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Tourism Maturity and Demand: A Co-Integration Approach

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TOURISM MATURITY AND DEMAND: A CO-INTEGRATION APPROACH

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Abstract: Tourism maturity means increasing difficulty in attracting tourists despite marketing efforts. But why do destinations mature? The tourism life- cycle literature suggests that tourism inter-action has an ultimate negative utility for tourists as a destination matures (i.e advances along the Butler S-curve). Thus, existing models of tourism demand (which focus on income and price factors) are of limited utility as they need to be modified for tourism maturity phenomena and related externalities. This paper presents a single equation constrained optimisation Lagrangian model of tourism demand which encompasses both the externality and the income/price factors. Alternative models were tested on data for Barbados, one of the more mature Caribbean destinations, using the co-integration approach. It was found that the standard models are not very applicable to this destination but an improved explanation may be obtained by the addition of tourism inter-action externalities such as the tourism density ratio and the relative tourism density ratio. **While this result is not unexpected, the value of this effort is in modelling and testing the impact of tourism externalities in a rigorous econometric framework.** The significance of the results is the provision of a basis for modelling tourism maturity and confirming the implication of life cycle studies that maturity of a destination alters the demand for the tourism product, irrespective of price/income factors. **Keywords:** maturity, life-cycle, externality, demand, model.

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1. INTRODUCTION

The development of rigorous and reliable estimations of the demand for the tourism product is an important first step in modelling the impact of alternative economic policies on tourism in the developing world. Demand models typically focus on income and price factors but little attempt has been made to model non-price phenomena. Yet, the tourism life-cycle and other literature suggests that there are underlying maturity factors and externalities which influence the reception of the tourism product in the market place. In addition, there is a growing tendency for composite demand generation via multiple destination packaging. If these maturity and composite demand phenomena could be modelled the explanation given by traditional price/income approaches might be greatly improved.

This paper aims to explain the variation of tourism output in maturing Caribbean destinations. A desegregated approach is advocated, focussing on the demand characteristics of the sub-markets generating a significant proportion of the visitors to a given destination. Alternative demand models developed in the literature are considered, and modified, based on the peculiarities of the Caribbean. However, this study only analyzes the dominant US tourism source market. Testable models are developed to explain US tourism demand in Barbados and evaluated using the co-integration approach.

2. ALTERNATIVE THEORIES OF TOURISM MATURITY

The concept of the maturity of a tourism destination refers to the eventual slowing of the rate of growth of arrivals, or bednights, with the likelihood of an eventual decline. The most obvious theory which suggests an explanation of this phenomenon is the product life cycle theory. The underlying rationale for the product life cycle is the observation in industry of limits to product innovation by producers and acceptability, or adoption, by consumers (Kotler 1988). As a product moves along the cycle, over time, some marketing strategies would, therefore, become obsolete (such as gaining market share by making more consumers aware of the existence of the product) and others would be more effective (such as finding new uses for the product - Levitt (1965). This approach originated in industry studies to explain the tendency for the sale of industrial products to eventually level off or even decline.

The life cycle concept has been applied to tourism for three decades. But Butler (1980) was the first to identify a specific S-shaped curve of the product life cycle which, he suggested, was applicable to most destinations. He cited Mexico as an example and suggested that destinations evolve through six growth stages: exploration, involvement, development, consolidation, stagnation, and decline or rejuvenation. Choy (1992) in his study of the Pacific Islands lamented the fact that the importance of the life cycle phenomenon has not been modelled in demand studies.

The field of environmental psychology has supplied two interesting concepts 'image' and 'crowding' which have been applied in tourism studies - see Fridgen (1984) and Stringer (1984). Pearce and Stringer (1991) suggest that the individual tourist brings to social interaction in the tourist destination certain requirements for personal space. Thus, Riley and Palmer (1976) carried out studies to determine the images which people have of seaside resorts while Morello (1983) had Dutch and Italian students rate seven countries as holiday destinations on a 'semantic differential'.

Crowding has traditionally been studied because of its association with increasing urbanisation and the resultant stress to urban residents. From a tourism perspective crowding may be seen as a constraint upon desired tourist experience (Schryer and Rogenbuck (1978); West (1982); Womble and Studebaker (1981). Graefe and Vaske (1987) suggested that tourism itself impacts on the quality of the tourists' experiences.

