Tourism Demand in the Mediterranean: An EC-LAIDS Approach

by: Alexi Thompson

Tourism has become a viable source of economic growth for many countries as world income continues to increase. The growth in world tourism has been followed by a host of tourism studies offering differing policy advice. Tourism is especially important in southern European countries. This study takes an Error Correction Linear Almost Ideal Demand System (EC-LAIDS) approach to modeling tourism demand in the Mediterranean and derives expenditure, own, and cross price elasticities.

Time series methods are the most popular when modeling tourism demand. Dritsakis and Gialektaki (2004) use quarterly data from 1960 to 2000 to model Greek tourism demand from EU member countries. An error correction model is utilized and results indicate exchange rates and real income in of the source countries have positive effects on Greek tourism revenues. Similarly, Thompson and Thompson (2010) employ an error correction model on Greek tourism demand using yearly data from 1974 to 2006 to examine the euro switch. Incomes, prices, and the euro switch all had positive effects on Greek tourism revenue, indicating inelastic tourism demand. Halicioglu (2004) measures tourism demand to Turkey as a function of world income, transport costs, and relative prices, finding world income providing the most explanatory power to the number of arrivals in Turkey. Time series methods are useful for measuring the seasonality, cyclality, and the dynamic nature of tourism. The dynamic nature of tourism refers to present tourism demand typically depends on tourism demand in previous years. Tourists may share their travel stories to neighbors influencing the choice of location for their next vacation.

Panel data approaches are also used widely in tourism demand literature. Panel methods are useful for increasing the number of observations as tourism data can be difficult to find for some countries. Kuo et. al (2009) measure the impact of exchange rates on a panel of eight Asian countries from 2001 to 2007. Depreciation or a decrease in the relative price level of the host country is found to positively affect tourism revenues. Muñoz (2005) using a panel approach, finds traveling to Spain a luxury good for German tourists.

The Almost Ideal Demand System (AIDS) model has been used to a much lesser extent in tourism demand models. Divisekera (2003) uses the AIDS model and finds tourists are less sensitive to price changes in traditionally popular tourism destinations. The US, UK, and New Zealand are both host and source countries; Japan is a source country and Australia is a host country. Lyssiotou (2001) incorporates an AIDS model to study UK demand for tourism to US, Canada, and 16 European countries. AIDS models have been used measure US and Western tourism demand for Mediterranean countries (Syriopoulos and Sinclair (1993), Papatheodorou (1999)).

Alternative forms of the AIDS model have been used in tourism demand studies including Dynamic Almost Ideal Demand System (DAIDS) and Linear Almost Ideal Demand System (LAIDS) models. De Mello and Fortuna (2005) employ the DAIDS model to study UK tourism demand to the countries of Spain, France, and Portugal. The Dynamic AIDS (DAIDS) model combines the structure of the AIDS model with first differenced variables assuming tourists do not respond immediately to price changes and current tourism demand may depend on past tourism demand. Li, Song, and Witt (2004) use the EC-LAIDS model to measure UK tourism demand to several European countries. The LAIDS model is the linear approximation of the AIDS model. Similar to De Mello and Fortuna (2005), Li, Song and Witt run an EC-LAIDS model to account for dynamics of tourism demand and derive short and long run elasticities.

This paper uses the EC-LAIDS model to look at US tourism demand to Spain, Italy, and Greece. The industry plays a vital role to the economies of these southern European countries. These countries share similar traits, including rich histories, warm summers, and nice beaches leading to high tourism demand. Spain and Italy are consistently among the top five countries in the world in both tourism arrivals and revenues. Greece is in the top 20 tourist countries. Tourism accounts for 15 % of GDP in Greece.

