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Tourism Maturity and Demand: Jamaica

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Abstract

Given the importance of tourism to the Jamaican economy and hence policy, this paper estimates a demand function for Jamaica's tourist product. It also assesses the stage in the product cycle of the industry. An error correction model (ECM), structural time model (STM) and an autoregressive moving average (ARIMA) model were employed. The ECM was more robust than the ARIMA and STM models in predicting tourism demand. The ECM and ARIMA models captured the major turning points in the series well and provided reasonably good forecasts. In contrast to the findings of Henry and Longmore (2002), the results indicate that source country income is significant. The explanatory power of the ECM improved with the inclusion of the tourism density ratio, implying that researchers should include inter-action factors in tourism demand models. The empirical analysis indicates that Jamaica has a mature tourism product. This implies that policy needs to focus on diversifying the product, promoting such diversity and targeting new markets.

Keywords: tourism demand, forecasting, Structural Time Series Modelling

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[1] The views expressed are those of the author and does not necessarily reflect those of the Bank of Jamaica. O'neil Malcolm is a summer intern at the Bank.

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1.0 INTRODUCTION

Tourism has emerged as one of the fastest growing industries in the developing world. It is the single largest earner of foreign exchange in Jamaica and has significant linkages within the economy. However, the industry is significantly influenced by external factors and susceptible to shocks. Given the importance of this industry, this paper estimates a demand function for Jamaica's tourism services.

There are very few studies that have attempted this for Jamaica. The most recent, Henry and Longmore (2003), estimated a model of tourism demand using an Unrestricted Error Correction Model (UECM). However, their results did not indicate a significant relationship between tourist arrivals and income growth in the United States of America (USA). This seems counterintuitive given that the USA market accounts for approximately seventy per cent of the demand. This paper, therefore, extends this work by developing alternative models of tourism demand for Jamaica. In particular, the paper applies an error correction model and a structural time series model to the Jamaican data, and evaluates the in sample fit of these models, relative to a benchmark ARIMA model. The objective is to develop a framework that can forecast tourism demand and assess the stage of the product cycle of the tourism industry.

With respect to the latter, the paper assesses the maturity of the tourism product. Butter (1980) identified six stages of the tourism life cycle – exploration, involvement, development, consolidation, stagnation and decline. The latter three stages are the mature stages. The maturity of a tourism destination is therefore characterised by the slowing and eventual decline in tourist arrivals in a context where income growth in the major source markets have not tapered off. The maturity of a destination is often characterised by four main events:

(a) Image loss – the visible aging of a hotel plant and other environmental factors;

(b) Space loss – the diminishing of free space per tourist owing to over-crowding;

(c) Service loss – the impairment of customer service owing to success induced attitudes of complacency, unwillingness to work overtime as wages increase, etc; and

(d) Fear/privacy loss – owing to increasing visitor harassment.

Crowding in resort areas is a common occurrence throughout the world. People usually move into resort areas for employment opportunities thus leading to increasing urbanisation and a stress on the infrastructure of the area. This is seen as a negative tourist experience, which will result in low repeat visitors. This negative perception can, to some extent, be corrected through creative marketing and promotional activities.

The results show that tourism demand is predominantly explained by the income in the source market. The price elasticity of Jamaica's tourism demand, however, was very small. The findings also suggest that Jamaica is a mature or maturing destination. Based on forecast evaluation tests, the ECM was more robust than the ARIMA and STM models in predicting tourism demand. The ECM and ARIMA models captured the major turning points in the series well and provide reasonably good forecasts.

The remainder of the paper is organised as follows: Section 2 discusses the history of tourism in Jamaica. Section 3 gives a brief review of similar studies. Section 4 describes the methodology used and the results are presented in section 5. Section 6 examines the forecast evaluation of the models. The final section concludes and discusses some of the policy implications of the results.

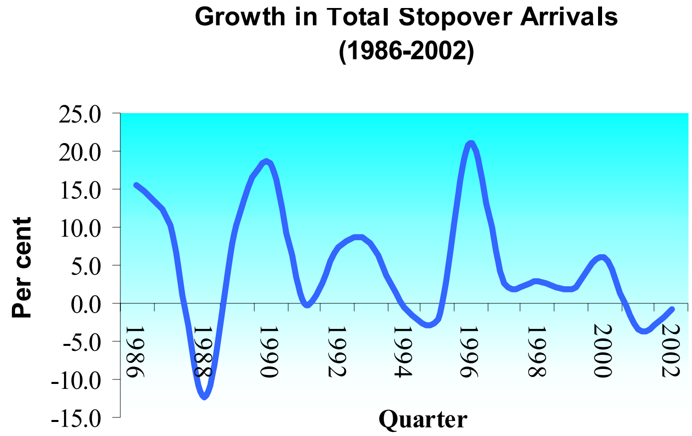
2.0 TOURISM IN JAMAICA

The tourism industry is the largest earner of foreign exchange for Jamaica. Within the balance of payments it is the largest source of foreign inflows outside of private capital inflows. Additionally, the tourism industry is the seventh largest contributor to Jamaica's Real Gross Domestic Product (GDP), contributing an average of 11.0 per cent between 1997 and 2002, directly. The Jamaican tourism market is dominated primarily by visitors from the USA, United Kingdom (UK) and Canada, which account for, on average, 64.0 per cent, 10.0 per cent and 8.0 per cent of total stopover arrivals, respectively, for the period 1994 to 2002.

Total visitor arrivals increased by 123.0 per cent between 1986 and 2002. Stop over visitors account for an average 87.5 per cent of total visitors over the period, with an average expenditure per person of US$67.4. The annual growth in stopover visitor arrivals in Jamaica between 1986 and 2002 was 5.0 per cent (see figure 1). Arrivals were relatively volatile over the period, attributed to both external and internal shocks to the industry.

Stopovers declined significantly in 1988, 1994 and 2001, with a marginal contraction recorded for 1991. The appreciable decline of 12.5 per cent in arrivals in 1988 was related to the adverse effects of a hurricane and unfavourable press reports of gang warfare and the involvement of Jamaicans in drugs. The marginal decline of 0.1 per cent in arrivals in 1991 was attributed to the negative effects of both the Persian Gulf War and the recession in the major source markets. In 1994 Jamaica's image was tarnished as a consequence of criminal activities against tourists, which was extensively publicised overseas. This influenced a 2.5 per cent decline in arrivals for that year. The decline continued into the second quarter of 1995 but improved thereafter. The poor performance of stopover arrivals in 2001 was linked mainly to the adverse effects of the 11 September attack in the USA on world travel and to some extent the social disturbances in the domestic economy in July of the same year.