Thus, maturity from crowding arises from growing numbers applied to the same land area, or size of population. This suggests consumption of a good with an ultimate negative externality which will eventually impair the repeat visitor process. Innovative marketing and advertising can, of course, be used to construct images which counter, to some, degree the realistic environmental impairment associated with maturity. Thus, a mature destination can undergo what Butler (1980) terms regeneration. Nevertheless, we expect that the underlying maturity factor should still be observable.

For example, the ageing of plant is associated with a reduced rate of return so that more advertising is necessary to attract an additional customer. Also, we would expect real effective rates on hotel rooms to appreciate more slowly as the plant ages. In summary, the maturity of a destination may be explained in terms of a destination life cycle phenomenon which is influenced, inter alia, by four main loss factors:-

(a) **image loss:** the visible ageing of hotel plant and associated fixtures or other impairment of the image of the environment;

(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 wage rates increase, etc.; and

(d) **fear/privacy loss:** owing to increasing visitor harassment.

Thus, the implication of maturity studies is that supportive non-price, non-marketing strategies need to be put in place to counteract the maturity syndrome. For example

Conlin (1995) advocates the need to re-orient labor attitudes while Carnegie (1995) advocates the need to criminalise behaviour likely to be offensive to tourists. Thus the maturity of a destination should be interpreted not only in relation to age, but as a determinant of the demand for a destination - See Whitehall (1997).

3. MODELLING THE DEMAND FOR TOURISM

Survey of the Literature

Econometric studies of the demand for tourism product have traditionally used the framework of consumer demand theory, Eadington and Redman (1991). The behaviour to be analysed is commonly defined as a single equation constrained optimisation problem where utility U is maximised subject to a budget constraint i.e.

$$Max\ U = U\ (A_1, A_2, \ldots A_N) :\ U_1, U_2, \ldots U_N > 0 \qquad (1)$$

subject to

$$Y = P_1 A_1 + P_2 A_2 + \ldots\ P_N A_N \qquad (2)$$

where Y is money income available for expenditure on goods and services, A_1, A_2

$\ldots A_n$, at prices P_1, $P_2 \ldots P_N$, respectively (with appropriate exchange rate adjustment having been made). The solution requires the construction of a simple Lagrangean extremum problem which is solved using the Implicit Function Theorem.

Thus, the tourism demand function has traditionally been expressed as the impact on the demand for the tourism product of the price of each service provided by the tourism destination and the money income available to purchase tourism products.

$$i.e.\quad A=f(P_1, P_2, \ldots P_N, Y) \qquad (3)$$

Using travel expenditure to measure demand researchers have found demand to be highly income elastic in nearly all cases, Witt and Martin (1987), Carey (1991), and the relationship appears to be more marked when a real income variable is used. They have also found the expected negative relationship between travel expenditure and price factors. In general, the closer the proximity of the tourism source country to the destination, the lower the price-inelasticity of travel expenditures, Eadington and Readman (1991). Thus, the 'standard' model of tourism demand tends to be comprehensive with the inclusion of the price of air transport T, (and often the value of promotional expenditures, but the latter information is often not readily available). One variant of the standard model is thus

$$A = f(\frac{Y}{P_s}, P, T,) \qquad (4)$$

Where P_s is a price deflator in the tourism source country.

Transportation may be thought of either as a good from which the consumer derives utility directly or, more properly, as a variable whose consumption is linked to consumption of other aspects of the product of the tourist destination. Data problems have, however, resulted in this variable being proxied by relative prices of gasoline (Di Mateo and Di Mateo (1996)) or by the geographical distance (Carey (1991)) from the source country to the tourism destination. In both studies good results were obtained. Gasoline prices were used in the Di Mateo study because the focus was on cross-border automobile visits of Canadian tourists to the US.

Researchers such as Di Mateo and Di Mateo (1996) have suggested a convenient specification of the utility optimisation problem in two-variable space i.e $U = U\ (A_s A_d)$, where A_s is a good offered in the tourism source country and A_d is the product of the tourism destination. Thus,

$$Y = (P_s\ A_s + P_d\ A_d) \tag{5}$$

The maximisation process yields a demand function in relation to the real exchange rate (relative prices between the tourism source country and the tourism destination) and the real income of the tourism source country i.e.

$$A=f\left(\frac{Y}{P_s},\ \frac{P_d}{P_s}\right) \tag{6}$$

This model is applicable to the empirical context of the present paper i.e. tourists from the US choosing between visiting US or Caribbean destinations or combinations of the two classes of destination.