Data

Price variables are derived from *ePR/PR** where e is the nominal exchange rate, *PR* is the price level if the tourism host country, and *PR** is the US CPI. The implication is that the derived price variable is the relative price of tourism in the host country from the viewpoint of a US tourist. Thus all tourists theoretically earn equivalent salaries as a US tourist since there no data on the origin country of the tourists. This is not an unreasonable assumption since the majority of tourists come from UK and Germany, both with similar income per capita to the US. The CPI index for *PR* and *PR** come from an OECD website. Nominal exchange rates are from the Penn World Tables. The study covers the years from 1982-2007.

THE AIDS MODEL

The AIDS model, developed by Deaton and Muellbauer (1980) takes the form

$$w_i = a_i + \sum_j \gamma_{ij} log p_j + b_i log\left(\frac{x}{p}\right) + u_i \quad (1)$$

where w_i is the budget share of the tourist host country i, p_i is the price in host country i, x is total annual tourism revenue by the three host countries included in the study, and P is an aggregate price index specified as

$$\log P = a_0 + \Sigma_i \alpha_i \log p_i + (1/2)\, \Sigma_i \Sigma_j \gamma_{ij} \log p_i \log p_j$$

(2)

The AIDS model is preferred to the linear expenditure system due to its strong theoretical foundation. Restrictions imposed on a demand system include homogeneity, symmetry, and negativity.

The homogeneity adding-up restriction requires budget shares to sum to unity,

$$\sum_{i=1}^{n} a_i = 1, \quad \sum_{i=1}^{n} \gamma_{ij} = 0, \quad \sum_{i=1}^{n} b_i = 0 \quad (3)$$

from (1).

The homogeneity restriction states that as long as prices and expenditures change by proportional amounts quantity demanded of the good is not affected. Symmetry implies $\gamma_{ij} = \gamma_{ji}$ and negative own price elasticities follow from negativity. Homogeneity and symmetry conditions of demand theory can be tested with the AIDS model.

This paper uses the linear approximation of the aggregate price index in equation (2) with Stone's (1954) Price Index (P*) specified as:

$$\log P^{*}=\Sigma_i w_i \log p_i$$

This linear approximation of the price index is suitable in demand studies when prices are collinear (Deaton and Muellbauer '80), as in tourist demand studies where the host countries are all in the same region. Further, homogeneity and symmetry conditions are imposed on the demand system in line with demand theory. The Spanish budget share equation is dropped in initial estimation and recovered through the adding up restriction. Table 1 lists the estimated coefficients and t-statistics from the LAIDS model.

Although these coefficients appear statistically significant, OLS assumes at least stationarity of variables. Stationarity implies convergence to a long run mean. Otherwise the series is explosive and estimated coefficients cannot be trusted. The data in this set covers 26 years from 1982-2007. It is likely, as in most time series regression, these variables are not stationary. This paper uses the EC-LAIDS to account for nonstationarity of variables and derive short and long term elasiticities.

Ray (1985) and Blanciforti (1986) are credited with the form of the the EC-LAIDS model that includes a lagged term for the dependent variable. The EC-LAIDS model was introduced to tourism demand literature recently by Durbarry and Sinclair (2003). The EC-LAIDS model used in this paper takes the form:

$$\Delta w_i = a_0 + \Sigma_j \gamma_{ij} \Delta \log p_j + b_i \Delta \log(x/P^{*}) + \lambda i \mu_{it-1} \qquad (4)$$

where δ_i, λ_i are parameters to be estimated and μ_{it-1} is the error correction term.

The first step in implementing the EC-LAIDS model involves testing all variables for difference stationarity. Variables that are not stationary can be difference stationary. The Augmented Dickey Fuller Test is used to check for a unit root (difference stationary) for budget shares, prices, and total tourism expenditure variables. The ADF test is specified $\Delta y_t = a_0 + \gamma y_{t-1} + a_1 \Delta y_{t-1} + a_2 t + e_t$ where Δ indicates difference in variable y_t, t is time, and a_0, γ, a_1, a_2 are parameters to be estimated. The null hypothesis is $a_0 = \gamma = a_1 = a_2 = 0$. If the null cannot be rejected by the appropriate F-test then y_t has a unit root ($\Delta y_t = e_t$) and can be used in EC-LAIDS model assuming e_t is a white noise residual. ADF tests are conducted in Stata on all variables and found to be difference stationary. The price of Greece is difference stationary with two lags. The critical F-test satistic is -4.38. The results are listed in Table 1.

