

Modelling Tourism Demand using Cointegration Analysis: A Case Study for Tourists Arriving from United Kingdom to Sri Lanka

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ABSTRACT. *The tourism industry in Sri Lanka is responsible for about 2% of the GDP and employs 0.7% of the total labour force. The industry has maintained the fourth position in foreign exchange earnings. Given the heavy investments and long-term planning need, demand forecasting and identifying the determinants are of paramount importance to the policy making institutions. However, a majority of the tourism studies use either ARIMA models that do not have an explicit economic context or multiple regressions that can lead to a spurious regression situation. Against this background, the aim of this paper was to model the tourism demand from United Kingdom (UK) to Sri Lanka, using error correction modelling approach. The dependent and explanatory variables were integrated of order one. A unique cointegrating relation was detected in the long-run model and indicated that income of United Kingdom (GDP) and exchange rate (EXR) were positively related with tourism demand while the relative price (RPI) was negatively related. Income of UK is the most important demand determinant in the long-run. In the short-run, above three variables were not statistically significant. Contrary to expectations, in the short-run, Tsunami effect was found to have a positive relationship and terrorism was not a significant factor that influenced UK tourism. The error correction model indicated that the deviation of dependent variable from its equilibrium will be corrected at a rate of 30.71% in the next period.*

INTRODUCTION

Tourism has become one of the largest and fastest growing industries in the world. Sri Lanka entered into the international tourism market in 1960 and Sri Lanka tourism sector has been growing significantly from 1978 to 1982. The growth of tourism in Sri Lanka has not been a smooth process. However, according to the Sri Lanka Tourist Board (SLTB), there is an average annual growth rate of 9.22 during the period, 1997-2006. The main economic impacts of tourism are its contribution to government revenues, foreign exchange earnings, employment generation and initiation of various business opportunities. The contribution to GDP was around two percent in 2003 and 2004 but declined to 1.2% in 2006

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(Central Bank of Sri Lanka, 2006). The total earnings from tourism in 2005 was around US\$ 410.3 and it recorded a slower increase in dollar terms of 13.2% in 2006.

The relative importance of tourism in 2006 as a foreign exchange earner is 3.8% and it has been maintaining its position as the fourth largest earner (Sri Lanka Tourist Board, 2006). The total labour force absorbed by the sector by the end of 2006 amounted to 55,649 which was an increase of 6.8% over the figure of 52,085 recorded in 2005. Public sector revenue from tourism in 2006 amounted to Rs. 2,100 million as compared to Rs.1,880.3 million collected in the previous year which was an increase by 11.7% (Sri Lanka Tourist Board, 2006).

Around 60% of the tourists arrived from Western Europe in 2002, which was reduced to 50% in 2006. After 1990, among Western European countries, United Kingdom (UK) is the Sri Lanka's prominent major market with an average annual growth rate of 9.4%. (Sri Lanka Tourist Board, 2006). UK is a developed country which contributes 3.4% to the world GDP and maintains a 2.9% GDP growth rate. According to the SLTB annual reports, more than 80% of UK tourists visit for pleasure and their average duration of stay is 12 days. It justified that tourism demand from UK does not depend on an industrial or trade base. Sri Lanka should therefore get the most out of locational advantages and respond to this opportunity to increase the country's scale of tourism. Although there are some recessions during the period of 1978 to 2007, tourist arrivals to Sri Lanka from UK have continued to grow slowly, despite the political, economic and military crises and natural disasters like Tsunami. Therefore, it is essential to consider the economic factors influencing UK tourist arrivals in Sri Lanka.

The identification of tourism demand determinants stems from two principal sources. They are public planning and the budgetary allocation process and effectively manipulate the tourism promotion activities to UK. By quantitatively researching into the traveller's behaviour as well as their seasonal patterns of demand would enable Sri Lanka to be more competitive in attracting UK tourist, in advance. Although tourism plays a key role in Sri Lanka economy, a little attention has been paid to this sector in empirical research (Gamage *et al.*, 1997, 1998; Gamage and King, 1999). However, no study has examined the causal relationships or economic determinants, especially for origin-destination pairs.

