
A system of equations model of UK tourism demand in neighbouring countries

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This paper uses a system of equations model to examine tourism demand during periods of destination country transition and integration into the wider international community. The Almost Ideal Demand System model is applied to the UK demand for tourism in the neighbouring destinations, France, Spain and Portugal. Spain and Portugal are interesting cases as, during the period under consideration, they experienced a process of transition from economies with characteristics typical of developing countries, only entering the World Bank's industrialized countries classification in the 1980s. The paper examines the evolution of tourism demand during these countries' transition from 'developing' to 'developed' status. Consideration of France as a neighbouring destination also allows the behaviour of tourism demand to be compared between relatively rich and poor countries. The results show the extent to which the cross-country behaviour of demand becomes more or less similar over time with respect to changes in expenditure and effective prices. The expenditure elasticities are greater for Spain than France during the initial period, indicating that tourism can assist countries to 'catch-up' with their richer neighbours. However, this outcome is not always the case and may not persist, as Portugal had a low initial expenditure elasticity and Spain's relatively high expenditure elasticity decreased over time. Destinations' sensitivity to changes in their own and competitors' prices can also change over time, as indicated by the increases in the own- and cross-price elasticities for Spain, compared with the decreases for France and Portugal. The cross-price elasticity estimates indicate substitutability between the immediate neighbours, Portugal and Spain, and France and Spain.

I. INTRODUCTION

Tourism has important impacts on the economies of both developing and industrialized countries, resulting in job creation, additional income for the private and public sectors, foreign currency receipts, higher investment and growth. Indeed, tourism has acted as a catalyst to economic restructuring in many recipient countries, assisting a shift away from primary sector activities, towards greater reliance on services and manufacturing. Given the scale of

tourism's contribution to the macroeconomy over time, knowledge concerning the nature of the demand upon which it is based is of both theoretical and practical relevance. It is well known that tourism demand is responsive to such variables as income, relative prices and exchange rates. What is not known is how the responsiveness of demand to changes in these variables alters during a country's economic transition and integration into the wider international community. For example, does tourism demand respond more to changes in income during the

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initial or subsequent years? Does the sensitivity of tourism demand to changes in its own prices, or those of its competitors, change between different periods?

Further questions concern the degrees of complementarity or substitutability between tourism destinations and the extent to which these change during periods of economic transition. Complementarity occurs if holidays in different destinations are purchased as a package. Alternatively, there may be an intense degree of competition between destinations (Tsai and Wang, 1998). Relationships of complementarity or substitutability may change over time as lower income destinations emerge from relative poverty to achieve a higher level of development. Little information is available about this issue. It is not known, for example, whether lower income destinations tend to become more or less competitive over time, either relative to other developing countries or relative to more industrialized nations.

Different models have been used to estimate tourism demand and some types of model are more appropriate for examining the above questions than others. The vast majority of studies of tourism demand have relied on single equation models of demand, estimated within a static context (for example, Loeb, 1982; Uysal and Crompton, 1984; Gunadhi and Boey, 1986). These models are not derived from consumer demand theory and fail to quantify the changes in demand behaviour that occur over time. Innovations in the methodology were subsequently introduced in the form of single equation models of demand estimated using an error correction methodology (Syriopoulos, 1995; Vogt and Wittayakorn, 1998). More recently, Song *et al.* (2000) used a general to specific, error correction model to estimate the UK demand for tourism in the form of visits per capita to outbound destinations and demonstrated that the model has good forecasting ability. This modelling approach has the advantage of explicit treatment of the time dimension of tourism demand behaviour and allows for improved econometric estimation of the specified equations.

A third approach to tourism demand estimation involves system of equations models such as the Almost Ideal Demand System (AIDS) approach (White, 1982; O'Hagan and Harrison, 1984; Syriopoulos and Sinclair, 1993; Papatheodorou, 1999). The AIDS model embodies the principles of consumer demand theory and is appropriate for estimating tourism demand in the form of expenditure shares in a range of destinations, to which the major shares of expenditure are attributed. The definition of tourism demand as expenditure shares rather than visits is appropriate in the context of the microeconomic foundations of the model. Moreover expenditure has a direct economic impact on each destination. The model is more appropriate for estimating tourism demand in a small number of destinations, owing to the limitations on the degrees of freedom in the context of a large number of independent variables. The AIDS approach is particularly useful for

testing the properties of homogeneity and symmetry which are basic to consumer demand theory. Hence, it provides a stronger theoretical basis for estimating the cross-price elasticities of demand than the single equation approach.

This paper will use the AIDS model to examine tourism demand by the UK in the neighbouring destinations, France, Spain and Portugal. The UK is relevant as it is a major origin country for tourism in the destinations under consideration. France, Spain and Portugal are key destinations within Europe, accounting for over one-third of all receipts from tourism in the European Union in 1997. The absolute value of their receipts from tourism is very high, at over £98 million in 1997. The choice of the countries as destinations for analysis is also appropriate owing to their position as geographic neighbours. Complementarity or substitutability in tourism demand, as indicated by the signs of the cross-price elasticities of demand, is of particular relevance in this context. The paper pays attention to this issue, which has not previously been examined for the case of neighbouring countries using a system of equations approach.

Spain and Portugal are interesting cases for consideration owing to their position as economies in transition during the period under consideration. At the beginning of the period, in 1969, they displayed classic symptoms of underdevelopment: high dependence on agriculture and fishing, lack of industrialization, low income and low standards of education, health provision and other indicators of social welfare. By 1997, the final year of the period under study, they had joined the ranks of the more developed European economies. Hence, an innovative feature of the paper is its examination of the evolution of tourism demand during these countries' transition from 'developing' to 'developed' status.

A number of related issues are examined within the paper. For example, given the common characteristics of underdevelopment that Portugal and Spain shared at the beginning of the sample period and similarities in their evolution in the ensuing period (including entry into the European Union, with increased co-ordination of fiscal and monetary policies along with funding for tourism-related infrastructure), it might be supposed that tourism demand would evolve similarly in the two countries. The paper will examine whether this, in fact, occurred and will estimate the responsiveness of demand to changes in its determinants for each country. The consideration of France as a neighbouring destination enlarges the scope of the study to allow for comparison of the behaviour of tourism demand between a developed country and its poorer neighbours. It also permits examination of the extent to which the behaviour of demand becomes more or less similar over time with respect to changes in expenditure, prices and exchange rates. Thus, the study provides

useful information, at the cross-country level, about changes in a major activity within each of the economies.