The residuals from the ADF tests must be white noise. White noise residuals have zero mean, zero covariance (low correlation between the residual and its lag), and constant variance. The Durbin Watson test is used to test for zero covariance. The Durbin Watson follows the test: $DW=2(1-\rho)$ and $\rho<.17$ is sufficient for zero covariance, however in small samples (such as in this paper) this test is not reliable. The results for the DW test are included in Table 1.

The ARCH (1) tests for constant variance assumes the form $\varepsilon_t^2=\beta_0 + \beta_1 \varepsilon_{t-1} + e_t$ with the null hypothesis that $\beta_1=0$ indicating homoskedasticity. The results from the ARCH(1) test are included in Table 1. All variables have constant variance.

Some of the variables do appear to fail the Durbin Watson test. Estimation of the EC-LAIDS model continues since the variables are difference stationary. It is assumed in a larger data set where prices varied more residuals would be white noise.

The differenced AIDS model is preceded by the Engle Granger test that tests the residual from the spurious model for a random walk in the regression $\Delta e_t = a_1 e_{t-1} + \varepsilon_t$. The null hypothesis is $H_0{:}a_1=0$. The critical F-statistic at 1% is -4.38. Results are listed in the Table 2. Residuals from Greek and Italian budget share regressions fail to reject the null hypothesis indicating that estimation can proceed with an error correction model.

The EC-LAIDS model (eq. 4) includes the residuals from the static (spurious) AIDS model (results in Table 3) in the first differenced model. Results are listed in Table 4 with t-stats in parenthesis.

The coefficients on the residuals are multiplied by the coefficients from the static model that accounts for adjustment relative to the long term dynamic equilibrium of the variables in the static AIDS model. The derived elasticities affect budget shares in the long run. Table 5 includes derived elasticities from the error correction model. Standard errors of the elasticities are derived through error propogation.

Conclusion

AIDS modeling has a strong theoretical background and can provide insightful estimates. In highly of competitive industries where competitor pricing can affect own market shares, AIDS modeling may be provide better estimate estimates of cross price effects.

THE EC-LAIDS model is an extension of the AIDS model that accounts for nonstationary variables. Stationarity problems are often not analyzed when using the AIDS model. Overlooking stationary issues will lead to inefficient estimates. A rigorous statistical analysis of variables should be applied before AIDS estimation.

The results of this paper should be useful to policymakers in this region. With regards to the expenditure elasticities, Own price elasticities are sensitive for the set of countries except for Spain. Spain is the closest to England and Germany and due the proximity Germans and English may be indifferent to price fluctuations in Spain compared to fluctuations in countries farther away.

The cross price elasticities have positive signs indicating the set of countries are substitutes, however these coefficients are not statistically significant. Figure 1 includes a graph of the variables. Although Greece was sufficiently cheaper than Spain and Italy in 1982, the gap narrowed within a few years and currently prices are quite similar. The similarity in prices may account for insignificant cross price elasticities.

The main conclusion is that policymakers in these countries should be wary of prices within their own borders, but should not consider their neighbors a threat. The degree to which they should work together is ambiguous because the results do not indicate that the countries are compliments. Policymakers should focus on marketing and pricing within their own countries.

The euro dummy is not statistically significant with respect to the Greek budget share. It is statistically significant in the Italian budget share but not economically significant. The euro has negatively affected tourism in Spain. The nominal exchange rate is embedded in the nominal exchange rate. The euro dummy accounts for decreased transactions costs and the decrease in exchange rate volatility.