Against this background, the objective of this paper is to investigate the economic determinants of long-run and short-run tourism demand from United Kingdom to Sri Lanka. Further, this paper is aimed at describing elasticity values of economic determinants. As per the objectives of this paper, cointegration and error correction techniques are employed to model the tourist demand.

Tourism demand and modelling

Many researchers have employed time series approaches such as Box-Jenkins ARIMA models that do not have an explicit economic context and are used to explain the level of tourist arrivals (Morley, 1992; Lim, 1997; Lim and McAller, 2000a and 2000b). Multiple regression method is an alternative technique used (Witt and Martin, 1987; Walsh, 1996), which enables to detect economic determinants as well as elasticity values. However, inclusion of non-stationary time series data in a regression model can lead to a spurious regression situation. Hence, the cointegration and error correction models are used in this

paper as per the objectives and to overcome the drawbacks of time series and general multiple regression models.

More studies that illustrate tourism demand model found in literature include Leob (1982), Uysal and Crompton (1984), Gunadhi and Chow (1986), Summary (1987), Sheldon (1993), and Crouch (1994a and 1994b). Leob (1982) found that tourism demand in the United States was significantly influenced by real per capita income of tourist generating countries, exchange rates and relative prices. Uysal and Crompton (1984) found that real per capita income, relative price and exchange rate are significantly influencing factors for tourism demand.

Log-linear multivariable model estimated by ordinary least square was the most widely used approach in modelling tourism demand. It is found that such models fit the data better and the coefficients of variables can be conveniently interpreted as demand elasticities. Other advantages in using models of this functional form are the capability to model cause and effects and to provide statistical measures of accuracy and significance. In the mid 1990s, error correction models (ECM) began to appear in tourism literature. Syriopoulos (1995), Kulendran (1996), Kulendran and King (1997), Kim and Song (1998), and Vogat and Wittayakorn (1998) were the first authors to apply such models. Since then, though many studies on tourism demand analysis based on cointegration and error correction models, no such work has been reported in Sri Lanka context.

MATERIALS AND METHODS

Theoretical framework

Johansen's (1991 and 1995) multiple cointegration analysis is employed in this study. The procedure was carried out in two steps. The first step is to test for order of integration of the variables. A condition for the test is that variables entering the cointegrating equation should be integrated of the same order. To test the degree of integration of variables, Augmented Dickey- Fuller (ADF) test was used (Dickey and Fuller, 1979).

If the considered variables were integrated of the same order i.e. $I(1)$, the cointegration analysis, using an Error Correction Model (ECM), is appropriate to model the tourism demand for Sri Lanka. The theory of cointegration and ECMs are linked with Granger's Representation Theorem (Engle and Granger, 1987), which states that if there is a cointegration relation between a set of variables, their relationship has an error correction model. Several methods have been developed to model cointegrating relationships. The method developed by Johansen and Juselius (1990) was applied for the purpose of this paper. The Johansen procedure, as it is known, obtains maximum likelihood estimates of the cointegrating vectors and adjustment parameters directly. Moreover, this method allows for measuring the speed of adjustment parameters.

Data and empirical model

This study utilized quarterly time series data for the period 1978q1 to 2007q4. Annual reports of Sri Lanka Tourist Board, annual reports of Central Bank of Sri Lanka and

International Monetary Fund (IMF) data bases are the sources for the secondary data utilized in this study.