The 'standard' demand models represented by equations (4) and (6) are useful. However, such models still require additional modification in order to realistically describe the process by which visitors decide to visit Caribbean destinations where maturity trends are observed together with multiple destination packages.

4. BUILDING A MODEL FOR A MATURING DESTINATION

It is observed that US tourists from a given city in the US may be found on a given day in both Barbados and Bermuda. Thus, it is fair to assume that tourists are aware of both destinations. The average tourist may seem to have a networked demand for travel in the two destinations, depending on the relative popularity of each, relative prices, and, of course, the information set available. This 'networked' demand is considered because some tourists simply want to be able to say that "I visited Barbados in the Caribbean and it was just as good as my network said it would be!" Changes in the specified variables are presumed to affect the relative propensity of the average tourist to visit one destination more so than another, e.g. the tourist may elect to spend 5 days in Barbados and none in Bermuda or 3 days in Barbados and 2 in Bermuda, and the converse. Thus, we begin by assuming that the average tourist; (a) is aware of the tourism product of at least two alternative destinations, and (b) would obtain utility from consuming units of each, singly, or in some combination.

$$i.e. \quad U = U(A_{d1}, A_{d2}) \tag{7}$$

We further assume that the average tourist allocates some fixed fraction K of his income Y towards the expenditure for foreign travel on the product offered by the two destinations, depending, inter alia, on destination prices paid.

$$kY = P_{d1} A_{d1} + P_{d2} A_{d2} \tag{8}$$

Here, kY is the sum of budgeted market expenditure on the two tourism destinations. One Lagrange solution for the demand for a given destination, say destination two, is as follows:

$$A_{d2} = A_{d2} \left(\frac{Y}{P_{d2}}, \frac{P_{d2}}{P_{d1}} \right) \tag{9}$$

This solution expresses the demand for A_{d2} in terms of the real value of the tourist's income when spent (on tourist services) in destination two and the relative prices of tourism services in the alternative destination.

Earlier we mentioned that the destination life-cycle was influenced by image, space, service and fear/privacy factors. This suggests the presence of externality factors affecting the demand for a destination. The presence of externalities may be modelled by disaggregating the destination prices and quantities into the marketed values, denoted $P_i \ A_i$ (including transportation element $P_T \ A_T$) and the non-marketed or externality values denoted $P_{1e} A_{1e}$. i.e.

$$P_{d1} A_{d1} = P_1 A_1 + P_{1e} A_{1e} + P_{1T} A_{1T}$$

and $$P_{d2} A_{d2} = P_2 A_2 + P_{2e} A_{2e} + P_{2T} A_{2T}$$

Thus destination prices may now be expressed in relation to marketed and non-marketed values as follows:

$$\begin{aligned} P_{d1} &= (P_1 A_1 + P_{1e} A_{1e} + P_{1T} A_{1T}) / A_{d1} \\ &= \alpha_{11} P_1 + \alpha_{1e} P_{1e} + \alpha_{1T} P_{1T} \end{aligned} \quad (10)$$

where $\alpha_{11} = A_1 / A_{d1}$; $\alpha_{1e} = A_{e1} / A_{d1}$; $\alpha_{1T} = A_{1T} / A_{d1}$

and $P_{d2} = (P_2 A_2 + P_{2e} A_{2e} + P_{2T} A_{2T}) / A_{d2}$

$$= \alpha_{22} P_2 + \alpha_{2e} P_{2e} + \alpha_{2T} P_{2T} \qquad (11)$$

where $\alpha_{22} = A_2 / A_{d2}$; $\alpha_{2e} = A_{2e} / A_{d2}$; $\alpha_{2T} = A_{2T} / A_{d2}$

Substituting the expressions in equations (15) and (16) for P_{d1} and P_{d2} into equation (14), allows us to generate an externality based demand function which includes both externality and price/income variables; i.e.

$$A_{d2} = A_{d2} \left[\frac{Y}{\alpha_{22} P_2 + \alpha_{2e} P_{2e} + \alpha_{2T} P_{2T}} \ , \ \frac{\alpha_{22} P_2 + \alpha_{2e} P_{2e} + \alpha_{2T} P_{2T}}{\alpha_{11} P_1 + \alpha_{1e} P_{1e} + \alpha_{1T} P_{1T}} \right] \qquad (12)$$

next we simplify to separate explicit observable prices from notional externality prices.

