectively. Formulae of double smoothing technique (Holt' method) are;

$$L_t = \alpha Y_t + (1-\alpha)(L_{t-1} + T_{t-1}) \tag{3-1}$$

$$T_t = \beta(L_t - L_{t-1}) + (1-\beta)T_{t-1} \tag{3-2}$$

$$\hat{Y}_t = L_{t-1} + T_{t-1} \tag{3-3}$$

$$F_{t+m} = L_t + mT_t \tag{3-4}$$

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

HOLT'S WINTERS THREE PARAMETER MODELS:

Winters' Method smoothes data by Holt-Winters exponential smoothing and provides short to medium-range forecasting. This can be used when both trend and seasonality are present, with these two components being either additive or multiplicative. Winters' Method calculates dynamic estimates for three components; level, trend and seasonal which denotes as α, β and γ (with values between 0 and 1) (Holt, 1957). Formulae of Winter's multiplicative model is ;

$$L_t = \alpha (Y_t / S_{t-p}) + (1-\alpha)[L_{t-1} + T_{t-1}] \tag{4-1}$$

$$T_t = \beta [L_t - L_{t-1}] + (1-\beta)T_{t-1} \tag{4-2}$$

$$S_t = \gamma (Y_t / L_t) + (1-\gamma) S_{t-p} \tag{4-3}$$

$$\hat{Y}_t = (L_{t-1} + T_{t-1}) S_{t-p} \tag{4-4}$$

Where,

L_t = is the level at time t, □ is the weight for the level, T_t = is the trend at time t, β is the weight for the trend, S_t = is the seasonal component at time t, γ is the weight for the seasonal component, p = is the seasonal period, Y_t = is the data value at time t, $\hat{Y}_t$ = is the fitted value, or one-period-ahead forecast, at time t.

Formulae of Winter's additive model is;

$$L_t = \alpha (Y_t - S_{t-p}) + (1-\alpha)[L_{t-1} + T_{t-1}] \tag{5-1}$$

$$T_t = \beta[L_t - L_{t-1}] + (1-\beta)T_{t-1} \tag{5-2}$$

$$S_t = \gamma (Y_t - L_t) + (1-\gamma) S_{t-p} \tag{5-3}$$

$$\hat{Y}_t = L_{t-1} + T_{t-1} + S_{t-p} \tag{5-4}$$

Where,

L_t = is the level at time t, α is the weight for the level, T_t = is the trend at time t, β is the weight for the trend, S_t = is the seasonal component at time t, γ is the weight for the seasonal component, p = is the seasonal period, Y_t = is the data value at time t,

$\hat{Y}_t$ = is the fitted value, or one-period-ahead forecast, at time t.

Mean Absolute Percentage Error (MAPE)

The best-fitting model was selected by comparing Mean Absolute Percentage Errors (MAPE);

$$MAPE = \frac{1}{n}\sum \left| \left(\frac{Y_t - F_t}{Y_t}\right).100 \right| \tag{6}$$

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

III. RESULTS

Data analysis consists four parts.

i. Descriptive Statistics

ii. Test MA models

iii. Test Exponential smoothing models Single Exponential Smoothing (SES) Double Exponential Smoothing (DES)

iv. Test Holts Winters three parameter model

DESCRIPTIVE STATISTICS:

Figure 2 is the graphical summary of descriptive statistics. Box and whisker plot in Figure 2 does not show any outliers. A histogram of the data set is somewhat symmetrical. The coefficient of skewness of the data set (0.388) suggest a positive skewness, but the p-value of the Anderson-Darling test (P= 0.180) is greater than the significance level (P> 0.05).Thus, number of arrivals to Sri Lanka follows a normal distribution. 95% confidence interval for the mean reveals that the mean of arrivals lies between 80352- 96082. Similarly, 95% confidence interval for the median reveals that the median of arrivals lies between 74077 and 91547. The first quartile shows that 25% of the months had at most 64188 arrivals. Median shows that 50% of the months had at most 84207 tourist arrivals. The third quartile shows that 75%of the months had at most 110262 tourist arrivals.