Future research should include spatial weight matrices since distance may be a determining factor in substitutability. It would also be interesting to get relative prices in terms of UK tourists and compare them to results from relative prices in terms of dollars (as in the present study). We should expect UK tourists to be less sensitive than their American counterparts due to the strength of the pound.

Table 1 . STATIONARITY RESULTS

VARIABLE	F-TEST STATISTIC F_{crit}=- 4.38	DW TEST 2(1-rho)	ARCH (1) TEST t-crit=1.71
PG	13.25 -1.971 (2 lags)	1.96	-1.52
PI	2.54	2.03	0.24
PS	3.61	2.06	0.28
Wi	1.29	1.79	1.54
Wg	2.87	1.54	-0.23
Ws	1.82	2.04	-0.77
X	1.69	2.11	-1.66

Table 2. ENGLE GRANGER COINTEGRATION RESULTS

RESIDUAL	T-CRIT	DW TEST	ARCH 1
RESIDUAL FROM GREECE	-2.73	1.27	3.26
RESIDUAL FROM ITALY	-3.15	1.41	-0.45

TABLE 3. STATIC LAIDS MODEL

DepVar/Budget shares	WG	WI	WS
DLNXLNP (t-stats)	-0.03 (-1.50)	-0.01 (-0.27)	0.04 (1.16)
LNPG	0.02* (2.09)	-0.01 (-0.98)	-0.01 (-0.47)
LNPI	-0.01 (-0.98)	0.41* (3.10)	-0.39* (-3.04)
LNPS	-0.01 (-0.47)	-0.39* (-3.04)	0.40 (0.13)
EURO	0.06* (4.45)	-0.04* (-1.88)	-0.02 (-0.004)

*-indicates statistically significant coefficients at 5% level.

TABLE 4. DIFFERENCE AIDS MODEL RESULTS

DepVar/Budget shares	DWG	DWI	DWS
DDLNXLNP	0.007 (0.47)	-0.04 (-1.63)	0.03 (1.07)
DLNPG	-0.069 (-2.41)	0.024 (0.61)	0.045 (1.24)
DLNPI	0.024 (0.61)	0.023 (0.26)	0.024 (0.61)
DLNPS	0.045 (1.24)	-0.047 (-0.60)	-0.069 (-0.05)
EURO	-0.014* (-1.92)	0.009 (0.70)	0.005 (0.002)
RESIDUAL FROM STATIC MODEL	-0.267* (-2.31)	-0.413* (-3.20)	Spanish eq. was dropped

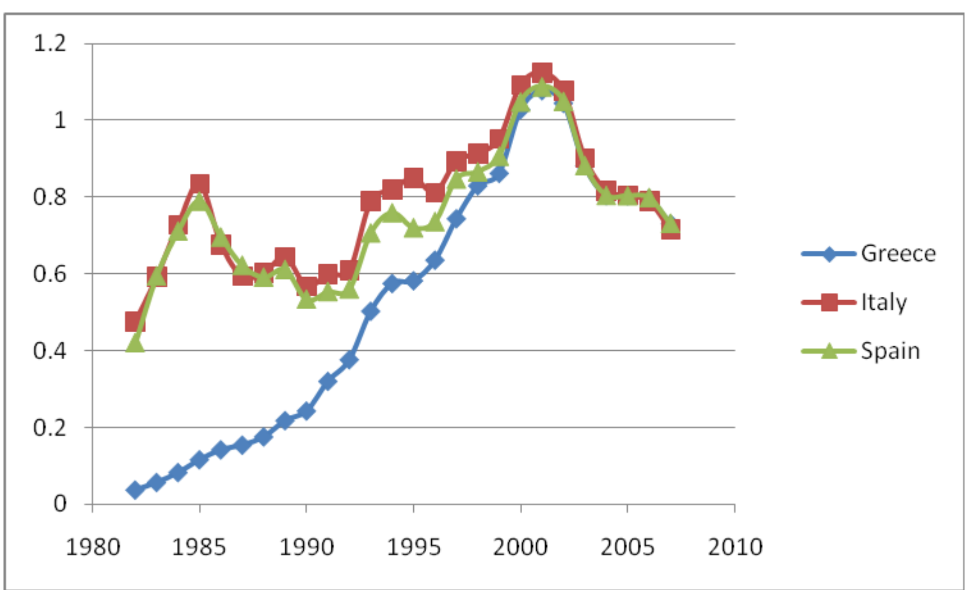
*-indicates statistical significance at the 5% level