Figure 1



Of note, on all occasions, tourist arrivals quickly rebounded, indicative of the resilience of the industry. In the context of the 1988 disturbances, visitor arrivals grew by 16.1 per cent the following year. For 1999, the growth in visitor arrivals was moderated to 1.9 per cent, followed by an expansion of 6.0 per cent in 2000. The events of 2001 have been particularly severe, contributing to a decline of 0.7 per cent in 2002. However, the data for the first half of 2003 indicate a recovery in arrivals.

Table 1 (in appendix) shows the annual foreign exchange receipt from visitors between 1985 and 2002. Consistent with the stopover tourist arrivals figures, receipts declined in 1988, 1994 and 2001. Between 1995 and 2002 the sector generated an average of US$1174.0 million in receipts representing an average of 15.5 per cent of GDP.

In terms of the regional market, Jamaica is the fifth most favoured destination in the Caribbean region, following Puerto Rico, Dominican Republic, Cuba and the Bahamas (see table 2 in the appendix). Prior to 1998, however, Jamaica had the fourth largest market share, followed by Cuba. Puerto Rico, Dominican Republic and Bahamas maintained their first, second and third positions, respectively, as the most favoured destinations in the Caribbean between 1991 and 2001.

In the context of the shocks and in an attempt to maintain the country's competitiveness the Jamaican government implemented a number of programmes throughout the period to enhance the diversity and quality of the tourism product. In 1988, the Jamaica Tourist Board (JTB) embarked on a strategy of targeting specific market segments. During 1991, new development opportunities in Eco-Tourism and the National Park System were launched. Four projects were launched during 1995, which saw a total of $60.86 million being expended during the year. Among these projects were the Resort Town Beautification Project and the Ocho Rios Sustaining the Environment and Tourism (SET) Project.

More recent initiatives by the JTB include "operation airlift", whereby efforts are concentrated on increasing the number of airlift to the country and an expansive marketing campaign aimed at improving the image of Jamaica abroad. Policy initiatives were also aimed at encouraging product diversification and expansion through the provision of incentives to private sector entities. These policies include revisions to the Hotel Incentive Act and the Resort Cottages Incentive Act, which allow for ten years and seven years relief form income tax and import duties, respectively. A 'stay and sail' programme, targeting cruise passengers was launched in 2002 to enhance the tourism product. Promotional activities in 2003 include live radio broadcast from resort areas to important target markets and the hosting of travel agents from North America, Europe and the Caribbean were done in collaboration with hotels, airlines and other segments of the industry. The JTB has also move to target young adults in the USA through its advertising campaign in cinemas.

In the context that most of visitors to Jamaica emanates from the USA, a plot of real GDP for the USA against arrivals shows a general positive relationship between the two series (see figure 1 in the appendix). Except for the major shocks in 1993, 1988 and 2001, the series tend to move together indicating that USA GDP should have a positive effect on stopover arrivals from that country. This visual impression is however insufficient to confirm the nature of the relationship between macroeconomic developments in the major source markets and the arrival of tourists in Jamaica. In a dynamic setting, the changes in income in the USA for a particular year may be associated with arrivals to Jamaica in subsequent years. Moreover, the behaviour of overall GDP may not be the best predictor of tourism demand. Rather, a component of expenditure in the USA national accounts may better explain arrivals, while alternative formulations of the series may shed more light on the nature of the relationship. In this context, it is difficult to draw firm conclusions from figure 1 (see appendix). This points to the need for more rigorous empirical work to ascertain the relationship between the two variables.

3.0 LITERATURE REVIEW

Generally, empirical studies of tourism demand employ a log linear model in which demand is a function of income growth in the source countries, the real exchange rate, and to a lesser extent, transportation costs to and from competing destinations. Notably, all the studies reviewed found income in the source country to be an important and significant determinant of tourist demand in addition to relative prices[2]. For example, Morley (1992), however, argues that most studies give little consideration to underlying microeconomic factors. Morley (1992) viewed tourism demand as complementary to the demand for food, and other types of entertainment and suggested that, while the product cannot be stored or transported, the industry has to cope with the problem of seasonal demand and large fixed costs. His work incorporated an indirect utility function, and the underlying model was derived from the following constrained optimisation problem:

$$\text{Max} \quad U_r(t_r, q_r) \tag{1}$$

$$\text{Subject to: } t_r + t^{`} \leq T_r$$

$$P^{`}.q_r + c_o t_r + f \leq Y_r$$

where t = time spent at destination(s), t\` = time spent in transit, T = total time available for tourism services, P =vector of prices of other goods, q = quantities of other goods, f =

[2] See for example Rahman, Giap and Chen (1996)

fare, c_o = cost per unit of time on tour, Y= income and r represents an agent's utility. The resulting optimum demand for tourism services and other consumption goods are

$$q_r^* = q_r(P, c_o, t`, f, T_r) \qquad (2)$$

$$t_r^* = t_r(P, c_o, t`, f, T_r) \qquad (3)$$

In terms of the empirical methodology, while most studies have employed a single equation error correction framework, some researchers have emphasised a systems approach. De Mello and Sinclair (2000) for example argue that the single equation models do not capture short and long run effects. Ramesh (2002) and De Mello and Sinclair (2000) adopted the Almost Ideal Demand System (AIDS). The AIDS model measured tourism expenditure as a function of prices and per capita expenditure. A typical AIDS model takes the following form:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_i + \beta_i \ln (x/P) \qquad i,j = 1,\ldots,n \qquad (4)$$

$$\ln P = \alpha_0 + \sum_I \alpha_i \ln p_i + \tfrac{1}{2} \sum_j \sum_i \gamma_{ij} \ln p_i \ln p_j \qquad (5)$$

where w_i is the share of tourism expenditure allocated in destination i to expenditure in n destinations, p = price of tourism, x = total per capita expenditure allocated in all n destinations and P is a price index. De Mello and Sinclair (2000) concluded that tourism demand for the UK was very sensitive to price changes in Portugal, Spain and France and found that expenditure elasticities with respect to tourism demand were positive, indicating that the tourism product was a normal good.