The period under study is subdivided into two periods, 1969–1979 and 1980–1997. This is due to the structural break that occurred between 1979 and 1980, concurrent with Spain and Portugal's moves towards integration with the wider European community. The responsiveness of tourism demand will be compared for the two periods by means of the estimation of income, own-price and cross-price elasticities for each destination, for each period. These provide useful information concerning the changes that occurred between the initial and subsequent periods of the overall transition. The estimated model will also be used to forecast tourism demand, thereby providing additional guidance concerning the overall model fit, as well as its ability to supply accurate forecasts of demand.

The paper proceeds as follows. Section II provides the derivation of the AIDS model which is used to estimate tourism demand in France, Spain and Portugal. The third section specifies the model and explains the variables included in it. The results obtained from estimating the model for the period 1969–1997 are provided in the fourth section, which also includes forecasts of tourism demand for the years 1995–1997, based on the estimation of the model for the period 1969–1994. The fifth section of the paper provides and interprets the elasticity values obtained from the model. The final section discusses the implications of the results for the higher and lower income destinations during the periods of economic transition and provides some conclusions.

II. DERIVATION OF THE MODEL

The AIDS model that is used to estimate the system of tourism demand equations for the countries under consideration is based on the theory of consumer demand, involving utility maximization for given prices and a given budget. The model can be viewed as an extension (including price-effects) of the Working–Leser model which relates the budget share of commodity i , w_i , to the logarithm of the total expenditure x , such that $w_i = \alpha_i + \beta_i \ln x$. The model rests upon a particular class of preferences, the PIGLOG¹ class, which are represented via a cost or expenditure function defining the minimum expenditure required for gaining a specific level of utility at given prices. As Muellbauer (1976) showed, the PIGLOG class of preferences permits an exact aggregation over consumers without imposing identical preferences.

¹ PIGLOG denotes logarithm of price independent generalized linearity.

² If prices are not collinear, the linear approximation of the AIDS model obtained through the use of the Stone price index can bias the estimation of the parameters in the budget share equations. However, the bias is likely to be more important in micro rather than in aggregate data, as shown by Pashardes (1993).

The derivation of the AIDS model (Deaton and Muellbauer, 1980a; 1980b) establishes the following basic equations for the demand for commodity i :

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln \left(\frac{x}{P} \right) \quad i, j = 1, \dots, n \quad (1)$$

where

$$\ln P = \alpha_0 + \sum_k \alpha_k \ln p_k + \frac{1}{2} \sum_k \sum_r \gamma_k^* \ln p_k \ln p_r \quad k, r = 1, \dots, n \quad (2)$$

In a tourism analysis context, i is a destination country among a group of n alternative destinations demanded by tourists from a specific origin. The dependent variable w_i represents destination i 's share of the origin's tourism budget allocated to the set of n destinations. This share's variability is explained by the price of tourism (p) in i and in alternative destinations j and by the per capita expenditure (x) allocated to the group of n destinations, deflated by price index P . The model is based on the following assumptions:

- (i) all budget shares sum to unity, the adding-up restriction, which requires that:

$$\sum_i \alpha_i = 1 \quad \sum_i \beta_i = 0 \quad \sum_i \gamma_{ij} = 0, \quad \text{for all } j$$

- (ii) a proportional change in all prices and expenditure has no effect on the quantities purchased, the homogeneity restriction, which requires:

$$\sum_j \gamma_{ij} = 0 \quad \text{for all } i$$

- (iii) consumers' choices are consistent, the symmetry restriction, which requires:

$$\gamma_{ij} = \gamma_{ji} \quad \text{for all } i, j$$

- (iv) a rise in prices results in a fall in demand, the negativity restriction, which requires the necessary condition of negative own-price elasticities for all destinations.

The restrictions on the parameters comply with the assumptions and ensure that Equation 2 defines P as a linear homogeneous function of individual prices. If prices are relatively collinear, ' P will be approximately proportional to any appropriately defined price index, for example, the one used by Stone' (Deaton and Muellbauer, 1980a, p. 76).² Hence, the deflator P in Equation 2 can be simplified using the Stone price index,

$$\ln P^* = \sum_i w_i^B \ln p_i \quad (3)$$

where w_i^B is the budget share of destination i in the base year. With this simplification the AIDS model can be rewritten in the following form:

$$w_i = \alpha_i^* + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln \left(\frac{x}{P^*} \right) \quad i, j = 1, \dots, n \quad (4)$$

The model assumes separability between consumption and labour supply and excludes quantity constraints. It also assumes that consumers' expenditure is allocated to groups of commodities in a multi-stage budgeting process, implying that each group of preferences is independent of other groups.

Equation 4 specifies a model in the linear-log form which prevents the direct interpretation of its coefficients as elasticities. However, the interpretation of the signs and values of the model's coefficients gives a preliminary indication of how the dependent variable reacts to changes in its determinants. The coefficients of the price variables (γ_{ij}) represent the absolute change in the expenditure share allocated to commodity i due to a 1% change in the price of commodity j , *ceteris paribus*. For $i = j$, the sign of the coefficient of the own-price variable is expected to be negative according to the theory of negativity which qualifies i as a normal good in economic terminology. For $i \neq j$, the sign of the coefficient is expected to be positive if i and j are substitutes, and negative if i and j are complements. The β_i coefficients represent the absolute change in the i th expenditure share given a 1% change in real per capita expenditure, prices being held constant. Generally, in an AIDS model framework, a coefficient $\beta_i > 0$ gives rise to an expenditure elasticity above unity, and a coefficient $\beta_i < 0$ gives rise to an expenditure elasticity in the interval (0,1). In the first case, the demand for commodity i would be expenditure (income) elastic and in the second case, expenditure (income) inelastic. In economic terminology, commodities with income-elastic demands are qualified as 'luxuries' and commodities with income-inelastic demands are qualified as 'necessities'. This qualification indicates that while a 'luxury' good can be given up when restrictions on income are imposed and its budget allocation redistributed to other purposes, a 'necessary' good is essential to consumers and budget restrictions affect only slightly the demand for this type of good. In this sense, an income-inelastic good ($\beta_i < 0$) is likely to have few competitors while an income-elastic ($\beta_i > 0$) good is likely to have many. In a tourism demand context, this could indicate a more stable demand for destinations for which $\beta_i < 0$, compared with a

more unstable demand for destinations for which $\beta_i > 0$. This qualification seems to be more adequate in a tourism context than the more general demand theory terminology which would qualify a tourism destination, in the first case, as a 'necessity' and in the second, as a 'luxury'.