Denoting $$\rho_1 = \frac{\alpha_1 P_1}{\alpha_1 P_1 + \alpha_{1e} P_{1e} + \alpha_{1T} P_{1T}} = \frac{\alpha_1 P_1}{Pd_1}$$

and, similarly, $\rho_2 = \alpha_2 P_2 / P_{d2}$; $\rho_{1e} = \alpha_{1e} P_{ie} / P_{d1}$; $\rho_{1T} = \alpha_{1T} P_{1T} / P_{d1}$

$$A_{d2} = A_{d2} \left[\frac{Y}{P_2} \left[\frac{\rho_2}{\alpha_2} \right] + \left[\rho_1 \ \frac{\alpha_2}{\alpha_1} \right] \frac{P_2}{P_1} + [\rho_{1e}] \ \frac{[\alpha_{2e}]}{[\alpha_{1e}]} \ \frac{P_{2e}}{P_{1e}} \right] + \rho_{1T} \ \frac{\alpha_{2T}}{\alpha_{1T}} \ \frac{P_{2T}}{P_{1T}} \qquad (13)$$

This leads to the general functional form which expresses demand in relation to the real value of income of the tourist in the destination, ie. Y/P_2, relative observable prices of tourism services in alternative destinations i.e. P_2/P_1, relative observable transport cost P_{2T}/P_{1T} and relative unobservable externality prices in alternative destinations. ie. P_{2e}/P_{1e}:

$$A_{d2} = f\left[\frac{Y}{P_2}, \frac{P_2}{P_1}, \frac{P_{2e}}{P_{1e}}, \frac{P_{2T}}{P_{1T}}\right] \tag{14}$$

Developing Testable Models

The next step is to derive testable proxies of the relevant variables. The difficulty in determining the externality prices can be partly alleviated by considering what an 'externality price' would mean conceptually. An externality price is a measure of the variation in the value of a good or service which is consumed indirectly but not marketed. As previously discussed, the relative maturity of a destination should induce changes to plant, environment etc, resulting in observable, though non-marketed, externality benefits or losses. The models to be tested are as follows, with expected signs of the coefficients above the variables:-

$$A = f_1\left(\frac{\overset{+}{Y}}{P_s}, \overset{-}{P_2}, \frac{\overset{-}{T}}{P_s}\right) \qquad \text{Model (1)}$$

$$A = f_2\left(\frac{\overset{+}{Y}}{P_s}\ ,\ \bar{P}_2\ ,\ \frac{\bar{T}}{P_s}\ ,\ T\bar{D}R_2\right) \qquad \text{Model (2)}$$

$$A = f_4\left(\frac{\overset{+}{Y}}{P_s}\ ,\ \frac{\bar{P}_2}{P_s}\ ,\ \frac{\bar{T}}{P_s}\ ,\ \frac{T\bar{D}R_2}{P_s}\right) \qquad \text{Model (3)}$$

$$A = f_5\left(\frac{\overset{+}{Y}}{\bar{P}_2}\ ,\ \frac{\bar{P}_2}{P_1}\ ,\ \frac{\bar{T}}{P_s}\ ,\ \frac{T\bar{D}R_2}{TDR_1}\right) \qquad \text{Model (4)}$$

Where:

A	=	US arrivals to Barbados as a proxy for tourism product
Y	=	US nominal income
P_s	=	US Consumer Price Index
T/P_s	=	Real US Average Unit Price of Air Transport as a proxy for transport cost
P_2	=	Barbados Tourism GDP Deflator

P_1	=	Bermuda Tourism GDP Deflator
TDR2	=	Barbados Tourism Density Ratio (total arrivals to Population)
TDR_1	=	Bermuda Tourism density ratio

Choice of Variables

Model (1) is a fairly standard price/income demand models based on equations (9) and (11). This model is tested to determine its applicability to the Caribbean. Models (2) and (3) reflect modifications of the standard model(1) to discover whether the inclusion of externalities in the utility function improves explanatory power. Model (4) is a more intuitive modelling of the presence of externalities based on equation (14). In Models (2) and (3) the externality used is the tourism density ratio in the given destination (say Barbados) while in Model (4) we use the relative tourism density ratio between Bermuda and Barbados. In the previous section we derived model 4 and it should be fairly obvious that all of the models are derivable using the same procedure of disaggregating destination prices into observable and externality prices.