The earliest available study on tourism for small Caribbean economies is Worrell (1995). He focused on the supply side of the Barbadian tourist industry, which was modelled as a function of unit labour cost (ULC), primary interest rate (r), occupancy rates (OCCUP) and the quality of the tourism product (LUX). The reduced form supply function took the following form:

$$\text{Ln } P = f\,[\,\ln ULC,\ r\,,\ \ln(OCCUP),\ \ln LUX\,]\,, \qquad (6)$$
$$\qquad\qquad (+) \quad (+) \quad\quad (-) \quad\quad\quad (+)$$

where P is the price of the tourism service.

Unit labour cost was found to be the principal factor affecting price, with interest rates having a minimal effect. Contrary to expectations, Worrell (1995) found that an increase in occupancy levels in the Barbadian tourism industry depressed prices, while the quality variable had no significant effect. A linear demand function was also estimated and the results indicated that the GDP was the most influential variable, while relative prices had a minimal effect.

Whitehall and Greenidge (2001) assessed the stage of development of Barbadian tourism demand. They use a tourism density ratio[3] as a proxy for maturity and estimated the following demand equation:

$$\ln A = \beta_1 \ln(Y / P_S) + \beta_2 \ln P_1 + \beta_3 \ln(T / P_S) + \beta_4 \ln TDR_1) \qquad (7)$$

where A = US arrivals to Barbados, Y = US nominal income, P_s = US Consumer Price Index, T/P_s = Real US Average Unit Price of Air travel, P_1 = Barbados Tourism GDP deflator, TDR_1 = Barbados Tourism Density Ratio. Similar to studies for other countries, Whitehall and Greenidge (2001) found real income in the source country to be most significant in explaining tourist arrivals in Barbados. The transport and relative price variables were also significant, with negative signs. The tourism density ratio was also found to be negative and significant indicating a maturing destination.

Alleyne (2003) suggested that when analysing tourism demand, account should be taken of the time series property of the data, in particular, seasonal unit roots. He employed the HEGY methodology[4] in modelling the demand for Jamaica's tourism product and

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[3] The ratio of total arrivals to population is used as a measure for maturity. Overcrowding of tourism destination is one sign of a maturing destination.
[4] See Hylleberg et al (1990)

compared the results with those obtained from the traditional Box Jenkins methodology in which seasonal unit roots are implicitly assumed. Alleyne (2003) found that pre-testing the data for seasonal unit root and incorporating their effects helps to improve forecasting accuracy in single equation model.

3.0 METHODOLOGY AND DATA

Following Whitehall & Greenidge (2001), this paper uses an Error Correction Model (ECM) to estimate the demand for tourism in Jamaica. Four specifications of the ECM will be assessed. In addition to the ECM, the paper explores the use of a Structural Time Series Model (STM) and a benchmark ARIMA (p,d,q) model in forecasting tourism demand. Where applicable, the data was seasonally adjusted. The analysis focuses on stopover arrivals, due to the absence of data on cruise disaggregated according to country of origin.

The explanatory variables used in the ECM are USA GDP, USA consumer price index (CPI), average expenditure per person, real effective exchange rate (REER) in Jamaica and the tourism density ratio (TDR). Similar to Whitehall & Greenidge (2001), the TDR is used to capture the maturity of the tourism product. The models, with variables in logs are specified as follows:

$A = f(Y_r, P_j)$ Model (1)

$A = f(Y_r, P_j, TDR)$ Model (2)

$A = f(Y_r, P_j/P_s, TDR)$ Model (3)

$A = f(Y_r, TDR, ER)$ Model (4)

where A = arrivals , Y_r = USA real consumption spending on services, P_j = average expenditure per person, P_s = USA CPI, TDR = Jamaica tourism density ratio, ER = Jamaica's REER.

Model (1) is a typical income/price demand model while models (2) and (3) modify model (1) to evaluate the effect of the TDR and relative prices on tourism demand. Model (4) uses the REER as the price measure instead of average expenditure per person.

All the variables were tested for the presence of unit roots using the Augmented Dickey Fuller (ADF) test. Two intervention dummies were created to capture the relatively significant increase in tourist arrivals during 1989 and 2002, following the shocks the previous years. The error correction model is as follows:

$$\Delta A = c_0 + c_1 U_{t-1} + \sum_{i=0}^{n} \alpha_i \Delta Y_{t-i} + \sum_{i=0}^{n} \beta_i \Delta Pj_{t-i} + \sum_{i=0}^{n} \gamma_i \Delta TDR_{t-i} + \sum_{i=1}^{n} \eta_i \Delta A_{t-i} \qquad (8)$$

where, U_{t-1} is the ECM term and β_4 the adjustment parameter ($-1 < \beta_4 < 0$). The error correction model was initially over parameterised with lagged values of the explanatory variables. Redundant variables were systematically eliminated until the most parsimonious[5] model was achieved.

Structural Time Series Models (STMs) are special cases of state space models (SSMs). A SSM typically consist of a measurement and a transition equation. The transition equation for the STM is formulated in terms of the components of the endogenous variable, that is its trend, cycle and seasonal patterns. These components are unobservable but they have natural interpretations and represent the salient features of the particular series. The measurement equation of the STM is referred to as state vectors, and is estimated through a standard Kalman filter which produces the minimum mean square estimator of the state vector. The full model is then estimated using maximum likelihood.

The trend component is modelled as follows:

(Level) $\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t$ $\qquad \eta_t \sim NID(o, \delta_\eta^2)$ (9)

[5] The model with the lowest Schwarz Criterion was selected.

(Slope) $\beta_t = \beta_{t-1} + \varepsilon_t$ $\varepsilon_t \sim NID\ (o\ ,\ \delta_\varepsilon^2)$ (10)

where η_t and ε_t are mutually uncorrelated. From this general specification, the trend can take various forms. For $\delta_\varepsilon^2 = 0$, the trend reduces to a random walk with constant drift, whereas for $\delta_\eta^2 = 0$, the trend is an integrated random walk. The extent to which the level and slope change over time is governed by the hyper parameters, $q_\eta^2 = \delta_\eta^2 / \delta_\varepsilon^2$ and $q_\xi^2 = \delta_\xi^2 / \delta_\varepsilon^2$ where δ_ε^2 is variance of the residuals for equation 10.