As mentioned above, Equation 4 specifies a linear-log functional form and hence, the relevant elasticities cannot be directly accessed in the parameter estimates. The elasticity values are calculated using the model's estimates as follows:³

Expenditure elasticities:

$$\varepsilon_i = \frac{1}{\bar{w}_i} \frac{dw_i}{d \ln x} + 1 = \frac{\beta_i}{\bar{w}_i} + 1$$

Uncompensated own-price elasticities:

$$\varepsilon_{ii} = \frac{1}{\bar{w}_i} \frac{dw_i}{d \ln p_i} - 1 = \frac{\gamma_{ii}}{\bar{w}_i} - \beta_i \frac{w_i^B}{\bar{w}_i} - 1$$

Uncompensated cross-price elasticities:

$$\varepsilon_{ij} = \frac{1}{\bar{w}_i} \frac{dw_i}{d \ln p_j} = \frac{\gamma_{ij}}{\bar{w}_i} - \beta_i \frac{w_j^B}{\bar{w}_i}$$

Compensated own-price elasticities:

$$\varepsilon_{ii}^c = \varepsilon_{ii} + w_i^B \varepsilon_i = \frac{\gamma_{ii}}{\bar{w}_i} + w_i^B - 1$$

Compensated cross-price elasticities:

$$\varepsilon_{ij}^c = \varepsilon_{ij} + w_i^B \varepsilon_i = \frac{\gamma_{ij}}{\bar{w}_i} + w_j^B$$

where \bar{w}_i represents the sample's average share of destination i ($i = 1, \dots, n$) and w_j^B represents the share of destination j ($j = 1, \dots, n$) in the base year.

III. VARIABLE DEFINITIONS AND MODEL SPECIFICATION

The UK demand for tourism in France, Spain and Portugal is estimated using the system of Equations 5, allowing for possible nonconstancy of the real expenditure coefficient over the sample period. Changes in the coefficient can occur if tourists' allocation of expenditure is affected, over time, by factors that modify the political and economic relationships between origin and destinations and among the destinations themselves. As the model involves three destination countries, the system has three equations:

³The elasticities quantify the sensitivity of tourism demand to changes in the expenditure budget (expenditure elasticities), prices in the destination under consideration (own-price elasticities) and prices in alternative destinations (cross-price elasticities). Compensated price elasticities allow for the effects of changes in real income which accompany price changes, while uncompensated price elasticities only take account of price changes.

$$\begin{cases} w_P = \alpha_P + \gamma_{PP}P_P + \gamma_{PS}P_S + \gamma_{PF}P_F + \beta_P E \\ \quad + \beta'_P[SE] + \delta_P D + \theta_P T + u_P \\ w_S = \alpha_S + \gamma_{SP}P_P + \gamma_{SS}P_S + \gamma_{SF}P_F + \beta_S E \\ \quad + \beta'_S[SE] + \delta_S D + \theta_S T + u_S \\ w_F = \alpha_F + \gamma_{FP}P_P + \gamma_{FS}P_S + \gamma_{FF}P_F + \beta_F E \\ \quad + \beta'_F[SE] + \delta_F D + \theta_F T + u_F \end{cases} \quad (5)$$

The dependent variables are each destination's share of the UK tourism budget allocated to the region. A better understanding of the evolution of the three countries' tourism shares is obtained from Figs 1 to 3, which plot these variables over time.

The independent variables are the effective prices of tourism in each destination, the UK real expenditure allocated to all destinations per capita of the UK population, a dummy variable D and a trend variable T . The effective price of tourism in country i and the UK real per capita expenditure are defined as follows:

$$P_i = \ln\left(\frac{CPI_i/CPI_{UK}}{R_i}\right) \quad \text{and} \quad E = \ln\left(\frac{\sum_i E_i/UKP}{P^*}\right)$$

where $i = F$ (France), S (Spain), and P (Portugal), R_i is the exchange rate between country i and the UK, CPI is the consumer price index of the countries involved, E_i is the UK tourism expenditure in country i , UKP is the UK population and P^* is the Stone price index defined in Equation 3. The data for UK tourism expenditure, disaggregated by destinations and measured in million pounds sterling, were obtained from one common source, the *Business Monitor MA6* (1970–1993) continued as *Travel Trends* (1995–1998). Data for the UK population, price indexes and exchange rates, were obtained from the *International Financial Statistics* (IMF, 1989–1997).

A structural break in the influence of UK real per capita expenditure on the dependent variables separates the sample period into two subperiods, 1969–1979 and 1980–1997. Important events that contributed to the structural break are Spain's membership of EFTA in 1980 and Spain and Portugal's negotiations for EC membership which started, for Portugal, in October 1978 and for Spain in mid-1979, marking this year as the turning point from isolation to partnership in one of the biggest potential markets in the world. This view can be illustrated by the statement of José da Silva Lopes (1996, 136):

One of the most important consequences of these negotiations was the ending of a secular separation between the Spanish and the Portuguese economies. From an economic point of view the two countries had, traditionally, lived back to back. Before membership of the EC, both countries allowed more trading concessions to any other country than to its neighbour. In 1973 Spain tried to negotiate with Portugal the creation of an Iberian common market, but Portugal declined. The Portuguese authorities believed that the differences in dimension and strength between the two economies were such that their integration would only be admissible in a vast multilateral framework where other influences and powers could also be present.

Events of such importance affecting Spain and Portugal inevitably affected France and, hence, the distribution of expenditure among the countries. Thus, a dummy variable S , assuming the value 1 in the years 1980–1997 and 0 otherwise, is multiplied by the variable E to account for the structural break detected. This new variable is denoted as SE . Support for the inclusion of this variable was also provided by statistical (F) tests.

The dummy variable D accounts for several events that appeared to have influenced the UK demand for tourism in France, Spain and Portugal during the period 1975–1981. The first was the political turmoil that followed the



Fig. 1. Tourism expenditure share of France

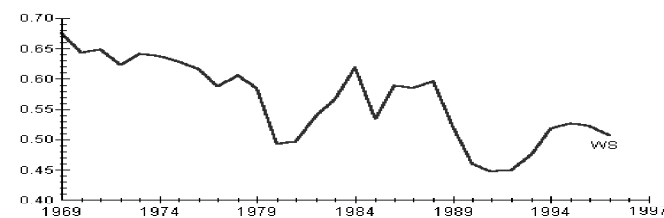


Fig. 2. Tourism expenditure share of Spain



Fig. 3. Tourism expenditure share of Portugal

Portuguese revolution in April 1974. This event had a substantial negative effect on UK tourism flows to Portugal, which is believed to have lasted until 1979. Second, Spain was affected by both the events in Portugal and its own political changes, involving the substitution of a dictatorial regime of forty years' duration by a parliamentary democracy. Third, additional events which had adverse effects on the demand for tourism all over the world and which particularly affected weaker and unstable economies like those of Portugal and Spain were the oil crises of 1973 and 1979.

