MODEL-BASED ANALYSIS OF INTERNATIONAL TOURISM INCOME OF SRI LANKA: POST-WAR PERIOD

K .M. U. B. Konarasinghe*

Institute of Mathematics and Management (Pvt) Ltd, Sri Lanka

INTRODUCTION

The tourism industry is one of the fastest growing industries in Sri Lanka, especially after 2009 with the end of 3 decades of war. Over the past years, international tourism in Sri Lanka has shown growth by value. The foreign exchange earnings from international tourism industry in Sri Lanka increased from Rs 37,506 million (US$ 326.3 million) in 2009 to Rs. 221,147.1 million (US$ 1,715.5 million) in 2013 (SLTDA, 2013). Sri Lanka Tourism Development Authority reported the rank of the tourism has increased up to fourth level as the largest source of foreign exchange earnings of the Sri Lankan economy in 2013.

RESEARCH PROBLEM

Forecasting is an essential planning tool that helps any industry to cope with the uncertainty of the future. According to Witt and Witt (1995) and Song and Witt, (2006) finding appropriate forecasting techniques is essential for planning at all levels. There were many attempts done for forecasting the volume of tourism as well as the demand for tourism. But least attempts were found for forecasting the value of tourism. Therefore, this study was designed to fill that knowledge gap. On view of the above, the current study was focused to identify a suitable econometric model for forecasting international tourism income of Sri Lanka.

METHODOLOGY

Autoregressive Distributed Lag Model (ADLM) is commonly used within the tourism industry to model the tourism demand. Yi-Yi (2010) defines that the regressors may include lagged values of the dependent variable and current and lagged values of one or more explanatory variables. Chau, (1970) applied the same ADL approach for forecasting income and employment. ADLM with log transformation used and model in this study is;

$$\log Y_t = \alpha + \beta_1 \log Y_{t-1} + \beta_2 \log Y_{t-2} + ...\beta_n \log Y_{t-n} + \varepsilon_t \quad (1)$$

Monthly income data from 2009 to 2013 were obtained from statistical reports of 2012 and 2013 by Sri Lanka Tourism Development Authority (SLTDA). Study concern the period of post war, which is after the year 2009. Model fitting was done by utilizing data from January 2009 to April 2012 and data from May 2012 to May 2013 utilized for model verification. ADLM was tested on forecasting tourism income at different lags. One- way Analysis of Variance (ANOVA) technique was used for overall model testing and t-test was used for individual parameter testing. Residual plots, Anderson Darling and Durbin Watson tests for residuals were used as a model validation criterion. Forecasting ability of the models was assessed by considering adjusted R^2 (R-Sq adj),
Mean Absolute Percentage Error (MAPE), Mean Square Error (MSE) and Mean Absolute Deviation (MAD).Three measurements of errors as follows;

* *Corresponding author: Email -* ***udaya35@yahoo.co.uk***

$$MAPE = \frac{1}{n}\sum \left| \left(\frac{Y_t - F_t}{Y_t} \right).100 \right| \quad (2)$$

$$MAD = \frac{1}{n}\sum \left| \left(Y_t - F_t\right) \right| \quad (3)$$

$$MSE = \frac{1}{n}\sum \left(Y_t - F_t\right)^2 \quad (4)$$

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

RESULTS AND DISCUSSIONS

Box and whisker plot showed one outlier and it was removed. The model tested with six legs at the first stage. The model as follows:

$$\log Y_t = \alpha + \beta_1 \log Y_{t-1} + \beta_2 \log Y_{t-2} + \beta_3 \log Y_{t-3} + \beta_4 \log_{t-4} + \beta_5 \log_{t-5} + \beta_6 \log_{t-6} + \varepsilon \quad (5)$$

The ANOVA output of the above model presented in the table 1.

Table 1. ANOVA table for model with six lags

Source	DF	SS	MS	F	P
Regression	6	0.91035	0.15173	45.83	0.000*
Residual Error	33	0.10925	0.00331		
Total	39	1.01961			

P value of ANOVA = 0.000 < α =0.05. It clearly showed that there is a linear relationship between the variables $\log Y_{t-1,}$ $\log Y_{t-2}$ $\log Y_{t-3}$ $\log Y_{t-4}$ $\log Y_{t-5}$ and $\log Y_{t-6,}$ with $\log Y_t$. The next step of the study was to test the individual regression coefficient. Results available in table 2.