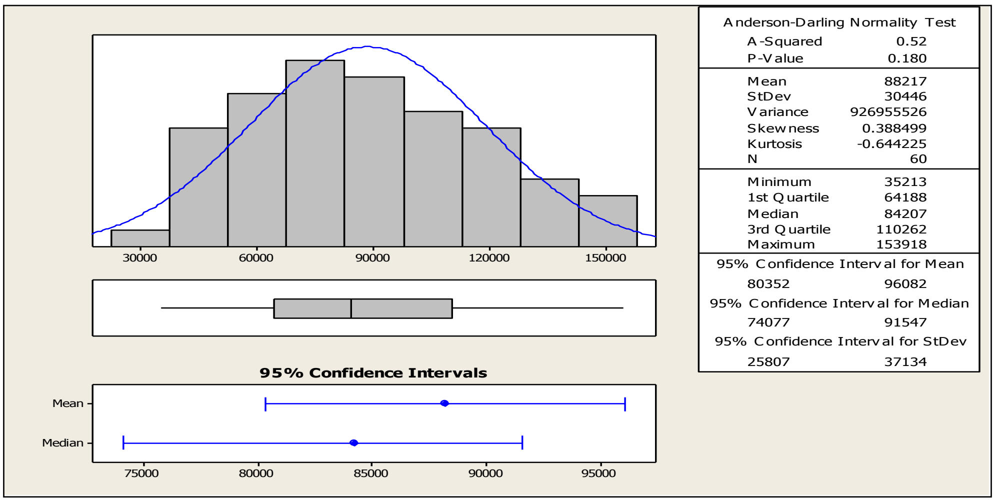

Figure 2: Summaries for Arrivals 2010-2014

TEST MOVING AVERAGE (MA) MODELS:

According to the Table 1, single moving average of order 4, 5, 8 and centered moving average order 5 have the least MAPE which is 17%. They are better models among other MA models. Their residuals were normally distributed and uncorrelated.

Table 1: Model Summary of Moving Average Models

Model	MAPE	Normality (P–value)
MA 2	18	0.354
MA 4	17	0.835
MA 5	17	0.321
MA 6	18	0.237
MA 8	17	0.897
MA 9	18	0.929
MA 2*5	17	0.321
MA 2*6	19	0.462
MA 2*3	18	0.032

Residual plots were obtained to test the modeling assumptions. Figure 3 is an example of the residual plots.

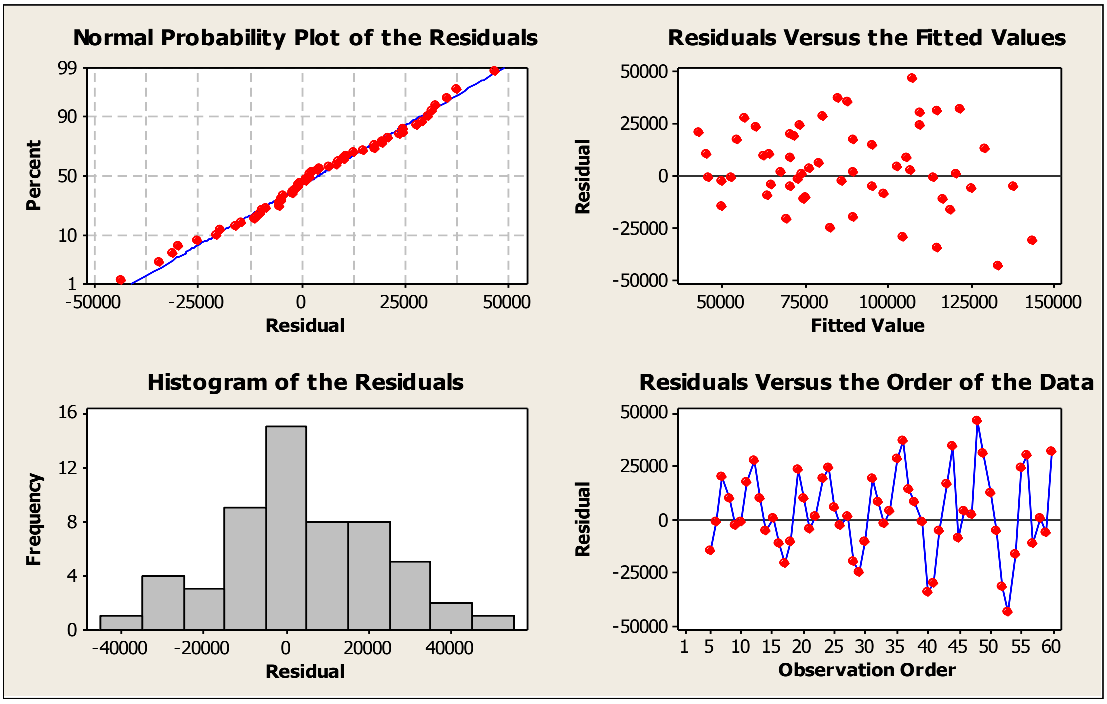

Figure 3: Residual Plots for MA (4)

Histogram of the above figure looks symmetrical, errors are symmetrically distributed. Normal probability plot of residuals and Anderson-Darling test confirm the normality of residuals. 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.

TEST EXPONENTIAL SMOOTHING MODELS:

SES and DES models were tested.

l. Single Exponential Smoothing (SES):

SES models were tested for different α values and residuals of each model were tested for normality at the same time. According to table 2 shows the summary of SES outputs. SES of α = 0.6 has the least MAPE which is 15% and residuals were normally distributed and uncorrelated. Therefore, SES of α = 0.6 is the better model among other SES models.