Ideally, the model should include three different dummy variables portraying the events that affected tourism demand in each of the different countries. However, this would mean the estimation of additional parameters, reducing further the already few degrees of freedom available. The tests performed on an equation-by-equation basis showed that the periods during which tourism demand in each country was affected by political changes and the oil crisis are very close to each other (1975–1979 for Portugal, 1975–1980 for Spain and 1975–1981 for France). Hence, one single dummy covering the period 1975–1981 is included in the model. The coefficients of the dummy are expected to be negative in the equations for Portugal and Spain and positive in the equation for France.

The trend variable accounts for changes in tastes of UK tourists – patterns of behaviour such as ‘country *i*-addicted’ (giving rise to a positive trend coefficient) or ‘cultural curiosity’ (resulting in a negative trend coefficient) – not taken into account by other explanatory variables. Tourists may adhere to the already known or may display more adventurous behaviour by visiting other countries, even when confronted with unchanged expenditure and prices in destination countries already visited. If this is the case and a trend variable is not included, the estimates of prices and expenditure coefficients may be spurious. An alternative ‘preference’ variable, as suggested by Song *et al.* (2000) was not included owing to the problem of collinearity between it and the other independent variables for the cases under consideration.

The homogeneity- and symmetry-restricted system is estimated using Zellner's (1962) seemingly unrelated regressions (SUR) method.⁴ The adding-up restriction is incorporated by suppressing one of the equations from the estimation. The results are invariant irrespective of which equation is excluded. The homogeneity and symmetry restrictions are included by imposing the required linear constraints on the appropriate parameters.

An implicit assumption in most of the literature concerning time series regression analysis is that such data are stationary. Nonstationarity of time series has always been regarded as a problem in econometric studies since it can give rise to spurious relationships among the levels of economic variables. A common practice for avoiding the problem of spurious association between variables in regression analysis involving time-series is the introduction of a trend variable.⁵ Although this procedure is not free of criticism under the scrutiny of recent theoretical work on time-series analysis, in some cases it can make the regression coefficients reflect the true association between the dependent and the explanatory variables of an econometric model. An alternative way of approaching the problem of nonstationarity in time series data is cointegration analysis, which investigates the existence of meaningful long-run relationships among economic variables.⁶

The stationarity of the time-series variables representing tourism shares of the three destinations (W_P, W_S, W_F), tourism prices in France, Spain and Portugal (P_P, P_S, P_F) and the UK per capita real expenditure (E) was analysed using the Dickey–Fuller and augmented Dickey–Fuller tests (Dickey and Fuller, 1979, 1981). All the variables in levels were found to be integrated of order one, or $I(1)$, and their first differences to be integrated of order zero, or $I(0)$. Therefore, the variables' levels are nonstationary and their first differences are stationary. In this study, it is assumed that the variables involved in those equations are cointegrated and that the equations in system (5) represent a meaningful long-run equilibrium relationship between the dependent variables and their determinants.⁷ Moreover, the estimated results, presented in the next section, indicate system (5) as a theoretically consistent, data-plausible and statistically robust econometric model, supporting the presence of a genuine steady-state relationship among them.

IV. ESTIMATED RESULTS

The first result from the model estimation concerns the tests for homogeneity and symmetry. The Wald test for homogeneity, symmetry, and homogeneity and symmetry simultaneously provides chi-square statistic values of, respectively, 2.885, 0.744 and 4.080. The values lie below the respective critical values of the chi-square distributions, implying that homogeneity, symmetry, and homogeneity and symmetry simultaneously are not rejected by the data

⁴ In the case of the unrestricted model, the OLS and Zellner's estimators are equivalent since the vector of independent variables is identical in all equations. In the case of the restricted model, Zellner's estimator is more efficient than the OLS estimator. The efficiency gain is directly related to the correlation between the different equations' disturbance terms and between the sets of independent variables.

⁵ See, for example, Gujarati (1995), pp. 240–1.

⁶ See, for example, Engle and Granger's (1991) survey.

⁷ Ongoing research (De Mello, 2000) shows that the variables are cointegrated on an equation-by-equation basis.

Table 1. AIDS model estimation results

Model	α_i	γ_{Pj}	γ_{Sj}	γ_{Fj}	β_i	β'_i	δ_i	θ_i	R^2	DW
P Unrestricted	0.092	-0.065	0.073	-0.018	-0.010	0.005	-0.017	0.001	0.85	1.75
	(5.17) [•]	(-2.23) [○]	(2.39) [○]	(-0.51)	(-0.81)	(1.10)	(-3.60) [•]	(0.88)	9	
	0.093	-0.064	0.077	-0.013	-0.010	0.006	-0.018	0.001	0.85	1.78
Restricted (H)	(5.33) [•]	(-2.25) [○]	(2.71) [•]	(-0.40)	(-0.80)	(1.54)	(-3.73) [•]	(0.82)	8	
	0.091	-0.072	0.072	-0.0004	-0.010	0.006	-0.018	0.001	0.85	1.79
	(6.01) [•]	(-2.99) [•]	(2.95) [•]	(-0.02)	(-0.99)	(1.73)	(-4.28) [•]	(1.17)	7	
S Unrestricted	0.412	-0.068	-0.375	0.526	0.111	-0.035	-0.053	-0.011	0.88	1.87
	(7.44) [•]	(-0.07)	(-3.92) [•]	(4.75) [•]	(2.90) [•]	(-2.57) [•]	(3.52) [•]	(-2.28) [○]	3	
	0.404	-0.023	-0.427	0.450	0.105	-0.047	-0.051	-0.007	0.86	1.71
Restricted (H)	(7.03) [•]	(-0.24)	(-4.56) [•]	(4.28) [•]	(2.66) [•]	(-3.87) [•]	(-3.24) [•]	(-1.65)	8	
	0.387	0.072	-0.453	0.381	0.127	-0.048	-0.049	-0.011	0.86	1.57
	(7.86) [•]	(2.95) [•]	(-5.62) [•]	(5.19) [•]	(4.26) [•]	(4.45) [•]	(3.53) [•]	(-3.85) [•]	1	
F Unrestricted	0.496	0.072	0.301	-0.508	-0.101	0.031	0.071	0.009	0.85	1.98
	(9.60) [•]	(0.85)	(3.39) [•]	(-4.92) [•]	(-2.83) [•]	(2.38) [○]	(5.02) [•]	(2.14) [○]	4	
	0.504	0.087	0.350	-0.437	-0.096	0.042	0.068	0.006	0.83	1.76
Restricted (H)	(9.41) [•]	(0.99)	(4.01) [•]	(-4.46) [•]	(-2.60) [•]	(3.65) [•]	(4.69) [•]	(1.50)	5	
	0.522	-0.0004	0.381	-0.380	-0.117	0.043	0.067	0.009	0.82	1.62
	(11.6) [•]	(-0.02)	(5.19) [•]	(-5.22) [•]	(-4.27) [•]	(4.24) [•]	(5.17) [•]	(3.59) [•]	7	

at the 5% significance level. This finding indicates rationality of consumer behaviour and accords with Papatheodorou's (1999) result.

