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Original Research Article

Forecasting Tourism Generated Employment in Sri Lanka: Multivariate Time Series Approach

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ABSTRACT

Tourism industry in Sri Lanka is growing over the recent past. As a result, the employment in the industry also shows a rapid growth. But there were very few attempts in forecasting tourism generated employment in Sri Lanka. Hence, the objective of the study was to forecast tourism generated employment in Sri Lanka. Annual employment data for the period of 1970 to 2015 were obtained from the Sri Lanka Tourism Development Authority (SLTDA). Karl Pearson's correlation used to test the correlation between total employment and tourist arrivals. Simple Regression Model (SRM) and Auto Regressive Distributed Lag Model (ARDLM) tested for forecasting. The Anderson-Darling, Ljung-Box Q test, Auto-Correlation Functions (ACF) and Durbin-Watson (DW) test used for model validation. Forecasting ability of the models was assessed by both relative and absolute measurements of errors. The SRM was not successful, but the ARDLM satisfied the validation criterion. Both relative and absolute measurements of ARDLM were very low. Hence, the ARDLM is suitable on forecasting tourism generated employment in Sri Lanka. The results of this study will be useful for planning and strategy development to overcome the surplus, shortfall of employment and workforce planning in both public and the private sector in the tourism industry. Further, the finding of the study can be used to assess the economic benefits to the host community in various tourism areas in Sri Lanka.

Keywords: Simple Regression Model, Auto Regressive Distributed Lag Model, Measurements of Errors, Employment

INTRODUCTION

The tourism industry is one of the fast growing industries in the global economy today. It generated 107,519,000 jobs in 2015. [1] Tourism industry creates jobs, accounting 1 in 11 worldwide. [1-2] Direct and indirect employment opportunities are major segments of tourism. Direct employment includes, employed by hotels, travel agents, airlines and other passenger transportation services, agencies providing recreational facilities, tourist guides, tourist shops and other organizations in the state sector. Indirect employment is businesses which sell goods and services to the tourism sector.

Konarasinghe (2016) showed that there is an increasing trend of tourist arrivals from all regions. [2] It could be an evidence of a growth of tourism industry in Sri Lanka. The growth of industry ensures the growth of tourism generated employment. [3] Figure 1 is the time series plot of tourism generated employment in Sri Lanka.

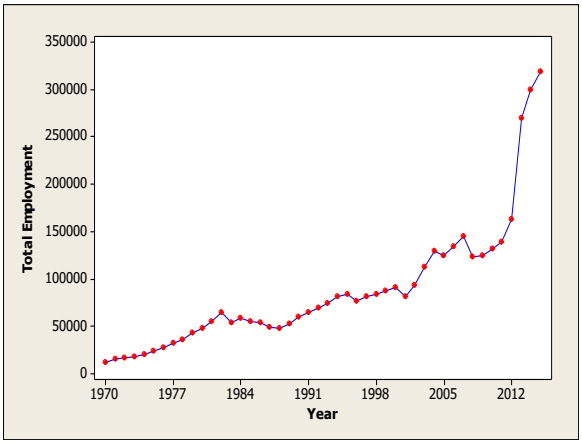

Figure 1: Time Series plot of total employment

Figure 1 clearly shows a growth of tourism generated employment in Sri Lanka.

Problem Statement

The growth of tourism industry and the growth of employment in the tourism industry are in line. Therefore, it is important to selecting and training individuals for specific job functions and charging them with the associated responsibilities. The employment forecasting is a process of estimating the future numbers of employees required and the likely skills and competencies needed. [4-6] Konarasinghe (2015) has shown the importance of planning and forecasting employment in the industry, in order to overcome the surplus and shortfall of employment. [7-1] However, fewer attempts were found in forecasting tourism generated employment in Sri Lanka. Hence, it is a timely requirement of forecasting tourism generated employment of tourism industry in Sri Lanka.

Significance of the Study

The industry creates millions of job opportunities worldwide. Also, it provides solutions to unemployment in Sri Lanka. The results of the study will be very helpful to develop strategies related on staffing, and other human resource management needs. In addition, it is useful for decision making in both macro and micro level in tourism industry.

Objective of the Study

To Forecasting tourism generated employment in Sri Lanka

LITERATURE REVIEW

The literature review of the study was focused on forecasting employment on various industries across the world.