The tourism density ratio is regarded as a good proxy of tourism interaction, crowding etc. It is calculated as the total arrivals to the destination divided by population in the given year. This is a proxy for crowding owing to tourism interaction since, of the factors associated with maturity, crowding is the simplest to measure. For mature destinations such as Barbados and Bermuda a tourism density ratio may indicate the presence of visitor crowding and resultant unpopularity. Thus, the sign of the coefficient of this variable is expected to be negative for Barbados and Bermuda because, with success at mass tourism, the destinations may be perceived to be losing some of their uniqueness. Conversely, the sign may well be positive for virgin destinations which are becoming more popular because others are going there. Models (1) through (4) are tested for arrivals from Barbados, A_{d2}. The Barbados data set is generally lengthy and as reliable as any for econometric purposes and a series on tourism arrivals has been compiled from 1956 onwards. However, the series on tourism bednights is not as lengthy or reliable. In the absence of reliable series on bednights, most researchers use the volume of arrivals as the independent variable. This approach is taken here, where the independent variable is US arrivals to Barbados. Carey (1991) also found that the results are better when the number of persons staying in hotels is used in place of arrivals, particularly when the price variable used is the hotel rack rate or a close proxy. The price variable used in this study is the tourism GDP deflator. In the absence of a series on airfares, transport costs are proxied by the real cost of air transport in the US.

5. ECONOMETRIC ANALYSIS

The focus of cointegration theory is on the temporal properties of economic time series. Most economic time series are non-stationary which invalidates some classical inferences. In this regard, a tourism demand model which represents a long-run equilibrium relationship may not reveal a 'true' relationship when its estimation is done using conventional regression approach. However, cointegration theory asserts that if there exists a linear combination of these nonstationary series that is stationary, then valid inferences are possible. Thus, the first step in our econometric analysis is to test for the order of integration of all the series involved in our analysis. The test for stationarity is given by:

$$\Delta x_t = \alpha + \beta_t + \delta_0 X_{t-1} + \sum_{j=1}^{j} \delta_j x_{t-j} + \varepsilon_t$$

J is chosen to be sufficiently large to ensure that the error term is free of significant serial dependence. $J \neq 0$ defines the Augmented Dickey Fuller (ADF) test. The null hypothesis that x_t follows a random walk is rejected if the coefficient on x_{t-1} is significantly negative. The results are shown in table 1. Since the ADF test may lose power when the i.i.d assumption is invalid, - see Phillips (1987), - the residuals (ε_t) are tested for serial correlation using a lagrange multiplier test and a variant of White's (1980) test for heteroscedasticity. For the level of the series none rejects the null hyposthesis of nonstationarity at the 5% level. After first differencing, all of the series with the exception of the negative price series, P_2 / P_s, rejected the null hypothesis of nonstationarity at the 5% level and are therefore integrated of order I(1). The P_2/P_s

variable turns out to be integrated of order I(2).

The next step in the analysis is to estimate the long-run demand equation for each model. Using Ordinary Least Squares, we begin by estimating Model (2) since this equation is merely a modification of Model (1) with an additional variable (TDR_2). The following results were obtained.

$$A_{d2} = \underset{(1.99)}{-44.1142} + \underset{(2.74)}{2.1017}\, Y/P_s + 1.1038\, P_2 - \underset{(3.29)}{1.3995}\, T/P_s - \underset{(-4.19)}{0.0681}\, TDR_2 \quad \underset{(-2.16)}{} \tag{20}$$

$R^2 = 0.963507$ SSR = 0.887764 DW = 1.10

$\bar{R}^2 = 0.937425$ DF = -3.7373(-2.9705) ADF = -3.0421(-2.9705)

SSR is sum of squared residuals. Both the DF and the ADF tests reject the hypothesis of nonstationarity of the residuals at the five percent level. These results, along with the relatively high value of the Durbin-Watson statistics, indicate that a co-integrated set have been obtained. There is a further issue to be asserted at this point. Banerjee et. al. (1986) have shown that there would be substantially small sample bias in the cointegrating vector estimates. Their theorem 2 shows that ($1-R^2$) can be used as an indicator of the bias in the OLS estimates, and the bias goes to zero as R^2 goes to 1. Given that our reported R^2 is 0.963507, the bias may be small in our case.