The coefficient estimates, asymptotic *t*-values (in parentheses), R^2 and Durbin-Watson (DW) statistics are provided, in Table 1, for three different versions of the model: unrestricted, homogeneity-restricted (H), and homogeneity- and symmetry-restricted (H + S). The symbols [•] and [○] indicate the 1% and 5% significance levels.

For the restricted model (H + S), the explanatory variables are all significant at the 5% level or less, except for the price of Portugal in the equation for France and the price of France, trend and real expenditure variables in the equation for Portugal.⁸ All the regressions are significant overall, with high explanatory power for the independent variables included in the model.⁹ The DW test is inconclusive. However, in the equation-by-equation estimation of the unrestricted model with OLS, both the Lagrange multiplier and the DW tests reject serial correlation. As Deaton and Muellbauer (1980b) pointed out, imposing homogeneity may generate positive serial correlation. However, if this is the case, it occurs in the equations for Spain and France but not in that for Portugal.¹⁰ In fact, for the former two countries, the values of the DW statistic for the model under homogeneity fall when compared with those obtained from the unrestricted single equation

model. Moreover, these same values fall further when we consider the model constrained by homogeneity and symmetry simultaneously. The equation for Portugal implies the opposite behaviour.

Forecasting results

A further indicator of the 'goodness of fit' of the model is provided by the model's ex post forecasting performance. Forecasting was undertaken by estimating the model for the period 1969-1994 and using the estimated coefficients to forecast tourism demand for the years 1995-1997. The forecasting performance can be evaluated by the summary statistics, mean absolute sum of squared errors (MABSE) and root mean sum of squared errors (RMSE). The actual and predicted values of tourism demand, as measured by the destination shares for France, Spain and Portugal, are provided in Table 2, along with the values of the summary statistics.

It is evident that the values of tourism demand that were forecast by using the model are very close to the actual values, for each country and each year. All of the forecasting errors are lower than 0.05 and the values of the MABSE and RMSE are also low, indicating that the model's overall forecasting ability is very good. This result confirms the finding by Song *et al.* (2000) that econometric

⁸ The equation for Portugal shows evidence of collinearity between the trend variable and the real expenditure variable. When this equation is estimated without the trend, the coefficient of the expenditure variable is positive and significant but when the trend variable is included, the estimated coefficient of the expenditure variable changes sign and becomes insignificant.

⁹ For the system under analysis, the null hypothesis of all coefficients being zero is rejected by the Wald test. The Wald statistic value for this hypothesis is 245.5(0.000).

¹⁰ In the equation for Portugal the Wald test would reject homogeneity at the significance level of 72% while in the equations for France and Spain it would reject the hypothesis at the 11% level.

Table 2. *Multivariate forecasts of destination country expenditure shares, WP, WS and WF*

	Portugal (WP)			Spain (WS)			France (WF)		
	Actual	Predicted	Error	Actual	Predicted	Error	Actual	Predicted	Error
1995	0.088	0.091	-0.003	0.526	0.518	0.008	0.385	0.390	-0.005
1996	0.087	0.094	-0.007	0.523	0.492	0.030	0.390	0.413	-0.023
1997	0.088	0.093	-0.005	0.507	0.508	-0.001	0.405	0.400	0.005

	Portugal (WP)		Spain (WS)		France (WF)	
	Estimation Period (1969–1994)	Forecast Period (1995–1997)	Estimation Period (1969–1994)	Forecast Period (1995–1997)	Estimation Period (1969–1994)	Forecast Period (1995–1997)
MABSE	0.0065	0.0047	0.0206	0.0132	0.0188	0.0114
RMSE	0.0075	0.0049	0.0249	0.0182	0.0232	0.0144

models are capable of providing accurate forecasts of tourism demand.

Interpretation of the coefficient values

The regression coefficients in Table 1 can be interpreted as follows: *ceteris paribus*, γ_{ij} measures the absolute change in the i th expenditure share following a 1% change in p_j , and the coefficients, β_i and $(\beta_i + \beta_i')$ measure the absolute change in country i 's share per 1% change in UK real per capita expenditure in the period 1969–1979 and in the period 1980–1997, respectively. For Portugal, both of the latter values are insignificant, so that changes in UK real per capita expenditure do not significantly affect the Portuguese share. However, these coefficient estimates are significant for France and Spain.

If $\beta_i > 0$, the share w_i increases with E and if $\beta_i < 0$, the share w_i decreases when E increases. In demand theory terms, this would indicate tourism in Spain to be a 'luxury' and tourism in France to be a 'necessity'. An alternative terminology might be to categorize Spain as a 'primary' (first choice or preference) destination and France as a 'secondary' (second choice or preference), meaning that consumers would prefer to direct additional expenditure towards Spain rather than France. Generally, a coefficient $\beta_i > 0$ gives rise to positive expenditure elasticities above unity, and a coefficient $\beta_i < 0$ gives rise to expenditure elasticities in the interval (0, 1). This means that for each 1% increase in the UK expenditure allocated to this region, the share of Spain (France) would respond with a more (less) than 1% increase, which confirms UK tourists' preference for Spain when their budget increases.

The values of the coefficient for the intercept dummy variable, D , demonstrated that the Spanish and Portuguese political changes and the oil crises that took place in the period 1975–1981 had a negative effect on Spain and

Portugal and a net positive effect on France. Hence, in the period 1975–1981, UK tourists' preferences moved in favour of France, relative to Portugal and Spain. The coefficients of the trend variable can be interpreted as the annual average change in the expenditure shares which would take place in the absence of change in the other explanatory variables. France's share increases while Spain's share decreases by approximately the same amount. The increase in the Portuguese share is insignificant.