Table 2: Model Summary of Single Exponential Smoothing Models

Model (α)	MAPE	Normality (P-Value)
0.1	18	0.664
0.2	17	0.973
0.5	16	0.099
0.6	15	0.228
0.7	16	0.655

2. DOUBLE Exponential Smoothing (DES) :

Double Exponential models were tested for different α and β values. Model Summary in Table 3 shows the outputs at various levels.

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

Model (α)	Model (β)	MAPE	Normality (P – Value)
0.2	0.1	17	0.983
0.2	0.2	18	0.925

Among all DES models, $\alpha = 0.2$ and $\beta = 0.1$ has the least MAPE which is 17% and residuals were normally distributed and uncorrelated. The better fitting model among DES is for $\alpha = 0.2$ and $\beta = 0.1$.

HOLT'S WINTERS THREE-PARAMETER MODELS:

At last various Holt's Winter's three parameter multiplicative and additive models were tested for different α, β and γ values and residuals of each model were tested for normality. Table 4 shows the summary of Winter's three parameter multiplicative outputs.

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

Model (α)	Model (β)	Model (γ)	MAPE	Normality (P–value)
0.6 (4)	0.2	0.2	15	0.242
0.7 (4)	0.2	0.2	14	0.417
0.9 (4)	0.1	0.1	13	0.092

According to Table 4, Winter's three parameters multiplicative model of length 4 $\alpha = 0.9$, $\beta = 0.1$ and $\gamma = 0.1$ has the least MAPE which is 13%, and residual of the model were normally distributed and uncorrelated.

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

Model (α)	Model (β)	Model (γ)	MAPE	Normality (P–value)
0.6	0.2	0.2	15	0.526
0.7	0.2	0.2	14	0.625
0.9	0.2	0.5	13	0.403

Table 4 emphasize that Winter's three parameters additive model of length 4, $\alpha = 0.9$, $\beta = 0.2$ and $\gamma = 0.5$ has the least MAPE which is 13%, and residual of the model was normally distributed and uncorrelated. Figure 3 and 4 are the actual tourist arrivals and fitted values of the multiplicative and additive model respectively. Both graphs clearly show that actual values and fitted values are close by.

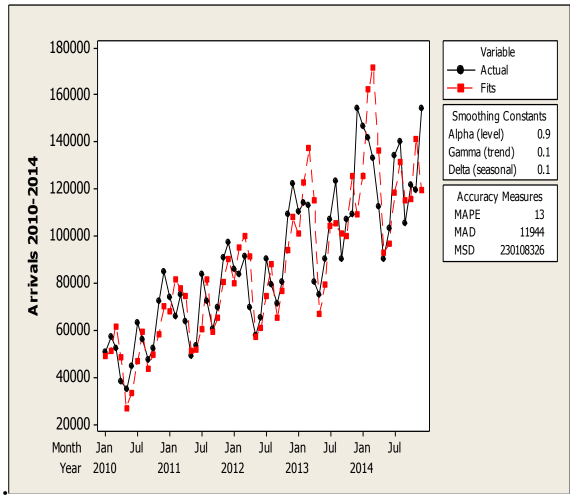

Figure 4. Winter's actual and fitted values Multiplicative Model

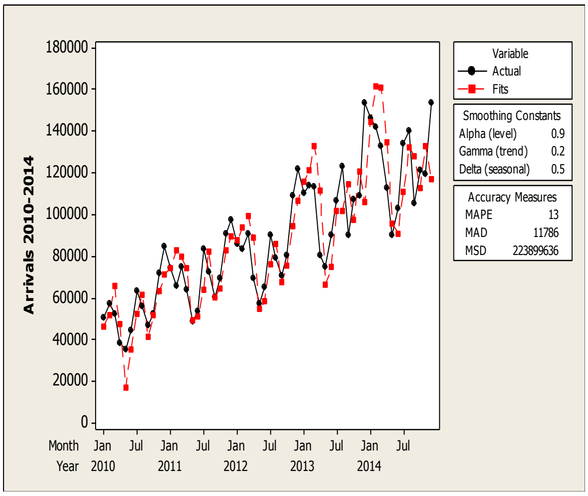

Figure 5. Winter's actual and fitted values Additive Model

IV. CONCLUSION AND DISCUSSION

It was concluded that the Winter's three parameter multiplicative and additive models of $\alpha = 0.9$, $\beta = 0.1$ and $\gamma = 0.1$ and $\alpha = 0.9$, $\beta = 0.2$ and $\gamma = 0.5$ had least MAPE (13%). Therefore, Winter's three parameter model is suitable for short term forecasting of tourist arrivals to Sri Lanka.

However, smoothing techniques can be accurately used only for short-term forecasting. It is recommended to test Decomposition techniques, Box-Jenkins ARIMA model, GARCH and ARCH models etc, for better forecasting as they can be used for a short term as well as long-term forecasting.

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