To build a short run model we then used the Johansen maximum likelihood procedure to identify the number of co-integrating vectors and to deal with the issue of simultaneity. Table 2 shows that there exist at most two co-integrating equations for the five variables of interest. Further analysis shows that the ECM enters only one of the co-integrating equations, hence weak exogenity is not violated and OLS estimates of the parameters of our model would be efficient, see Philips and Lonetan (1991).

Therefore equation 20 constitutes a valid long-run relationship and we can proceed to the second stage of the Granger - Engle procedure: the error correction mechanism (ECM). The error correction model contains contemporaneous and lagged conditioning variables - see Hendry, Sabra and Yeo (1978); Hendry, Pagan and Sargan (1984); Salmon (1982); and Miller (1991) - along with the lagged value of the residual from the long-run co-integrating equation. Starting with an over parameterized model containing contemporaneous variables, the ECM lagged one period, and two-period lags of all other variables, we systematically eliminate redundant regressors, following Hendry's General to Specific methodology, until a parsimonious representation of the data generating process was achieved.

Table 3 contains the results of this process. The model was subjected to a battery of diagnostic checks. The Jarque-Bera normality test statistic indicates that the residuals are normal but the implied marginal significance of the test is 0.78102. Further investigations, however, showed that the moments of the scaled residuals (skewness -0.0555 and Kurtosis 2.624470) are not significantly different from those of a standard normal distribution. ARCH is Engle's k^{th} order autoregressive conditional heteroscedasticity test, which is chi-squared distributed with K degrees of freedom. The results validate the hypothesis that the coefficient of the lagged squared residuals are all zero. Ramsey Reset is Ramsey's specification error test using the square of the fitted residuals; the low F-statistic rejects the null hypothesis of specification error. Further test on the residuals are the Breusch-Godfrey Serial Correlation LM Test and White's Heteroskedasticity Test (WHT). The model passed on both accounts. Based on the battery of diagnostic tests, we concluded that the model presented in table 3 represents a valid error correction model. Hence, model (2) can be judged as an adequate specification of the demand for tourism product in Barbados.

Since Model (2) contains only one additional variable (TDR_2) we perform a variable redundancy test on Model (2) to ascertain whether the TDR_2 variable should be dropped entirely from both the long run and the short run equations. The F-statistic from the test indicates that the TDR_2 variable should remain in the model. When made redundant, the resulting R^2 is significantly lower (falling from 0.96 to 0.79). Also, the larger Akaike information and Schwarz criterion values point to the preferred model as Model (2). Hence, we can safely accept Model (2) as superior to Model (1). This important result underscores the improved explanatory power from modifying the standard model for externality factors.

We now turn our attention to Model (3). The model passed all of the preliminary tests for cointegration. Table 4 summarises the results for the long run equation along with the error correction model. Neither the relative price variable nor the transportation variable have any effect in the long run, whereas in the short run, each variable comes into play with different lag structures. Hence Model (3) is quite an acceptable model. The final results for Model (4) are shown in table 5. All the variables were significant in the long run equation, while in the short run error correction model, both the relative price variable and the income variable were insignificant.

Significance of the results

The standard model did not perform well in terms of the significance of the variables and attained a lower level of explanatory power when compared to Model (2) which included the tourism density ratio. As in other studies, the real income variable tended to be the most significant, particularly in the long run. The sign was positive in model 2 but negative in model 4 which uses the price index of the destination as the deflator. This indicates that the equation may need to be modified or better proxies developed. The transport and relative price variables were significant, with negative signs, as expected, but the domestic price variable was positive, indicating that demand responds positively to higher prices. This would be true of up-market destinations but would be difficult to explain in Barbados which is usually considered mass market. The tourism density ratio was significant and negative as expected in a maturing destination. However, the relative tourism density ratio is negative indicating that Barbados is considered relatively less mature than Bermuda by the market. Overall, the results suggest that the modelling of externalities improves explanatory power. However, more research needs to be undertaken to (a) determine the consistency of the results across alternative destinations and (b) the best specification of an externality-based model.