V. ELASTICITY VALUES AND THEIR INTERPRETATION

A more detailed analysis of the results requires the relevant elasticity values. These were calculated using the formulae given in section II and the following values for the average and year-base shares:

	Year-base share (1990) w^{90}	Overall period average share (1969–1997) w	First period average share (1969–1979) w^F	Second period average share (1980–1997) w^S
Portugal	0.0923	0.0775	0.0574	0.0898
Spain	0.4607	0.5635	0.6267	0.5249
France	0.4470	0.3590	0.3159	0.3853

The ensuing discussion focuses on the uncompensated elasticities as they tend to be more important for policy purposes. The estimates of the expenditure and uncompensated own- and cross-price elasticities within the restricted

Table 3. Expenditure and uncompensated price elasticities (restricted model)

	Expenditure elasticities		Own-price elasticities		Cross-price elasticities					
					P_P		P_S		P_F	
	First	Second	First	Second	First	Second	First	Second	First	Second
W_P	0.82 (4.5)	0.95 (10.1)	-2.24 (-5.5)	-1.80 (-6.7)	X	X	1.35 (2.8)	0.83 (2.8)	0.07 (0.2)	0.02 (0.1)
W_S	1.203 (25.2)	1.15 (26.9)	-1.82 (-12.9)	-1.93 (-11.7)	0.10 (2.6)	0.12 (2.7)	X	X	0.52 (4.7)	0.66 (5.0)
W_F	0.63 (7.3)	0.81 (24.5)	-2.04 (-9.3)	-1.90 (-10.4)	0.03 (0.4)	0.02 (0.3)	1.38 (5.6)	1.08 (5.3)	X	X

model (H + S) and respective *t*-values are presented in Table 3.¹¹

Expenditure elasticities

The expenditure elasticities relating to the UK demand for tourism differ considerably between the neighbouring countries; those for Portugal and France are below unity while that for Spain is above unity. All the estimated expenditure elasticities are statistically significant at the 1% level. Given the estimated values of the standard deviation of the expenditure elasticity for Portugal (0.182 in the first period, and 0.094 in the second), the null hypothesis of a unit expenditure elasticity for Portugal in both periods, could not be rejected. However, the same hypothesis tested for the other two countries was conclusively rejected by the data. Therefore, the UK tourism demand is expenditure elastic for Spain, is expenditure inelastic for France and is not significantly different from unity for Portugal. Consequently, the UK expenditure share of France is less responsive to variations in UK real tourism expenditure than those of Spain or Portugal. Given the relatively low estimated value of this elasticity when compared with those of its neighbours, France is likely to benefit/lose less from increases/decreases in UK total tourism expenditure than Spain or Portugal. The values of the expenditure elasticities indicate France to be a ‘secondary’ destination ($0 < \epsilon_F < 1$) while Spain can be viewed as a ‘primary’ destination ($\epsilon_S > 1$).

An interesting aspect is the difference in the magnitudes of the expenditure elasticities for Spain and France between the first and second periods. The responsiveness of the UK demand for Spain to changes in real expenditure seems to decrease while that of France seems to increase from the first to the second period. This implies that, for the most recent two decades (the second period), France

and Spain have been moving in opposite directions in relation to their roles as ‘primary’ and ‘secondary’ destinations. This view can be further supported by the differences in the uncompensated and compensated own- and cross-price elasticities observed in the first and second periods for these two countries.

Own-price elasticities

The uncompensated own-price elasticities are all negative, as expected for normal commodities for which demand responds negatively to increases in prices. In the cases of Portugal and France, the value of the own-price elasticity decreases from the first to the second period while in the case of Spain an increase is observed. The absolute magnitude of the decrease for Portugal is greater (-0.44) than that for France (-0.14) or the increase for Spain (0.12). Hence the impact of the changes in prices on the UK demand for tourism in these three destinations varies not only across countries but also between the two periods considered. In the period 1969–1979, the UK demand for tourism is more responsive to changes in Portuguese and French prices (a 1% change in prices of France or Portugal induces a demand decrease of more than 2%, *ceteris paribus*) than to price changes in Spain. However, in the period 1980–1997, the UK demand for tourism is more responsive to price variations in Spain than in France or Portugal. The second period values of the own-price elasticities also indicate that changes in effective prices in France and Spain have a greater impact on the UK demand for tourism than would result from equivalent changes in Portugal. For all three countries in both periods, the positive returns that could be gained from increases in the UK tourism budget would not compensate the adverse effects of increased prices.

¹¹ Given the elasticities’ definition in Section II, their variances, based on which the *t*-values are calculated, are computed as follows: $VAR(\epsilon_i) = (1/w_i)^2 VAR(\beta_i)$; $VAR(\epsilon_{ii}) = (1/w_i)^2 VAR(\gamma_{ii}) + (w_i^B/w_i)^2 VAR(\beta_i) - 2[w_i^B/(w_i)^2] COVAR(\gamma_{ii}, \beta_i)$; $VAR(\epsilon_{(j)}) = (1/w_i)^2 VAR(\gamma_{ij}) + (w_j^B/w_i)^2 VAR(\beta_i) - 2[w_j^B/(w_i)^2] COVAR(\gamma_{ij}, \beta_i)$.

Comparison of the magnitudes of the expenditure elasticities in the first and second periods shows a stable value for Portugal, an increasing value for France and a decreasing value for Spain. On the other hand, the own-price elasticities indicate decreasing responsiveness of UK demand towards changes in prices in France and Portugal and an increasing sensitivity of UK demand to price variations in Spain. Hence, the estimates of the expenditure and own-price elasticities indicate a tendency for Spain to lose ground to France and Portugal.

Cross-price elasticities

Substitutability and complementary among the destinations are indicated by positive and negative cross-price elasticities, respectively. Clear conclusions about the complementarity or substitutability among destinations are not usually obtained in studies using the AIDS model, which have produced few well defined cross-price effects. However, the results in this study seem consistent and also coincide with *a priori* expectations. Hence they are taken as an indication of the relative magnitudes and directions of the changes in demand.

In both the first and second periods, all cross-price elasticities are positive, indicating substitutability among destinations. However, since the price of France (Portugal) in the equation for Portugal (France) is not significantly different from zero, the cross-price elasticities between Portugal and France are expected to be null. The insignificance of the cross-price elasticities is statistically confirmed by the respective *t*-values in Table 3. Hence, Portugal and Spain and France and Spain are substitute destinations, while the UK demand for Portugal (France) does not react to changes in the effective price of France (Portugal).