The cyclical component is modelled as follows:

$$\begin{pmatrix} \psi_t \\ \psi_t^* \end{pmatrix} = \rho \begin{pmatrix} \cos \lambda_c & \sin \lambda_c \\ -\sin \lambda_c & \cos \lambda_c \end{pmatrix} \begin{pmatrix} \psi_{t-1} \\ \psi_{t-1}^* \end{pmatrix} + \begin{pmatrix} k_t \\ k_t^* \end{pmatrix} \quad , \quad t = 1, \ldots, T \qquad (11)$$

where λ_c is the frequency, in radians, in the range $0 \leq \lambda_c \leq \pi$ and ρ is the damping factor such that $0< \rho < 1$. k_t and k_t^* are white noise disturbances which are mutually uncorrelated with zero mean and common variance σ_k^2.

The use of STM in time series models allows for the trend, seasonal and cycle component of the series to be modelled stochastically. This is important as it capture information that would otherwise be lost, thus improving the predictive power of the model. Another important feature of STM is that it allows for out-of-sample forecast. Out-of-sample forecasts can be generated for the endogenous variable without future values of the independent variables.

The STM to be estimated is as follows:

$$\ln A = f(\ln Y, \ln P, Trend, Seasonal, Cycle) \qquad (12)$$

Given that the tourist arrivals series was seasonal adjusted to be consistent with the USA income data, the seasonal component is not relevant.

A Basic Structural Model (BSM) is first estimated in which the fundamental explanatory variables are left out and only the trend and cycle components are considered. In the second stage a General Structural Model (GSM) is estimated with the inclusion of fundamental explanatory variables. In both set of estimates, the relevant residual diagnostic tests are conducted. The Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) are used to select the most parsimonious model. The root mean square error (RMSE) along with other forecast evaluation statistics are used to examine the performance of the model with respect to its predictive power.

Quarterly data for the period 1988:2 to 2002:4 were used in the STM regression. All the variables were logged before entering the model. The tourist arrival series used was retrieved from the Statistical Digest published by the Bank of Jamaica and the Annual Travel Statistic published by the Jamaica Tourist Board. The remainder of the data were gathered from the International Financial Statistic (IFS) CD ROM, except for the REER and US consumption expenditure on services, which were obtained from the Research Services Department, BOJ and the Bureau of Economic Analysis online database, respectively. In estimating this model, a four period moving sum of tourist arrivals was used to make the data compatible with the income series for the USA. Of note this adjustment removes seasonality from tourist arrivals. This STM was estimated in the software: Structural Time Series Analyser, Modeller and Predictor (STAMP).

5.0 RESULTS

5.1 ECM

The Augmented Dickey Fuller test suggested that the variables are integrated of order one, I(1) (see table 3 in appendix). Based on the Johansen test, all four models had a system of cointegrated variables. The paper first used the real GDP for the USA as the proxy for income. However, the results for model 2 showed that, while the GDP was significant in explaining tourist arrivals, it had a negative relationship (see table 4 in appendix). Given this result, other income proxies were considered. In this regard, total consumption expenditure[6] in the USA and the services component of consumption were considered. These components produced relatively favourable and significant results, which were consistent with a prior expectation. The results of the ECM models using USA expenditure on services are presented in table 1.

DUSCS is the change in expenditure on consumption services in the USA, DEXP is the change in average expenditure per person, DRP is the change in the real average expenditure per person divided by USA CPI, TDR is tourism density ratio, DREER is the change in the real effective exchange rate and LARR is log stopover arrivals. The income variable is positive and significant in all of the models. For model (1), a one per cent change in US income will result in a 1.43 per cent increase in visitor arrivals to Jamaica. Similarly, in model (2), a one per cent increase in US income will generate a 0.95 per cent increase in arrivals with a lag of four quarters. The TDR, which captures externalities factors, was included in model (2) with three lags. Observation would suggest that contemporaneous TDR might not be critical, as tourists would have to know the particular tourism product before determining whether it is crowded. Thus a crowed destination may affect repeat visitors.

[6] This component of expenditure would most likely reflect permanent income

Table1: Regression estimate for ECM

Regressors	Model 1	Model 2	Model 3	Model 4
Constant	-0.006	0.001	-0.01	-0.01
	(-1.28)	*(0.11)*	*(-0.96)*	*(-2.5)*
DUSCS	1.44			
	(2.34)			
$DUSCS_{t-2}$			1.12	1.14
			(2.20)	*(2.36*
$DUSCS_{t-3}$				1.25
				(2.39)
$DUSCS_{t-4}$		0.96	1.10	1.20
		(2.13)	*(2.19)*	*(2.47)*
$DEXP_{t-2}$		0.01		
		(2.38)		
DRP_{t-2}			0.02	
			(2.84)	
DTDR		-0.09		-0.08
		(-3.97)		*(-3.08)*
$DTDR_{t-1}$		-0.09		-0.09
		(-3.43)		*(-3.21)*
$DTDR_{t-2}$		-0.09		-0.10
		(-3.35)		*(-3.71)*
$DTDR_{t-3}$		-0.10	-0.03	-0.11
		(-4.37)	*(-2.36)*	*(-4.20)*
$DREER_{t-1}$				
ECM	-0.21	-0.34	-0.33	-0.25
	(-2.95)	*(-3.76)*	*(-3.32)*	*(-3.09)*
D1	0.06	0.21	0.23	0.23
	(3.64)	*(2.12)*	*(2.28)*	*(2.21)*
D2	0.04	0.02	0.04	0.02
	(3.08)	*(2.22)*	*(6.63)*	*(1.76)*
$DLARR_{t-1}$	0.29	0.63	0.59	0.58
	(2.98)	*(5.29)*	*(5.87)*	*(5.52)*
$DLARR_{t-2}$	0.31	-0.39	-0.40	-0.39
	(2.93)	*(-3.33)*	*(-3.32)*	*(-3.14)*
R^2	0.70	0.69	0.62	0.67
Durbin Watson stat	2.02	2.34	2.43	2.45
Jarque-Bera stat	0.34	1.56	0.58	0.19
White H test	8.79	21.87	20.78	29.06
Breusch-Godfrey test	23.19	17.75	13.95	16.50

The TDR had a negative sign in all the models indicating a maturing tourism product. This is corroborated by the growth rate of arrivals, which since 1988 has for the most part has been declining. (see Figure 2 in the appendix).