6. CONCLUSIONS

The underlying impetus for this paper has been to gain a greater understanding of why tourism destinations mature, recognising that maturity means increasing difficulty in attracting tourists despite continued, and often, increasing marketing efforts. The tourism life- cycle literature suggests that tourism inter-action has an ultimate negative utility for tourists as a destination matures (i.e advances along the Butler S-curve). Thus, existing models of tourism demand (which focus on income and price factors) are of limited utility in some instances, as they need to be modified for tourism maturity phenomena and related externalities. This paper presented a single equation constrained optimisation Lagrangian model of tourism demand which encompasses both the externality and the income/price factors. Alternative models were tested on data for Barbados using the co-integration approach. It was found that the standard model is not very applicable to this destination but an improved explanation may be obtained by the addition of tourism inter-action externalities such as the tourism density ratio and the relative tourism density ratio. The significance of the results is two-fold. Firstly, we can now begin the process of developing a more rigorous framework for modelling the phenomenon of tourism maturity. Secondly, we have uncovered tentative evidence which seems to confirm the implication of life cycle studies that the maturity of a destination may alter the demand for the tourism product, irrespective of price/income factors. Since maturity affects demand, rejuvenation planning is vital. But rejuvenation requires increased cash flow to the tourism sector. Thus, mature destinations may need to reconsider the advice of those who suggest that taxes on the tourism product should be increased, see Bird (1992).

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Table 1

Test for Stationarity 1965-1994

ADF			ADF		
Variables	Without Trend	Trend	Variables	Without Trend	Trend
A	-2.576251	-3.096399	$D[P_2/P_s,2]$	-4.539597	-4.511928
D(A)	-3.553927	-3.951595	(TDR/P_s)	-2.254963	-2.292169
P_2	-1.672781	-0.873210	$D(TDR/P_s)$	-2.979633	-3.369678
$D(P_2)$	-4.301804	-5.042666	Y/P_2	-1.479299	-1.161316
T	-0.657847	-1.813300	$D(Y/P_2)$	-4.086897	-4.497251
D(T)	-2.645135	-2.589634	(P_2/P_1)	-0.26401	-1.830280
Y/P_s	-0.310958	-4.189799	$D(P_2/P_1)$	-4.665598	-5.198482
$D(Y/P_s)$	-4.469946	-4.392749	TDR_2/TDR_1	-1.439174	-3.530561
TDR_2/PS_2	0.227943	-2.447971	$D(TDR_2/TDR_1)$	-3.722377	-3.649360
$D(TDR_2)$	-3.794372	-3.009247			
(P_2/P_s)	-2.153327	-1.362553			
$D(P_2/P_s)$	-2.569997	-3.173484			
* 1%	-3.675	-4.3082		-3.6772	-4.3082
5%	-2.9665	-3.5731		-2.9665	-3.5731
10%	-2.6220	-3.2203		-2.6220	-3.2203

*Mackminon critical values for rejection of hypothesis of a unit root.

Table 2

Johansen Cointegration Test

Sample: 1965 1995

Included Observations: 27

Test assumption: Linear deterministic trend in the data

Series: A Y/P_s P_2 , T/P_s , TDR_2

Lags interval: 1 to 3

Eigenvalue	Likelihood Ratio	5 Percent Critical Vlue	1 Percent Critical Value	Hypothesized No. of CE(s)
0.834423	97.92006	68.52	76.07	None**
0.591279	49.36551	47.21	54.46	At most1*
0.486778	25.20797	29.68	35.65	At most 2
0.191338	7.197695	15.41	20.04	At most 3
0.052764	1.463583	3.76	6.65	At most 4

*(**) denotes rejections of the hypothesis at 5%(1%) significance level

L.R. test indicates 2 cointegrating equations (s) at 5% significance level

Table 3

"Error Correction Model" for Model (2)

Dependent Variable is D(A)
Sample Adjusted: 1968 1993
Included Observations: 26 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$D(Y/P_s)$	4.727948	0.977362	4.837459	0.0002
$D(Y/P_s(-2))$	2.800472	0.977636	2.864534	0.0118
D(P2)	0.440031	0.211885	2.076748	0.0554
D(P2(-1))	0.720480	0.215369	3.345334	0.0044
D(P2(-2))	0.826162	0.204700	4.035967	0.0011
$D(T/P_s)$	-0.571424	0.240354	-2.377427	0.0312
$D(TDR_2(-2))$	-0.536162	0.193980	-2.764015	0.0145
C	-0.224917	0.060806	-3.698942	0.0021
$D(TDR_2)$	-0.043885	0.018770	-2.338068	0.0336
ECM2(-1)	-0.586304	0.138476	-4.233958	0.0007
D(A(-1))	0.598777	0.124305	4.817017	0.0002