The cross-price elasticities for the equations for France and Spain show that the French share is more sensitive to price changes in Spain than that of Spain is to price changes in France. However, this sensitivity alters from the first to the second period, showing a decrease in the responsiveness of the UK demand for France to price variations in Spain and an increase in the responsiveness of the UK demand for Spain to price variations in France. If Spanish prices increase by 1%, the French share increases by 1.38% in the first period and by only 1.08% in the second, while if prices increase by 1% in France, the demand for tourism in Spain will increase by 0.52% in the first period and by 0.66% in the second. This is consistent with Spain's loss of ground relative to France, mentioned above.

The results also indicate Spain and Portugal to be substitutes, although price changes in Portugal have a minor effect on the UK demand for Spain compared with the effect on the UK demand for Portugal caused by price changes in Spain. This is not surprising given the difference

in the sizes of the tourism markets of both countries. Yet, the situation again alters from the first to the second period. The results posit that if prices in Portugal increase by 1%, the demand for tourism in Spain will increase by 0.10% in the first period and 0.12% in the second. These small effects show the low sensitivity of the UK demand for Spain to price changes in Portugal. However, if prices in Spain increase by 1%, the UK demand for Portugal increases by 1.35% in the first period and by 0.83% in the second. Hence, although the sensitivity of the UK demand for Portugal to price changes in Spain remained greater than the sensitivity of the UK demand for Spain to price changes in Portugal, the former diminished in the two last decades. In contrast, the sensitivity of the UK demand for Spain to price changes in Portugal increased. This provides further evidence of the increasing sensitivity of the UK demand for Spain to price variations in its competitors.

VI. CONCLUSIONS

This paper has applied the AIDS model in two contexts not addressed in other studies that have estimated system of equations models of tourism demand. First, the model was applied to neighbouring destinations, two of which experienced a transition from features characteristic of developing countries at the beginning of the sample period, towards higher levels of income and welfare by the end of the 1990s. Second, the model allowed for comparison of the changes in the behaviour of tourism demand in each of the countries over time, not only in terms of the values of the expenditure and own-price elasticities but also those of the cross-price elasticities. The estimated results show the model to be consistent with the data, as indicated by both the diagnostic statistics and the model's good forecasting ability. Moreover, in contrast to many studies which have estimated system of equations models, the results are consistent with the properties of homogeneity and symmetry. This accords with the microfoundations of the AIDS approach and increases the credibility of the elasticity values.

The elasticities that were obtained from the model provide interesting insights concerning the behaviour of tourism demand in the two lower income countries, both relative to each other and relative to their richer neighbour. In both periods, the estimated expenditure response of the UK demand for tourism in Spain is elastic, while that for France is inelastic and that for Portugal is not significantly different from unity. The expenditure elasticity for Spain is marginally lower in the second period than the first, while that for France is higher.

These results indicate that Spain has benefited from increases in the expenditure budget relative to France. Hence, increases in the tourism expenditure budget can

assist poor countries to 'catch-up' with their richer counterparts. However, unlike Spain, Portugal did not benefit significantly from increases in the UK expenditure budget, so that the two Iberian countries have experienced different patterns of behaviour over time. These findings are clearly relevant to policy-makers who are concerned with the responsiveness of tourism demand to changes in expenditure. For example, Portugal's lack of significant gains from increases in the expenditure budget, along with Spain's apparently declining share, corroborated by the negative sign of the trend coefficient, merit further attention by the relevant tourism authorities.

The estimates of the uncompensated own-price elasticities for the first period show Spain to be a less price elastic destination than France but in the second period they are more similar. This indicates that the price sensitivity of tourism demand can vary significantly over time. Although UK tourists remain more sensitive to price changes in France than in Spain, they are becoming increasingly sensitive to price changes in Spain, implying that Spain may experience more instability of demand relative to France if this trend continues. The sensitivity of the UK demand for Spain is increasing in response not only to changes in its own-price but also to changes in the prices of its competitors, France and Portugal, as is shown by the values of the cross-price elasticities in the first and second periods. In contrast, the sensitivity of the UK demand for France and Portugal to price changes in Spain demonstrates a tendency to diminish between the first and second periods.

Portugal is a small country, in terms of tourism, compared with its neighbours. This fact, combined with the political and historical events that contributed to its lagging behind other European countries in development terms, may explain Portugal's late awareness of its tourism potential. However, calculations based on World Tourism Organisation data (1999a, 1999b) show that between 1985 and 1997, tourism in Portugal has increased faster (except for France in terms of arrivals and for the Netherlands in terms of receipts) than any other western or southern continental European country. In fact, tourist arrivals in Portugal increased by 60% between 1987 and 1996, only surpassed by France with an increase of 69%, and Portugal's tourism receipts increased by 275% between 1985 and 1997, only surpassed by the Netherlands with an increase of 288% in the same period. Furthermore, Portugal's share of international tourist arrivals has exceeded 1.5% since 1990, classifying the country as one of the 20 most visited countries in the world (WTO, 1996). Nevertheless, in terms of receipts, the picture is less favourable as Portugal drops to a position below 25 among the

most important tourism destinations. In terms of tourist arrivals in Portugal, Spain is the most important origin, followed by the UK, while in terms of receipts, the UK is the most important origin (Instituto Nacional de Estatística, 1975–1997). Spanish tourists in Portugal are mainly short-term visitors who enter the country in huge numbers but spend very little. UK tourists display the opposite behaviour, entering the country in smaller numbers (roughly, 10% of the Spanish tourists, according to the Direcção-Geral do Turismo¹²) but spending more time and money during their longer-term visits.

Although Portugal undertook a major effort of modernization in an attempt to adjust to its EU partners' development levels, this effort, in tourism terms, has only been noticeable during the 1990s. For most of the sample period, the data reflect an attractive but relatively underdeveloped country. There are, of course, places in Portugal with the cosmopolitan environment seen in similar destination countries but they tend to be too crowded for tourists looking for a minimum of quality to accompany rising service prices. These features are not easy to capture in the model, given the data available, and may be one of the reasons for the statistical performance of the equation for Portugal, rendering the elasticities estimates more difficult to interpret.

However, there is sufficient evidence to indicate the changes that Portugal has been experiencing in tourism terms. For instance, although the expenditure elasticity of the UK demand for Portugal is not significantly different from unity in both periods, its estimate increases from the first period to the second. If additional observations could provide significant confirmation of this tendency, this would mean that an increase in the UK tourism budget allocated to the region would be accompanied by a larger share for Portugal in the second period *ceteris paribus*, confirming a growing UK preference for Portugal and assisting the country to 'catch-up' with its richer neighbours. The own-price elasticity is significant in both periods and clearly portrays a diminishing sensitivity of the UK demand for Portugal with respect to price changes in this destination country. In fact, from the first to the second period, this elasticity estimate drops sharply to a value even below that of France, while Spain shows an increase in its second period own-price elasticity estimate.