With regard to the error correction term (ECT), it indicates the amount by which tourist arrivals would be corrected in the current period given the deviation from long run equilibrium in the last period. The ECT from model (2) indicates that arrivals would be corrected by 0.33 per cent of its deviation from long run equilibrium in the previous quarter. This result is consistent with other studies and confirms the ability of the local industry to rapidly recover from a shock that has displaced arrivals from its long run path. In relation to the price measure, average expenditure per person, while significant, it had a positive sign indicating that demand responds positively to prices. This result goes against prior expectations. Greenidge and Whitehall (2001) obtained a similar result for Barbados.

With respect to model (3), the income and relative price variables were found to be positive and significant. The ECM and TDR coefficients were also consistent with expectations. As was anticipated, the results for model (4) showed US income and tourism density ratio to be significant with positive and negative coefficients, respectively.

Given the possibility of endogeneity, the price variable would be correlated with the errors, as such a two stage least square estimate was also considered (see table 5 in the appendix). The results from this regression were similar to the findings of the ECM estimated by OLS.

The demand for the Jamaican tourism product from the United Kingdom (UK) was also assessed. The results are contained in table 6 in the appendix. The findings indicated that arrivals from the UK were positively related to income. In addition, it was found that the Jamaican tourism product was also mature for the UK market.

5.2 STM Results

The hyperparameter estimates for the BSM and GSM are both zero indicating that the trend and slope coefficient of arrivals are deterministic. The model passed all of the diagnostic tests (see tables 2 and 3). Figure 3, in the appendix shows the individual component of the tourist arrivals series. The first graph shows arrivals against its trend, the second illustrates the slope component and the third the cycle. The cycle is stochastic given that it has no set pattern. Both the cycle period and the amplitude vary over time. The trend is a straight line indicating its deterministic nature. The graph of the cycle shows a dramatic downturn in USA arrivals between 1988 and 1989, reflecting the adverse effect of the hurricane in 1989 and unfavourable reports on Jamaica in the international press. The next cycle depicts the reverse of the first and the next major cycle captures the effects of 11 September 2001 on arrivals.

For the GSM, both the income and price variables were found to be insignificant, however, the level and the slope were significant in explaining tourist arrivals from the USA. The coefficients on the explanatory variables can be interpreted as elasticities. The elasticity of demand (given a significant coefficient), with respect to the income proxy, a one per cent increase in income in that country would result in a 0.53 per cent increase in tourist arrivals from the USA. Similarly, a one per cent change in relative prices would result in an incremental increase in arrivals by nine hundredth of a percentage point.

Table: 2 BSM

	US	
Hyperparameters	SD	q-ratio
(level)	0	0
(slope)	0	0
(Cycle) 1		
2	0.00015	(1.00)
3		
Coefficients	Value	t-value
level	13.721	2157.5
slope	0.01149	59.666
Cycle		
Diagnostic Tests		
Normality	15.153	
H(19)	0.37824	
DW	2.1489	
Q-Statistic	3.5405	
Rd^2	0.70507	

Table 3: GSM

	US	
Hyperparameters	SD	q-ratio
(level)	0	0
(slope)	0	0
(Cycle) 1		
2	0.01241	(1.00)
3		
Coefficients	Value	t-value
level	9.3568	2.9378
slope	0.00729	2.4453
Cycle		
lnUSCS	0.53052	1.37
$\ln(exp/P_i)$	0.00972	1.1533
Diagnostic Tests		
Normality	13.608	
H(19)	0.33712	
DW	2.1108	
Q-Statistic	3.2213	
Rd^2	0.71484	

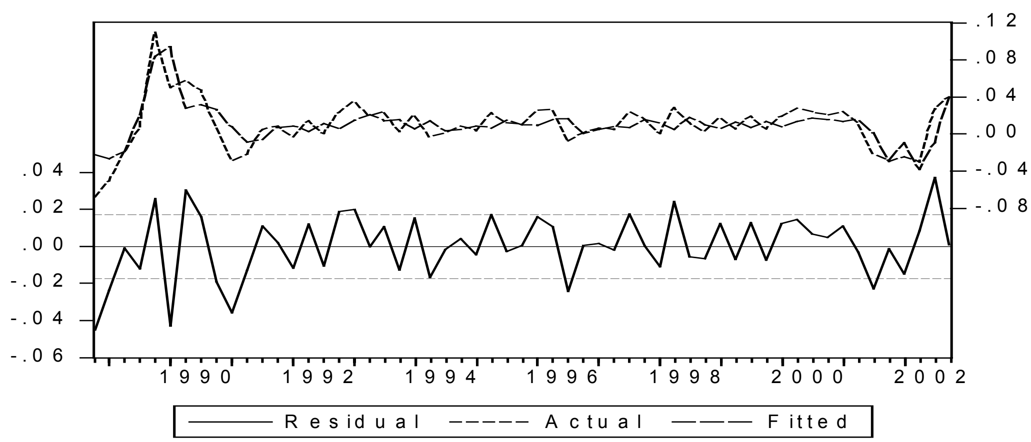
5.3 ARIMA Results

An ARIMA (1,1,0) model provided the best fit to the data. Two pulse dummies were created to take account of the two shocks to tourist arrivals. The first pulse dummy was used to capture the effect of the 1988 shock and the second the 11 September effect in 2002. The two pulse dummies were found to be statistically significant. The Llung-Box Q-Statistics indicated the absence of serial correlation along with the Breusch-Godfrey serial correlation LM Test (F statistics of 0.59 and probability of 0.62), while the White's test suggested that the error term was heteroskedastic.

6.0 FORECAST EVALUATION

Figures 2,3 and 4 depict the in-sample forecast from the three models under consideration. The ARIMA and ECM models performed relatively well capturing the major turning points in the series. However, the STM did not capture the major turning points in the series[7].

Figure 2
ARIMA Forecast
Actual and Forecasted Arrivals



[7] This may be due to the absence of the two dummies in the STM model.