A log-linear model was used to estimate the tourism demand. Gross Domestic Product (GDP of UK), exchange rate (Exchange rate between a Sterling Pound and a Sri Lanka Rupee) and relative price (this is defined as CPI_{SL}/CPI_{UK} , where CPI_{SL} and CPI_{UK} are consumer price indices of Sri Lanka and United Kingdom respectively.) are the explanatory variables used in the study while the dependent variable was tourist arrivals from UK to Sri Lanka. The demand model was specified as follows.

$$\ln TA = \mu_t + \beta_1 \ln GDP_{UK} + \beta_2 \ln RPI_{UKvsSL} + \beta_3 \ln EXR_{UK/SL} + \beta_4 S_1 + \beta_5 S_2 + \beta_6 S_3 + \beta_7 TER + \beta_8 TSU + \varepsilon_t$$

Where,

- $\ln TA$ = log of tourist arrivals from UK to Sri Lanka,
- μ_t = Intercept
- $\ln GDP_{UK}$ = log of Gross Domestic product of UK
- $\ln RPI_{UKvsSL}$ = log of relative price index for UK and Sri Lanka
- $\ln EXR_{UK/SL}$ = log of exchange rate between UK and Sri Lanka
- TER = Dummy variable to capture the terrorist attacks
- TSU = Dummy variable to capture the Tsunami effect

S_1 , S_2 , and S_3 are dummy variables that represent the first, second and third quarters respectively (seasonality is an inherent characteristic in tourism arrivals and hence we have added deterministic seasonal dummies to capture the seasonal pattern).

$$TER = \begin{cases} 1 & \text{for } 1983 Q_3 - 1984 Q_4 \\ & 1987 Q_1 - 1989 Q_4 \\ & 2001 Q_3 - 2001 Q_4 \\ & 2006 Q_1 - 2007 Q_4 \\ 0 & \text{for all other quaters} \end{cases}$$

Value one was given to the dummy variable TER for the periods defined as above by considering the severe terrorist events. TSU is assigned value one for the quarters from 2004 Q_4 to 2005 Q_2 .

Using the information provided by Johansen cointegration test, an error correction model is constructed to obtain the short-run elasticities. Modelling the short-run dynamics will provide information concerning how adjustments take place among the variables, to restore long-run equilibrium, in response to short-term disturbances in the demand for tourism in Sri Lanka. The unrestricted error correction model is as follows.

$$(\Delta \ln TA) = \mu + \sum_{j=1}^g \sum_{i=1}^k \beta_{ij} \Delta \ln X_{j,t-i} + \sum_{j=g+1}^{g+d} \sum_{i=1}^d \beta_j D_i + \alpha EC + \varepsilon_t$$

By using the coefficient of this error correction term (EC), the speed of adjustment was calculated. This explains how quickly the system returns to the long term equilibrium after a random shock and this is expected to be negative to ensure the convergence.

RESULTS AND DISCUSSION

Unit root analysis

ADF tests did not reject the null hypothesis of unit roots under 5% level of significance (Table 1) but first differences attained the stationery at the level of 5% level of significance (Table 2). Hence, these results suggest that all variables appear to be integrated of order one in their level form (Tables 1 and 2).

Table 1. Unit roots test for the variables in level form

Variable	Panel A: with Constant		Panel B: with Constant and Trend	
	ADF Test		ADF Test	
	Test Statistic	5%	Test Statistic	5%
lnTA	-1.980	-2.887	-3.379	-3.450
lnGDP _{UK}	3.189	-2.887	1.764	-3.450
lnRPI _{UKvsSL}	3.688	-2.887	1.093	-3.450
lnEXR _{UK/SL}	2.369	-2.887	-0.331	-3.450

Table 2. Unit roots test for the variables in first differenced form

Variable	Panel A: with constant		Panel B: with constant and trend	
	ADF Test		ADF Test	
	Test Statistic	5%	Test Statistic	5%
Δ lnTA	-6.994	-2.887	-6.958	-3.450
Δ lnGDP _{UK}	-3.145	-2.887	-4.079	-3.450
Δ lnRPI _{UKvsSL}	-4.329	-2.887	-6.719	-3.450
Δ lnEXR _{UK/SL}	-5.261	-2.887	-6.116	-3.450

Cointegration analysis

Since the variables were considered to be I(1), the Johansen approach was employed to test whether there were any cointegrated relationships among the variables in level form. This approach to cointegration is based on a vector-autoregression (VAR) framework. Variables *lnTA*, *lnGDP*, *lnEXR* and *lnRPI* were entered as endogenous variables, while deterministic seasonal dummies, *TER* and *TSU* were treated as exogenous variables. A constant was also included.