The cross-price elasticities provide useful information about the interrelationships between the destinations. The cross-price elasticities between Portugal and France indicate the lack of sensitivity of the UK demand for Portugal (France) to price changes in France (Portugal) since for both periods, the cross-price elasticity of the UK demand for Portugal (France) with respect to price changes in

¹² Direcção-Geral do Turismo, *Foreign arrivals*, in http://www.world-tourism.org/portugal/htm/stat_uk.htm

France (Portugal) is not significantly different from zero. The case is different for the cross-price elasticities estimates between Spain and Portugal. For both periods and in both countries, the UK demand for tourism in one country responds significantly to price changes in the other. However, as expected, the UK demand for Spain is only marginally affected by price changes in its smaller neighbour, while the UK demand for Portugal is responsive to price changes in Spain, particularly in the first period. In the second period, the UK demand for tourism in Portugal responds less to price changes in Spain than in the first period, which indicates that Portugal may have achieved more stability as a UK tourism destination, along with greater independence from price changes in Spain.

Political changes are likely to have an adverse effect on tourism demand, as indicated by the negative coefficient on the dummy variable for Spain and Portugal whose average shares decreased during the period 1974–1978, while that of France increased. The estimated coefficient for the trend variable also shows an increasing average share of UK tourism expenditure for France, while Spain's share tends to decrease. This further confirms the already stated loss of ground of Spain to France and indicates that countries cannot rely on continuing gains from tourism.

The application of the AIDS model has provided new information about the behaviour of tourism demand during the development process. For example, it has shown that although lower income countries can benefit from increases in the expenditure budget relative to their neighbours, they will not do so automatically. Portugal and Spain, for example, failed to achieve similar gains from increases in the UK tourism budget. Exploration of the reasons why some lower income countries experience disproportionate gains from rises in tourism expenditure is a topic for investigation, as is the reasons why countries can fail to maintain their advantageous position. The study has also shown that competition for international tourism demand, rather than complementarity, characterized the neighbouring countries under consideration. Investigation of the degree to which competitiveness rises or falls as other countries attain more similar levels of development is a further topic for research.

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REFERENCES

Barten, A. P. (1977) The system of consumer demand functions approach: a review, in *Frontiers of Quantitative Economics*,

- Michael D. Intriligator (Ed.) North-Holland Publishing Company, Amsterdam.
- Business Monitor MA6 (1970-1993) *Overseas Travel and Tourism*, Government Statistical Service, Central Statistical Office, HMSO, London.
- Deaton, A. and Muellbauer, J. (1980a) *Economics and Consumer Behaviour*, Cambridge University Press, Cambridge.
- Deaton, A. and Muellbauer, J. (1980b) An Almost Ideal Demand System, *The American Economic Review*, **70**, 312–26.
- De Mello, M. (2001) Theoretical and empirical issues in tourism demand analysis, PhD thesis, *mimeo*, Tourism and Travel Research Institute, University of Nottingham.
- Dickey, D. A. and Fuller, W. A. (1979) Distributions of the estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association*, **74**, 427–31.
- Dickey, D. A. and Fuller, W. A. (1981) Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, **49**, 1057–72.
- Engle, R. F. and Granger, C. W. J. (eds.) (1991), *Long-run Economic Relations: Readings in Cointegration*, Oxford University Press, Oxford.
- Government Statistical Service, *Travel Trends: A Report on the 1994 (1995/6/7) International Passenger Survey*, Central Statistical Office, HMSO, London.
- Gujarati, D. N. (1995) *Basic Econometrics*, 3rd ed., McGraw-Hill, New York.
- Gunadhi, H. and Boey, C. (1986) Demand elasticities of tourism in Singapore, *Tourism Management*, **7**, 239–53.
- Instituto Nacional de Estatística (1975–1997) *Estatísticas do Turismo*, Instituto Nacional de Estatística, Lisbon.
- International Monetary Fund (1989–1997) *International Financial Statistics Yearbook*, International Monetary Fund, Washington, DC.
- Loeb, P. D. (1982) International travel to the United States: an econometric evaluation, *Annals of Tourism Research*, **9**, 7–20.
- Lopes, J. S. (1996) *A Economia Portuguesa Desde 1960*, Gradiva, Lisbon.
- Muellbauer, J. (1976) Community preferences and the representative consumer, *Econometrica*, **44**, 979–99.
- O'Hagan, J. and Harrison, M. (1984) Market shares of US tourist expenditure in Europe: an econometric analysis, *Applied Economics*, **16**, 919–31.
- Papatheodorou, A. (1999) The demand for international tourism in the Mediterranean region, *Applied Economics*, **31**, 619–30.
- Pashardes, P. (1993) Bias in estimation of the Almost Ideal Demand System with the Stone index approximation, *Economic Journal*, **103**, 908–16.
- Song, H., Romilly, P. and Liu, X. (2000) An empirical study of outbound tourism demand in the UK, *Applied Economics*, **32**, 611–24.
- Syriopoulos, T. (1995) A dynamic model of demand for Mediterranean tourism, *International Review of Applied Economics*, **9**, 318–36.
- Syriopoulos, T. and Sinclair, M.T. (1993) An econometric study of tourism demand: the AIDS model of US and European tourism in Mediterranean countries, *Applied Economics*, **25**, 1541–52.
- Tsai, P.-L. and Wang, K.-L. (1998) Competitiveness of international tourism in Taiwan: US versus Japanese visitors, *Applied Economics*, **30**, 631–41.
- Uysal, M. and Crompton, J. (1984) Determinants of demand for international tourism flows to Turkey, *Tourism Management*, **5**, 288–97.
- Vogt, M.G. and Wittayakorn, C. (1998) Determinants of the demand for Thailand's exports of tourism, *Applied Economics*, **30**, 711–15.

- World Tourism Organisation (1996) *Datos Esenciales*, WTO, Madrid
- World Tourism Organisation (1999a) *Destination Country Totals According to a Single Indicator – International Tourism Receipts 1985–1997*, WTO, Madrid.
- World Tourism Organisation (1999b) *Destination Country Totals According to a Single Indicator – Arrivals of Tourists from Abroad 1987–1996*, WTO, Madrid.
- White, K. J. (1982) The demand for international travel: a system-wide analysis for US travel to Western Europe, Discussion Paper No. 82–28, University of British Columbia, Vancouver.
- Zellner, A. (1962) An efficient method of estimating seemingly unrelated regressions and test for aggregation bias, *Journal of the American Statistical Association*, **57**, 348–68.