Figure 3
ECM Forecast
Actual and Forecasted Arrivals

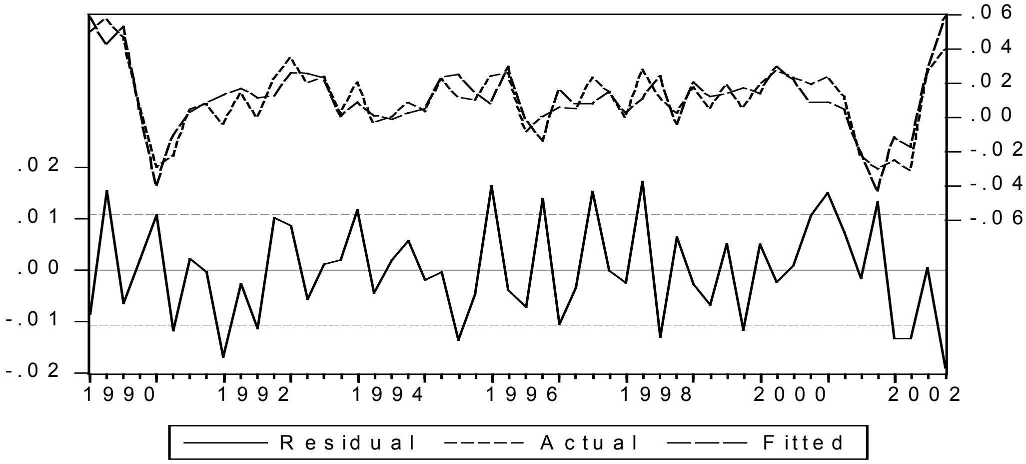


Figure 4
STM Forecast
Actual and Forecasted Arrivals

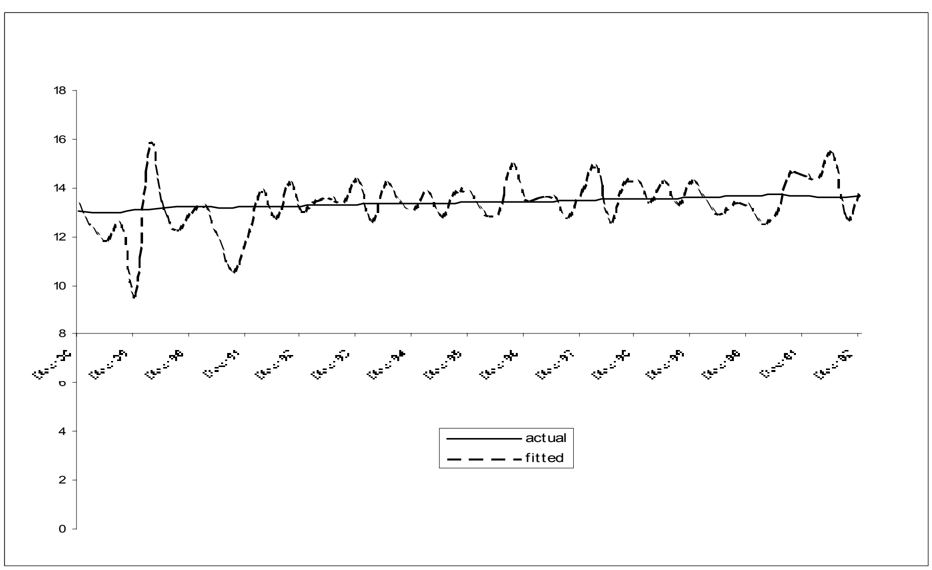
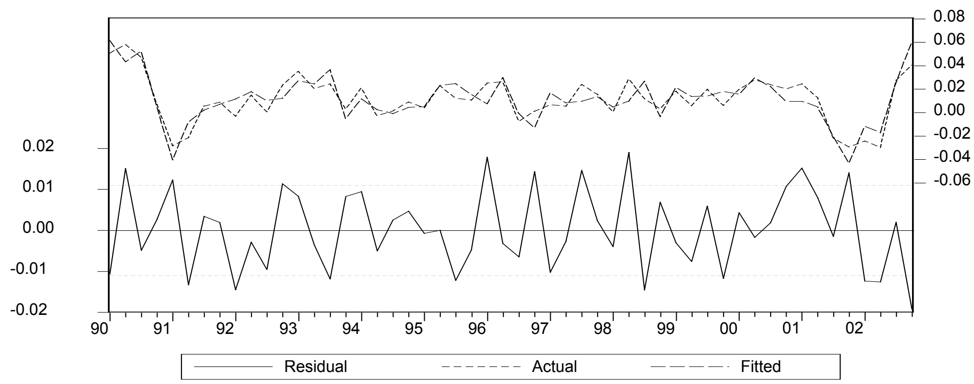


Figure 5
Two Stage Least Square Forecast
Actual and Forecasted Arrivals



Although the ARIMA model captured the major turning points in arrivals well, there are indications that arrivals was overstated between 1989:2 and 1990:1 and in 1991 and 2002 it under estimated the series. The ECM and two stage least square models underestimated arrivals during 2000, however, it captured arrival perfectly in the first three quarters of 2002. The STM forecast of arrival was relatively poor when compared to the other models forecast.

The mean square error (MSE), root mean square error (RMSE), mean absolute error (MAE) and Theil U statistics were used to assess the forecasting performance of the three models under consideration (see table 4). Based on these statistics, the ECM has the greatest predictive power for in-sample forecasts. It has the lowest mean squared error (MSE), root mean squared error (RMSE) and mean absolute error (MAE). The two stage least square and the ARIMA models follow the ECM, with the second and third smaller values for the MSE, RMSE and MAE, respectively. Although the Theil U suggests that the forecasts from the STM are superior, the other models captured the data generating process more adequately.

Table 4: Model Forecast Evaluations

In-sample Forecast

Model	MSE	RMSE	MAE	THEIL U
ARIMA	0.0003	0.0179	0.0107	0.367
STM	0.0060	0.0772	0.0551	0.037
ECM	0.0000	0.0009	0.0001	0.211
Two Stage	0.0000	0.001	0.0001	0.215

7.0 CONCLUSION

The empirical analysis indicates that tourism demand is predominantly explained by income in source country. The absolute price, relative price and exchange rate have very marginal, and in most cases no significant impact on tourism demand. The finding also suggests that Jamaica is a maturing destination for the USA and UK markets. This implies that Jamaica needs to diversify its product and explore new source markets.

Of the three models estimated the ECM was the most appropriate in explaining tourism demand. It was found that the inclusion of the tourist density ratio in the regression improved the explanatory power of the model. The unit price of the service was found to be insignificant. This result would be plausible only if the Jamaican tourism service was predominantly an upscale product. The result could be reflecting the weakness in the proxy used. Pricing tourism is one of the main difficulties that researchers face in modelling tourism demand and further work on this is required.