Chau (1970) used multiple regression models for forecasting civilian personal income and employment of Hawaii. [8] The forecasting ability of the model is quite accurate in employment forecasting. Auto Regressive Distributed Lag Models (ARDLM) approach used to forecast tourism generated employment in Denmark. [9] The measurements of errors were satisfactorily small. ARDLM performed highly satisfactory in forecasting employment growth in Missouri. [10] Log – linear model used Paquet, Sargent, and James (2006) to examine the past and future behavior of the employment rate of men and women in Canada. [11] Fitted models are reliable for short-term forecasting, but the same was not true for in the long run. Soft computing techniques namely; neural network used to forecast regional employment in both the former West and East Germany. [12] The performance of forecasting is highly satisfactory. The neural network performed well in employment forecasting on three districts in Germany. [13] Logistic Regression did not performed well in forecast employment demand in local government area in Northern New South Wales, Australia. [14]

Bayesian vector autoregressive models used to forecast industry employment for a resource-based economy in a state of Georgia. [15] The fitted models perform well in long run. Vector Auto-Regressive models used to forecast employment growth in Sweden. [16] It was successful up to a certain extent in short-term forecasting. Linear and non – linear trend models used in forecasting direct employment trend in the tourism industry in Sri Lanka. [7-2] The results of this study confirmed that linear trend model is suitable for forecasting. Hybrid Trend- ARIMA is another univariate time series approach was successful in forecasting tourism generated employment in Sri Lanka. [17] According to

the literature; researchers have tested statistical and soft computing techniques as forecasting tools. Most of them have used multivariate techniques, while some of them used univariate techniques. The ARDLM and Regression models were the commonly tested models. Hybrid approach is another technique for forecasting. Except logistic regression all other techniques were successful in forecasting. Some fitted models are suitable for short term forecasting.

METHODOLOGY

Annual data on tourist arrivals and total employment in the tourism industry in Sri Lanka for the period of 1970 to 2015 was obtained from annual statistical reports from 2008 to 2015, published by Sri Lanka Tourism Development Authority (SLTDA). Karl Pearson's correlation used to test the correlation between total employment and tourist arrivals. Time series plots used for pattern identification. Simple Regression Model (SRM) and Auto Regressive Distributed Lag Model (ARDLM) used for forecasting total employment. Anderson-Darling test used to test the normality of data and residuals. The LBQ test, Auto-Correlation Functions (ACF) and Durbin-Watson (DW) test used to test the independence of residuals. The Augmented Dickey-Fuller (ADF) test used to test the stationary of the series. Forecasting ability of the models assessed by Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD) and Mean Square Error (MSE).

RESULTS

Outliers are the extremely large or small values of a data set. They replaced by moving average of order three. The study adopted the technique used by Konarasinghe, Abeynayake, and Gunaratne (2016) and Konarasinghe (2016) for outlier adjustment. [18,19]

Data analysis is organized as follows;
1. Descriptive Statistics
2. Correlation Analysis
3. Forecasting tourism generated employment.

Descriptive Statistics

Graphical summary of descriptive statistics is shown in Figure 2;