TABLE 5. ELASTICITY DERIVATION

ELASTICITY	GREECE	Italy	Spain
EXPENDITURE $1+b_i/w_i$	1.15* (10.45)	0.92* (55.6)	1.15* (3.29)
OWN PRICE $-1+b_{ij}/w_i$	-1.78* (-33.45)	-0.67* (-3.98)	-0.30 (-0.50)
CROSS PRICE b_{ij}/w_i	with Italy: 0.29 (0.64) with Spain: .49 (0.93)	with Greece: 0.07 (1.17) with Spain: 0.27 (0.84)	with Greece: .10 (0.25) with Italy: 0.24 (0.79)
EURO EFFECT	-0.03 (-0.24)	0.03* (15.99)	-0.15* (5.00)

*-indicates statistical significance at the 5% level

Figure 1. PRICES ACROSS TIME (IN LEVELS)



REFERENCES

1. Alan Heston, Robert Summers and Bettina Aten, Penn World Tables Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, August 2009.

2. *Compendium of World Tourism*, Madrid, Spain. World Tourism Statisitcs

3. Deaton, A. and Muellbauer, J. (1980) *Economics and Consumer Behaviour*, Cambridge: Cambridge University Press.

4. DeMello, Maria and Natércia Fortuna, ‘Testing Alternative Dynamic Systems for Modelling Toursim Demand’, Research Center On Industrial, Labour & Managerial Economics

5. Divisekera, S. “Dynamic Analysis of British Demand for Tourism Abroad.” Empirical Economics, Vol. 25, No.3.

6. Durbarry, R. and Sinclair, M.T. (2003) ‘Market shares analysis-The case of French tourism demand’, *Annals of Tourism Research*, 30, 4: 927-941.

7. Hacioglu, Ferda. “An ARDL Model of International Tourism Flows to Turkey.” Global Business and Economic Review, 2004, pp. 614-624.

8. International Monetary Fund

9. Kuo, Hsiao-I, et al ‘Tourism Demand &Exchange Rates in Asian Countries: Evidence from a Panel Approach’, csie, vol. 4, pp. 508-512, 2009 WRI World Congress on Computer Sciences and Information Engineering, 2009.

10. Li, Gang et. al. (2004) ‘Modelling Tourism Demand: A Dynamic Linear AIDS Approach, Vol. 43, No. 2, 141-150

11. Lyssiotou, P. (2000) ‘Dynamic Analysis of British demand for tourism abroad’, Empirical Economics, Vol. 25, No.3: 421-436

12. Muñoz, T. and Amaral, T. (2000) ‘An econometric model for international tourism flows to Spain’, *Applied Econometric Letters*, 7: 525-529.

13. Papatheodorou, A. (1999), ‘The demand for international tourism in the Mediterranean region’, *Applied Economics*, 31, 5: 619-630

14. OECD. Stat Extracts. Web. 19 Apr. 2010

15. Syriopoulos , T.C. and Sinclair, M.T. (1993), ‘An econometric study of tourism demand: the AIDS model of US and European tourism in the Mediterranean Countries’, *Applied Economics*, 25: 1541-1552.

16. Thompson, Alexi and Henry Thompson. (2010) ‘The Exchange Rate, Euro Switch, and Tourism Revenue in Greece’, *Journal of Tourism Economics* (forthcoming)

17. *Tourism Market Trends*, Europe 2004, Madrid, Spain, World Tourism Organization.