Table 3 presents the results of Johansen Cointegration Test. Panel A and panel B, report the values of λ_{Max} and λ_{Trace} respectively for number of cointegration relationships. Both the λ_{max} and λ_{trace} did not reject the null hypothesis since the smallest eigen value is 0, reinforcing the idea arrived at earlier, namely that the series are in fact non-stationary. However, some linear combination may be I(0), since both tests reject the hypothesis that the rank of Π is 0, at least at the 5 percent significance level. The net result here is that there is fairly strong evidence for the presence of a unique cointegrating relation between visitor arrivals (lnTA) and lnGDP, relative price (lnRP) and exchange rate (lnEXR).

Table 3. Results of Johansen Cointegration tests (λ_{\max} and λ_{trace} tests)

Rank	Eigen value	Panel A		Panel B	
		λ_{\max}	P-Value	λ_{trace}	P-Value
0	0.313	44.424	0.0000	72.513	0.0000
1	0.137	17.482	0.1553	28.089	0.0790
2	0.085	10.604	0.1781	10.607	0.2410
3	0.000	0.003	0.9588	0.003	0.9588
Long – run elasticities					
Variable	LGDP	LEXR	LRPI	Constant	
Elasticity	4.2615 (0.000)	0.73357 (0.018)	-3.9 (0.000)	-0.514843 (0.000)	

P values are in parentheses.

The long - run elasticity estimates are also shown in the bottom part of Table 3 which were obtained by normalizing $\ln TA$ as one.

The results in the long-run model (Table 3), suggest that income (GDP) of the origin country (UK) is positively related to the tourism demand with a long-run elasticity of around 4.62 and it is compatible with the prior expectation. Hence, in the long-run tourism demand from UK is income elastic. This is confirmed by Khalik (Khalik, 2003) and he has proved that income elasticity for UK tourists is greater than one. Finally, holding the effect of relative prices and the exchange rate constant, one percent rate of change in real income of UK induces tourism demand to increase by 4.62 percent. There is a negative relationship between tourism and relative price in long-run. It suggests that, UK residents are highly price sensitive, since the price elasticity of tourism is highly elastic i.e. -3.9. Keeping other factors constant, one percent increase in price will reduce the UK tourist arrivals by 3.9 and vice versa. The exchange rate variable is significant in long-run indicating the elasticity of around 0.7, but it causes to increase the tourist arrivals slightly because the positive elasticity is less than one.

Analysis of error correction model

Based on the Johansen's cointegration test, an error correction model (ECM) was developed to obtain the short-run elasticities. Since all variables were not significant in the unrestricted model, we reduced it to parsimonious specification by using the general-to-specific approach (Table 4). As shown in the error correction model, the speed of adjustment was calculated as -0.307. The error correction (EC) term is negative and the coefficient guarantees the convergence of the series in long-run. The coefficient of this term implies that a deviation of tourism demand from long term equilibrium is corrected around 31% of in the next period.

From the results in Table 4, short-run changes in income (GDP) variable do not seem to have a significant effect on tourist arrivals since the variable is insignificant in the parsimonious model. According to Song and Witt (2004) tourists are also likely to be more income elastic in the long- run than in the short-run. In the short-run also higher prices are likely to discourage tourists from traveling. On the other hand exchange rate is not a significant factor in the short-run. Significant lag dependent variable $\Delta \ln TA_{(-2)}$, shows a negative impact on tourism demand.