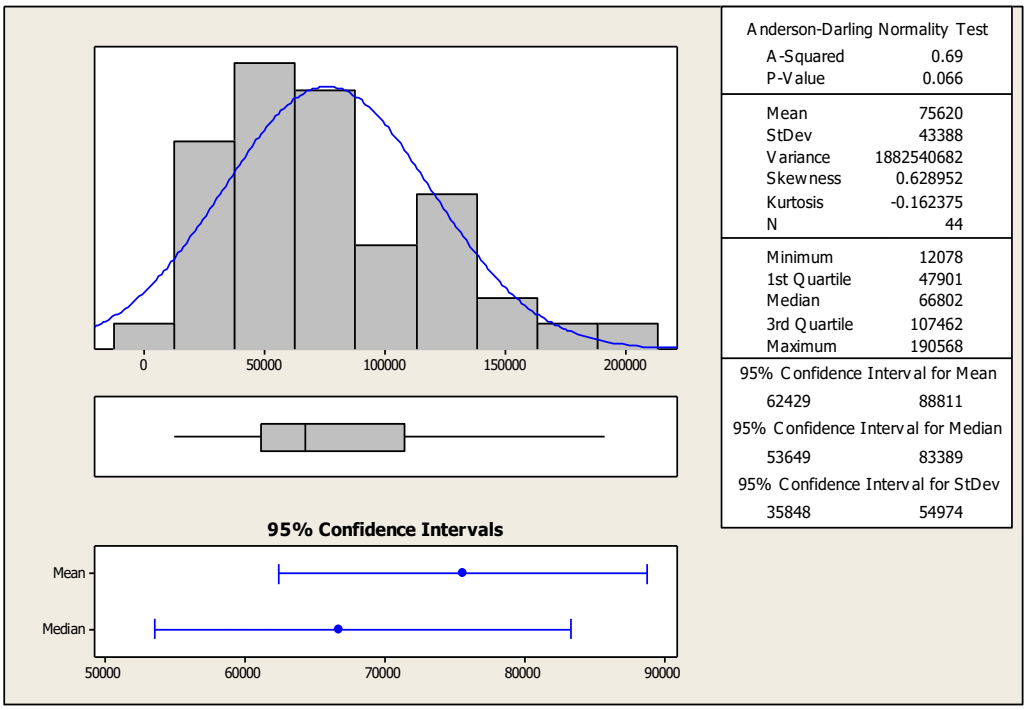

Figure 2: Graphical Summary

Minimum tourism generated employment of Sri Lanka were 12078 whereas maximum were 190568 during the period. The first quartile of generated employment is 47901. It means at most 25% of employment opportunities generated by tourism industry in Sri Lanka is 47901 during the period. Median employment opportunities were 66802 and the third quartile of employment is 107462. Histogram of the employment looks symmetrical. P value of the Anderson-Darling test is greater than the significance level (α=0.05 <0.066). As such number of tourism generated employment follows the Normal distribution.

Correlation Analysis

The correlation analysis was done in two ways; correlation between variables and correlation within the series (Auto Correlation). Table 1 show that there is a strong positive significant correlation between tourist arrivals and total employment in the tourism industry in Sri Lanka. It means the increasing of tourist arrivals affect on increasing of tourism generated employment in Sri Lanka.

Table 1: Correlation Matrix

		Employment	Arrivals
Employment	Correlation	1	0.973**
	Sig. (2-tailed)		0.000
Arrivals	Correlation	0.973**	1
	Sig. (2-tailed)	0.000	

**. Correlation is significant at the 0.01 level (2-tailed)

Forecasting Employment

Then the SRM (1) was tested;

$$Y = \alpha + \beta X + \varepsilon \quad (1)$$

Where;

Y = Total employment

X = Total arrivals

α = Constant

ε = Random Error

The normality was tested for total employment (Y). The P value is 0.242. It confirms the normality of Y variable. The residuals of the model were not normally distributed. Therefore, log transformed data used for the SRM. The tested model is as follows;

$$\ln Y = \alpha + \beta \ln X + \varepsilon \quad (2)$$

The ANOVA test revealed that the model (2) is significant. The adjusted R-Sq of the model is high (92.2%). The residuals of the model were normally distributed but not independent. Therefore, model (2) is not suitable for forecasting. Then the stationary of the series; $\ln Y_t$ and $\ln X_t$ tested with the help of ACF and ADF test.

Figure 3 and 4 are the ACF's of tourism generated employment and tourist arrivals. Both figures confirmed two lags from each series were significant.

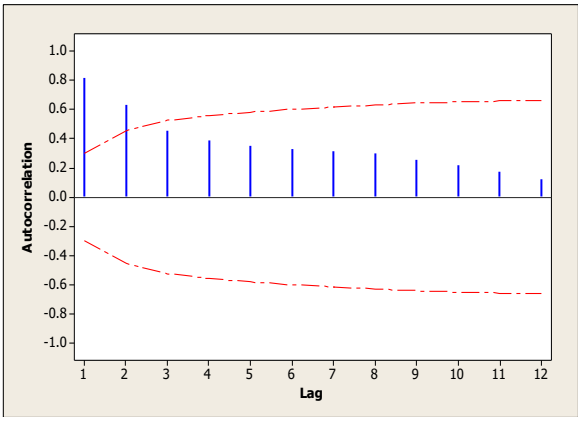

Figure 3: Autocorrelation Function for Employment ($\ln Y_t$)