Based on the forecast evaluation tests, the ECM generated more accurate forecasts than the ARIMA and STM models in predicting tourism demand. Notwithstanding, both the ECM and the ARIMA models captured the major turning points in the series well and provide reasonably good forecasts.

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Appendix

Table 1	Visitor Expenditure and Annual Change in Expenditure	
Year	Visitor Expenditure (US$mill)	Change %
1985	404.8	
1986	514.9	27.20
1987	594.9	15.54
1988	527.1	-11.40
1989	598.9	13.62
1990	739.9	23.54
1991	770.8	4.18
1992	858.1	11.33
1993	947.5	10.42
1994	926.6	-2.21
1995	1074.9	16.00
1996	1092.3	1.62
1997	1130.8	3.52
1998	1196.9	5.85
1999	1279.6	6.91
2000	1332.6	4.14
2001	1232.2	-7.53
2002	1176.7	-4.50

Source: Jamaica Tourist Board

Table 2	Tourist Arrivals					
Year	Bahamas	Cuba	Dom. Rep.	Puerto Rico	Jamaica	Carib. Total
1991	1472	424	1416	2559	845	13098
1992	1399	460	1524	2724	1057	13864
1993	1489	544	1636	3014	1105	14872
1994	1516	617	1767	3140	1098	15632
1995	1598	763	17776	3140	1147	16280
1996	1633	1004	1926	3094	1162	16722
1997	1618	1170	2211	3362	1192	17865
1998	1528	1416	2309	3213	1225	18216
1999	1577	1603	2649	3136	1248	19117
2000	1596	1774	2973	3453	1323	20425
2001	1553	1775	2882	3609	1277	20021

Figure 1
Stopover Arrivals and US GDP
(1988 to 2002)

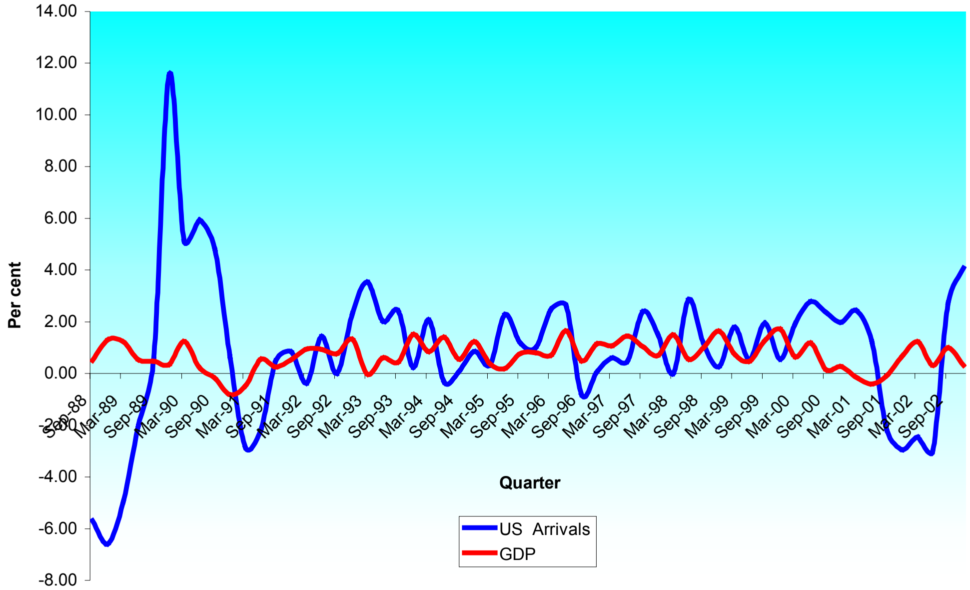


Table 3: Test for stationarity

ADF

	Without Trends			With Trend		
Variables	levels	1st Diff	lag	levels	1st Diff	lag
log A	-1.64	-3.63	1	-3.13	-3.70	1
log Yr	0.04	-5.26	1	-2.39	-5.22	2
log Pj	-2.27	-2.87	2	-0.80	-3.63	2
log Ex	-1.13	-5.54	2	-2.59	-5.51	1
log Ps	-0.42	-6.04	1	-1.23	-5.98	1
log TDR	-2.21	-3.52	4	-3.40	-3.66	4
log USCS	0.70	-4.97	1	-1.98	-5.05	1
log (Pj/Ps)	-2.26	-2.85	2	-0.87	-3.60	2
5% critical value	**-2.91**			**-3.49**		
1% critical value	**-3.55**			**-4.13**		

Table 4
Error Correction Model (2) (USA GDP is used as income)

Dependent Variable: DLARR
Method: Least Squares
Sample(adjusted): 1989:4 2002:4
Included observations: 53 after adjusting endpoints
Convergence achieved after 14 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.019646	0.003275	5.997898	0.0000
DGDP	-0.837644	0.326816	-2.563047	0.0138
DEXP(-4)	0.011045	0.007775	1.420545	0.1623
DTDR(-3)	-0.025568	0.012203	-2.095214	0.0418
LRES2	-0.382033	0.073036	-5.230767	0.0000
D1	0.041478	0.019675	2.108213	0.0406
D2	0.046326	0.012108	3.825926	0.0004
DLARR (-1)	0.281718	0.183416	1.535946	0.1316

R-squared	0.781767	Mean dependent var	0.012996
Adjusted R-squared	0.747820	S.D. dependent var	0.023435
S.E. of regression	0.011769	Akaike info criterion	-5.908511
Sum squared resid	0.006232	Schwarz criterion	-5.611109
Log likelihood	164.5755	F-statistic	23.02885
Durbin-Watson stat	1.744732	Prob(F-statistic)	0.000000

Table 5
Two Stage Least Square Model (2)