Table 2. Summary table for regression Coefficients with all lags

Predictor	Coef	SE Coef	T	P
Constant	0.4532	0.3263	1.39	0.172
$\log Y_{t-1}$	1.1327	0.1389	8.16	0.000*
$\log Y_{t-2}$	-0.6472	0.2141	-3.02	0.004*
$\log Y_{t-3}$	0.1009	0.2444	0.41	0.682
$\log Y_{t-4}$	0.5637	0.2527	2.23	0.031*
$\log Y_{t-5}$	-0.5638	0.2286	-2.47	0.017*
$\log Y_{t-6}$	0.3592	0.1390	2.58	0.013*

The results of the table 2 revealed that, except variable with lag 3, all other variables were significant. Their P values were < α =0.05. The next step of the analysis was fitting models with different significant lags and select the best model for forecasting. Various combinations of lags were tested. The Durbin Watson statistics of the models were between 2 and 4. If the

Durbin Watson statistic value falls between 2 and 4, then residuals are negatively correlated. Therefore, such models cannot be taken for forecasting. Model with variable lag 1 confirmed the normality and uncorrelated of residuals: P value of Anderson Darling test was 0.155 and Durbin Watson statistic was 1.65. Adjusted R^2 of the model is 86.1%. As such the best fitting model was;

$$\log Y_t = 0.745 + 0.907 \log Y_{t-1} \quad (6)$$

Table 3 gives the summary outputs of model fittings and verifications of model (6).

Table 3. Summary outputs of model fittings and model verifications

Model	Model Fitting		Model Verification	
$\log Y_t = 0.745 + 0.907 \log Y_{t-1}$	R-Sq(adj)	86.1%		
	MAPE	0.872	MAPE	0.869
	MAD	0.068	MAD	0.070
	MSE	0.006	MSE	0.006
	Normality	0.155		
	Durbin Watson	1.65		

MAPE values of fitting and verification of model with lag 1 were 0.872 % and 0.869% respectively. Mean Absolute Deviation (MAD) and Mean Square Error (MSE) also very small.

Figure 1 and 2 shows that fits and forecasting values of model with lag 1 are very close to the actual values.

Figure 1. Actual Income Vs Fits

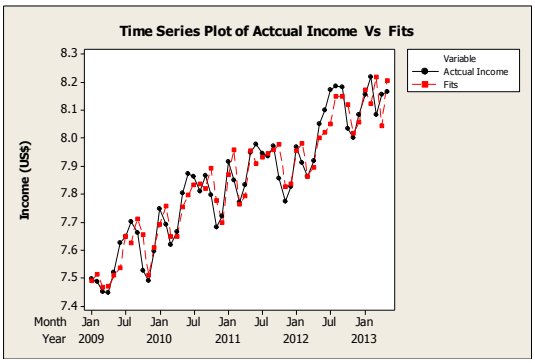
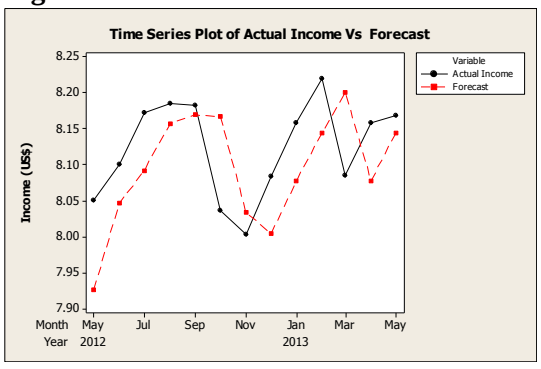


Figure 2. Actual Income Vs Forecast



ONCLUSIONS AND RECOMMENDATIONS

This study was a model based analysis on forecasting international tourism income in Sri Lanka. ADLM were tested with log transformation for the post war period in Sri Lanka. Models with different lag combinations were tested and it was concluded that ADLM with log transformation is suitable in forecasting international tourism income in Sri Lanka.

Figure 1 shows that actual income data has an increasing trend with a wave like pattern. In general waves can be explained by Auto Regressive Integrated Moving Average (ARIMA) models. Konarasinghe and Abeynayake (2015), and many others have given evidence for the success of ARIMA models in explaining wave like patterns. However, the trend has to be captured first.Therefore, it is recommended to do the trend analysis first, detrend the data and test ARIMA models in forecasting international tourism income in Sri Lanka.

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