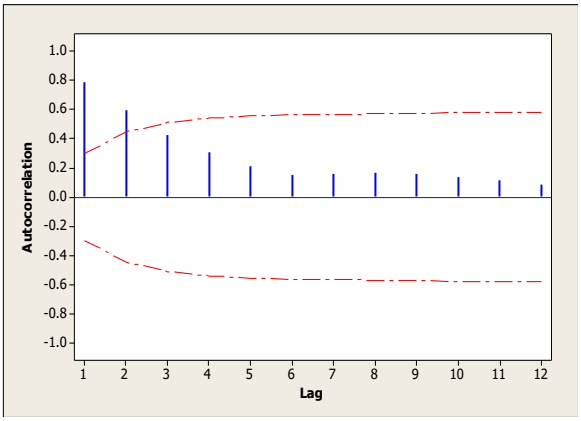

Figure 4: Autocorrelation Function for Arrivals by Year ($\ln X_t$)

The series were stationary, therefore, ARDLM (3) is tested, and the results are given in Table 2 and Table 3:

$$\ln Y_t = \alpha + \beta_1 \ln X_t + \beta_2 \ln Y_{t-1} + \beta_3 \ln Y_{t-2} + \beta_4 \ln X_{t-1} + \beta_5 \ln X_{t-2} + \varepsilon \quad (3)$$

Where;

$\ln Y_t$ = Logarithm of total employment

$\ln X_t$ = Logarithm of arrivals

$\ln Y_{t-1}$ = Lag one of total employment

$\ln Y_{t-2}$ = Lag two of total employment

$\ln X_{t-1}$ = Lag one of arrivals

$\ln X_{t-2}$ = Lag two of arrivals

α = Constant

ε = Random error

Table 2: ANOVA table

Source	DF	SS	MS	F	P
Regression	5	13.8226	2.7645	587.01	0.000
Residual Error	31	0.1460	0.0047		
Total	36	13.9686			

Table 2, the P value of ANOVA = 0.0000. It clearly showed that, at least one regression coefficient is non zero. Table 3 is summary of regression coefficients. According to the results; $\ln X_t$ and $\ln Y_{t-1}$ are the significant lag variables.

Table 3: Summary table for regression coefficients

Predictor	Coef	SE Coef	T	P
Constant	-0.1646	0.2612	-0.63	0.533
$\ln X_t$	0.36382	0.07538	4.83	0.000
$\ln Y_{t-1}$	0.6185	0.1892	3.27	0.003
$\ln X_{t-1}$	-0.1400	0.1263	-1.11	0.276
$\ln Y_{t-2}$	0.3448	0.1992	1.73	0.093
$\ln X_{t-2}$	-0.1826	0.1189	-1.54	0.135

Then the model was run only with the significant lags and the results are given in Table 4 and Table 5:

Table 4: ANOVA

Source	DF	SS	MS	F	P
Regression	2	13.7478	6.8739	1058.64	0.000
Residual Error	34	0.2208	0.0065		
Total	36	13.9686			

The ANOVA confirmed the significance of the model. The hypotheses test for regression coefficients confirmed that $\ln X_t$ and $\ln Y_{t-1}$ are significantly related to $\ln Y_t$.

$$\ln Y_t = \alpha + \beta_1 \ln X_t + \beta_2 \ln Y_{t-1} + \varepsilon \quad (4)$$

Table 5: Summary table for regression coefficients

Predictor	Coef	SE Coef	T	P
Constant	-0.4961	0.2489	-1.99	0.054
$\ln X_t$	0.20600	0.06457	3.19	0.003
$\ln Y_{t-1}$	0.80572	0.07731	10.42	0.000

The summary of regression coefficients confirmed, both $\ln X_t$ and $\ln Y_{t-1}$ is significant lag variables. Table 6 is summary of model fitting and verification: according to the Table 6, the R^2 (Adj) 98.3%. The Anderson-Darling test confirmed the residuals were normally distributed (P = 0.315).The Durbin-Watson static D, ACF and LBQ test confirms that residuals were not correlated.

Table 6: Model Summary

Model	Model Fitting		Model Verification	
$\ln Y_t = -0.496 + 0.206 \ln X_t + 0.806 \ln Y_{t-1}$	R-Sq	98.4%		
	R-Sq(adj)	98.3%		
	MAPE	0.5821	MAPE	1.2177
	MAD	0.0629	MAD	0.1454
	MSE	0.0061	MSE	0.0460
	Normality	P =0.315		
	DW	1.53		

MAPE of the model was 0.58% and 1.21% under the fitting and verification. MSE of the model was 0.0061 and 0.0460. MAD was 0.0629 and 0.1454 in the fitting and verification.