Dependent Variable: DLARR
Method: Two-Stage Least Squares
Date: 08/11/03 Time: 17:16
Sample(adjusted): 1990:1 2002:4
Included observations: 52 after adjusting endpoints
Convergence achieved after 12 iterations
Instrument list: DLARR C DUSCS(-4) DREER(0 TO -2) DTDR(0 TO -3)
LRES2USCS(-1) D1 D2 DLARR(-2 TO -1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001422	0.004750	-0.299331	0.7662
DUSCS(-4)	1.199432	0.528757	2.268401	0.0288
DEXP(-2)	0.024571	0.012519	1.962638	0.0567
DTDR	-0.089866	0.024794	-3.624496	0.0008
DTDR(-1)	-0.089558	0.028248	-3.170456	0.0029
DTDR(-2)	-0.081041	0.028281	-2.865536	0.0066
DTDR(-3)	-0.097315	0.024105	-4.037185	0.0002
LRES2USCS	-0.334283	0.101759	-3.285057	0.0021
D1	0.220169	0.105001	2.096837	0.0424
D2	0.026214	0.011369	2.305779	0.0264
DLARR (-1)	0.598181	0.111557	5.362096	0.0000
DLARR (-2)	-0.381382	0.121039	-3.150898	0.0031

R-squared	0.745250	Mean dependent var	0.011144
Adjusted R-squared	0.675193	S.D. dependent var	0.019353
S.E. of regression	0.011030	Sum squared resid	0.004866
F-statistic	10.83782	Durbin-Watson stat	2.384585
Prob(F-statistic)	0.000000		

Figure 2

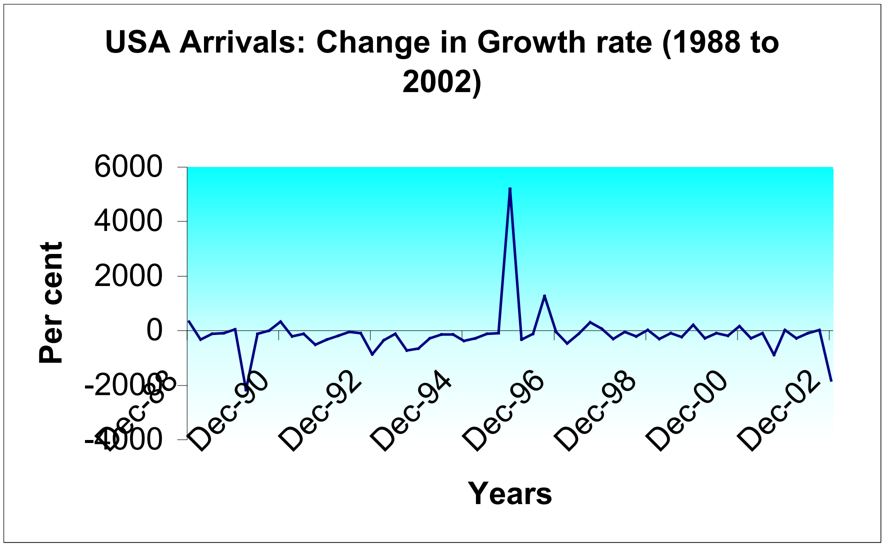


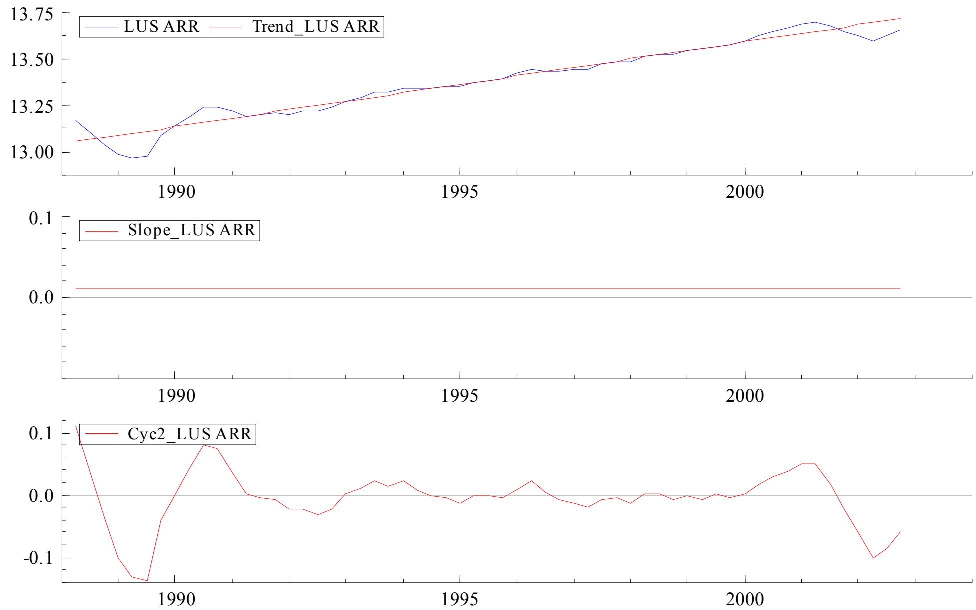
Table 6
ECM UK

Dependent Variable: DUKARR
Method: Least Squares
Date: 08/12/03 Time: 09:35
Sample(adjusted): 1990:1 2002:4
Included observations: 52 after adjusting endpoints
Convergence achieved after 9 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.004719	0.011719	0.402689	0.6890
DUKGDP	0.647200	0.344528	1.878513	0.0667
DTDR(-4)	-0.018961	0.008523	-2.224786	0.0310
LRESUK	-0.043148	0.022401	-1.926167	0.0503
DUKARR (-1)	1.276332	0.111380	11.45929	0.0000
DUKARR (-2)	-0.421253	0.112830	-3.733513	0.0005

R-squared	0.906302	Mean dependent var	0.015313
Adjusted R-squared	0.896117	S.D. dependent var	0.035777
S.E. of regression	0.011531	Akaike info criterion	-5.979334
Sum squared resid	0.006117	Schwarz criterion	-5.754190
Log likelihood	161.4627	F-statistic	88.98748
Durbin-Watson stat	2.358452	Prob(F-statistic)	0.000000

Figure 3: STM - Components of Arrivals



Data Annex

ARR	Stopover Arrivals from United States
TDR	Tourism Density Ratio
USCS	US Consumption expenditure -Services
REER	Real Effective Exchange Rate
D1	Intervention Dummy for sharp increases in 1989
D2	Intervention Dummy for sharp decrease in 2001
GDP	USA real GDP
ECM	Error correction term
LRES2	ECM term
USCON	USA consumption Expenditure
Y_r	Real US GDP
EXP	Expenditure per person (proxy for price)
RP	Relative price (EXP/US CPI)
UK GDP	United Kingdom Gross domestic Product
UKARR	Stopover Arrivals from the United Kingdom