R-squared	0.912052	Mean Dependant var	0.051157
Adjusted R-squared	0.976753	S.D. Dependant Var	0.155289
S. E. of regression	0.071711	Akaike info criterion	-4.974125
Sum squared resid	0.077136	Schwarz criterion	-4.441854
Log likelihood	38.77123	Ramsey Reset F-statistic	0.0314
Durbin-Watson stat	1.927519	ARCH: F-statistics	0.210384
Serial Correlation:			
F. statistics	1.609949		

Table 4

MODEL (3)

Long-run Equation

Dependant Variable is A
Sample (adjusted): 1965 1993
Included observations: 29 after adjusting endpoints

Variable	Coefficient	Std. Error	t-statistic	Prob.
Y/PS	2.468329	0.170778	14.45347	0.0000
TDR /PS	0.699545	0.159616	4.382673	0.0002
C	-57.66709	4.936897	-11.68084	0.0000

R-squared	0.973172	Sum squared resid	0.982780
Adjusted R-squared	0.944955	Durbin-Watson stat	0.325141
S.E. of Regression	0.194420		

ERROR CORRECTION MODEL

Variable	Coefficient	Std Error	t-statistic	Prob.
D(Y/PS(-1))	-1.962908	0.8397060	-2.3376140	0.031900
D(P2/PS(-1))	-0.685534	0.3516300	-1.9495890	0.067900
D(TDR /PS)	0.523052	0.1466190	3.5674120	0.002400
D(TDR2/PS(-2))	-0.374549	0.1210010	-3.0954120	0.006600
D(T/PS)	-0.607746	0.2452370	-2.4781950	0.024000
D(T/PS(-2))	0.859517	0.2802340	3.0671390	0.007000
ECM3A(-1)	-0.042395	0.0215540	-1.9669100	0.065700
D(A(-1))	0.596007	0.1417060	4.2059470	0.000600
C	1.34207	0.6449870	2.0807780	0.052900

R-squared	0.850412	Mean dependant var	0.051157
Adjusted R-squared	0.780018	S. D. dependant var	0.155289
S.E. of regression	0.072834	Akaike info criterion	-4.971712
Sum squared resid	0.090182	Schwarz criterion	-4.536217
Log likelihood	36.73985	F-statistic	12.08068
Durbin-Watson stat	2.527883	Prob(F-statistic)	1.200E-05

Table 5

MODEL (4)

Long-run Equation

Dependant Variable is A
Sample (adjusted): 1965 1991
Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-statistic	Prob.
Y/P2	-1.501268	0.395782	-3.793166	0.0010
P2/P1	-0.888305	0.471343	-1.884626	0.0728
T/PS	-1.177006	0.364343	-3.230492	0.0038
TDR2/TDR1	1.000691	0.259272	3.859614	0.0008
C	51.27484	12.58103	4.075567	0.0005

R-squared	0.927520	Sum squared resid	0.828244
Adjusted R-squared	0.910706	Log likelihood	8.726505
S.E. of Regression	0.194029	Durbin-Watson stat	0.933164

ERROR CORRECTION MODEL

Variable	Coefficient	Std Error	t-statistic	Prob.
D(T/PS)	-0.824673	0.3182210	-2.5915100	0.017900
D(T/PS(-2))	1.006568	0.3226560	3.1196320	0.005600
D(TDR2/TDR1)	0.502262	0.1861 650	2.6979410	0.014300
D(TDR2/TDR1(-1))	-0.412452	0.1836210	-2.2462150	0.036800
D(A(-1))	0.885651	0.1631210	5.4294030	0.000000
ECM5(-1)	-0.274019	0.1423590	-1.9248520	0.069400

R-squared	-0.824673	Mean dependant var	0.052444
Adjusted R-squared	1.671336	S. D. dependant var	0.158350
S.E. of regression	0.090781	Akaike info criterion	-4.593052
Sum squared resid	0.156582	Schwarz criterion	-4.300522
Log likelihood	27.93968	F-statistic	10.80459
Durbin-Watson stat	2.028267	Prob(F-statistic)	4.900E-05

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