Based on the significance, validation, and verification criterion, model (5) is a suitable model for forecasting tourism generated employment in Sri Lanka:

$$\ln Y_t = -0.496 + 0.206 \ln X_t + 0.806 \ln Y_{t-1} \quad (5)$$

Figure 5 and Figure 6 is the time series plot of actual vs. fits and actual vs. forecast of above model. Fits almost follow the pattern of actual behavior. Both are closer to each other. The deviation of actual and forecast is very less. Hence, the selected model is suitable models for forecasting tourism generated employment in Sri Lanka.

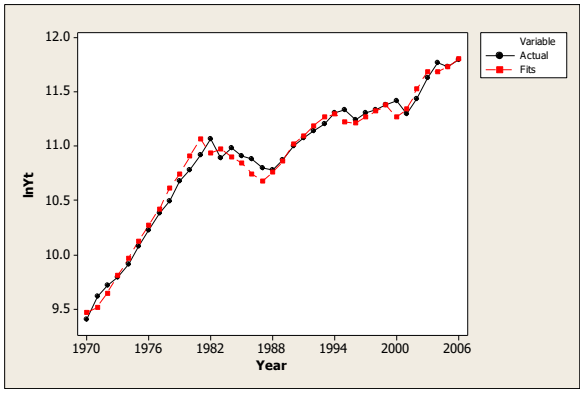

Figure 5: Actual Vs Fits

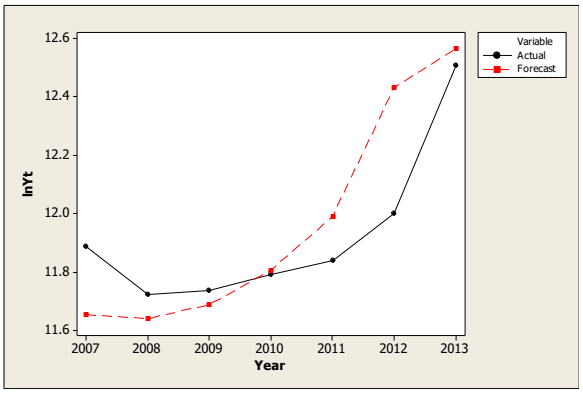

Figure 6: Actual Vs Forecast

DISCUSSION

Konarasinghe [17] has concluded that the Hybrid-trend ARIMA model was successful in forecasting tourism generated employment. The Hybrid trend –ARIMA model is a Univatriate time series model. The present study evidenced that, the Multivariate time series models also serve for the purpose. As such; one can use either univariate approach or multivariate approach, based on the purpose. For instance; if it is needed to forecast merely the head count of employment, then the univariate techniques would do; but if it necessary to see how the employment depends on arrivals etc., then the multivariate techniques would do.

The results of this study can be used for estimate of the number of employees required and, skill requirements to meet objectives in tourism industry. It will be useful to develop proactive strategies more effectively and efficiently. To assess the needs of employees and other administrative needs are another requirements of forecasting. It will helps to avoid long-term gaps in staffing needs by keeping on top of which of employees might be retiring, leaving or asked to leave. It will be facilitate to create or update better organization chart. This model can be used to estimate employment opportunities for industry level. And it will be a light house for expansion of the industry and various product developments. The outcome of this model can help for proper staffing, including training and recruitment of employees to address the deficit or reducing staff when necessary for better productivity. Reduces HR costs is another benefit from forecasting employment. It can be achieved by effective recruitment plan (Internal and external recruitment), apply the best way of payment systems, work out the employee needs without any wastage, work out extra working hours etc.

Increases different types of organizational flexibility are another significant achievement from employment forecasting. Mainly it ensures the functional and numerical flexibility in employment matters. Workout the requirement of multi skilled workers, recruitment and downsize employees are the main activities under functional and numerical flexibility.

The results of forecasting tourism generated employees will show the growth or decline of the tourism industry. Therefore, it is useful for developing training programs such as workshops, academic and professional courses related to hospitality management. It will ensure the knowledge base industry to maximize the benefits within the industry and other related business in tourism.

CONCLUSION

This study confirmed that the increasing of tourist arrivals effect on increasing of tourism generated employment in Sri Lanka. The simple regression used for forecasting employment from tourist arrivals. It was not successful due the non-random of residuals. Finally, the results of the study revealed that ARDLM model is suitable for forecasting tourism generated

employment in Sri Lanka.

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