Table 4. Results of Parsimonious error correction model (ECM)

Error correction model	Coefficient	P value
Constant	-0.083199	0.127
$\Delta \ln RP_{(-2)}$	-2.916	0.047
$\Delta \ln TA_{(-2)}$	-0.386	0.000
S1	0.021	0.000
S2	-0.100	0.005
S3	0.273	0.000
Tsu	0.058	0.000
EC	-0.307	0.001
Adjusted R ² (Adj R ²)	0.7343	
Durbin –Watson Statistic (DW)	1.98	
Standard Error of Residuals	0.095	
Diagnostic Tests		
Type of the test statistic	Value	P value
Normality: Chi square χ^2 (2)	24.775	0.297
Heteroskedasticity		
LM test (TR ²)	29.10	0.407
Multicollinearity		
VIF		
$\Delta \ln RP_{(-2)}$	1.018	NA ¹
$\Delta \ln TA_{(-2)}$	1.012	NA ¹
Stability of Parameters		0.205
RESET F _(2,108)	1.61	
Serial Correlation		0.311
LM F _(1,107)	1.78	

NA = Not applicable

Although a negative impact of Tsunami was expected, the short-run model yielded a positive impact contrary to the expectation. This would be due to the inclusion of embarkation of aid workers and expatriates who returned to the island to help family members after the Tsunami, within the UK arrival figures. If it is necessary to elaborate the Tsunami effect, those figures should be removed from total arrivals of UK. This was not possible due to data limitation. The study displays the capability of the approach to predict tourism demand related to other destinations.

Deterministic seasonal dummies were included in the model without any transformation. The first three quarters were explained by dummies (S1, S2, and S3) and fourth quarter by the intercept term. The significance of the seasonal variables confirms the seasonality of tourist arrivals. A dummy variable was included to represent the terrorist events that occurred during the past period. However, it was not statistically significant.

As per Table 4, normality test indicates that, residuals are approximately normally distributed. According to the LM test (Table 4) there is no heteroscedasticity in the model. Serial correlation LM test did not reject the null hypothesis of no serial correlation among residuals which is consistent with DW = 1.98 showing no positive first order autocorrelation.

The accuracy of the model specification has been assessed by the Ramsey's RESET test and did not reject the null hypothesis of no misspecification in the model.

Multicollinearity is an important issue in OLS regression and it is necessary to confirm that it is not a serious problem on estimated coefficients. The variance inflation factor was calculated for the significance variables in the final model and results are summarized in Table 4. As the VIF of all variables are negligible (too much less than 10 a rule of thumb) multicollinearity is not a serious problem in the short-run dynamic model. Diagnostic tests approve the model since the model validity can be assured through all the tests.

CONCLUSIONS

According to the discussion conducted above it is possible to draw the following specific concluding remarks under the empirical results of this study.

There exists a long-run equilibrium relationship as well as a short - run dynamic relationship between tourist arrivals from UK to Sri Lanka. The influencing factors were income, relative price and exchange rate between destination and country of origin. Tourist income (GDP) in UK positively affects tourist arrivals to Sri Lanka which is highly elastic. Therefore, increase of tourist income of origin country provides a favourable impact on Sri Lanka tourism. Further, it is obvious that income has no effect on tourism in the short - run.

As expected, relative price has negative effect on tourism sector in Sri Lanka with a high elasticity in the long - run as well as the short-run. . Therefore, it can be concluded that UK tourists are highly price sensitive to Sri Lanka as a destination. Since UK is the top tourism generating market in the European region, policy makers should study the price stability of destination as well as the cost of living and tourism prices of other competing destinations.

Exchange rate shows a positive impact on Sri Lanka tourism in the long-run *i.e.* favourable exchange ratio between Sri Lankan rupee and sterling pound may gain an advantageous situation for Sri Lanka tourism in the long - run. But there is no effect in the short - run.

In the destination selection process, the word of mouth recommendation has operated negatively for Sri Lanka. Although we expected a negative impact of Tsunami, the short-run model resulted in a positive impact contradictorily to the expectation. This is due to the inclusion of arrivals of Tsunami aid workers and expatriates who returned to Sri Lanka after Tsunami.

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