

Research note: The exchange rate, euro switch and tourism revenue in Greece

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The exchange rate and switch to the euro may be thought to have lowered tourism revenue in Greece. These effects are examined with data from 1974 to 2006 in an error correction model of optimal tourist spending that includes source country income and air travel costs. The results may be relevant for touristic countries considering competitive devaluation or a monetary union.

Keywords: tourism revenue; competitive devaluation; euro; tourist expenditure; Greece

This paper focuses on the effects of the real exchange rate and the switch to the euro on tourism revenue in Greece from 1974 to 2006. Tourism is a major part of the Greek economy, over one-tenth of the national income and perhaps one-fifth of employment. The present error correction model includes an index of air travel cost and tourist income represented by US income per capita. Greece may offer lessons for other touristic economies considering devaluation or a monetary union.

Positive effects of the euro switch include exchange rate stability, lower transaction costs and competition in the government-owned banking industry. Negative effects include appreciation against other currencies, increased competition with alternative euro destinations, higher wages and lost manipulation of the drachma for the tourist season.

Dritsakis (2004) and Dritsakis and Gialetaki (2004) model European demand for tourism in Greece as a function of the real exchange rate and EU income with monthly data up to the euro switch. They find that drachma appreciation increases tourism revenue, implying inelastic demand, and that Greek tourism

is a normal good. The present paper extends their analysis through the euro switch.

Garin-Munoz and and Perez Amaral (2000) find tourist income and relative prices affect tourism revenue in Spain. Tse (2001) finds exchange rate, local prices and tourist income affect tourism revenue in Hong Kong. Algieri (2006) finds source country prices, income and airfare cost affect tourism revenue in Russia. Toh *et al* (2006) find Japanese tourists to Singapore are sensitive to exchange rate and income. Eilat and Einav (2004) find exchange rates matter for tourism revenue in developed countries. This literature generally uncovers less than unit elastic effects of the exchange rate, implying inelastic tourism demand.

The following sections introduce the data, present a model of optimal tourism, report stationarity analysis and analyse elasticities of tourism revenue in the error correction model.

Data

Tourism revenue R is assumed to be a function of the real exchange rate e , source income Y^* , air travel cost α and a dummy variable for the 2001 switch from the drachma to the euro €. Tourism revenue R in 2000 dollars from the Greek National Tourism Organization (2008) includes day-trippers and overnight visitors, but neither cruise ships nor Greek nationals living abroad.

The real exchange rate is $e \equiv EP_{gr}/P_{us}$, where E is the nominal drachma rate in terms of US\$/dr or the converted euro rate after the switch, P_{gr} is the Greek price level and P_{us} the US price level, all from the *Penn World Tables* (2008) up to 2004. For the last two years, these data have come from Econstats, the National Statistical Service of Greece, and the US Department of Labor. Tourists are assumed to face US prices at home. Balassa (1973) discusses the relevance of the real exchange rate relative to the nominal exchange rate. Real appreciation (an increase in e) lowers the number of tourists, but tourism revenue R rises if tourism demand is price inelastic.

The airline cost index α is from the Air Transport Association (2008). The typical tourist arrives in Greece by air and an increase in α should lower the number of tourists.

Tourist home income Y^* is US per capita income from the *Penn World Tables*, consistent with the dollar real exchange rate e . The USA as the source country is reasonable since tourists would have relatively high income, and both German and UK incomes lead to similar results. Income per capita is the relevant measure given underlying economic growth over 33 years.

The euro switch in 2001 increased exchange rate stability, lowered transaction costs, altered the price for EU tourists relative to other tourists, changed the pattern of competition and liberalized the banking industry in Greece. The anticipated effect of the dummy variable € is unclear.

Optimal tourist spending

Tourists maximize utility $u(q_T, q)$ subject to source country income $Y^* = P_T q_T$

+ $P_{us}q$, where $P_T = (\alpha + EP_{gr})q_T$, q_T is the quantity of Greek tourism and q is the quantity of goods consumed at home. The optimal q_T^{opt} is derived with constrained optimization as a function of exogenous variables Y^* , α , E , P_{gr} and P_{us} .

Nominal appreciation (an increase in E) raises the price of tourism and decreases q_T^{opt} , as would an increase in the Greek price level P_{gr} . An increase in air travel cost α also lowers q_T^{opt} , while a higher home price level P_{us} raises q_T^{opt} .

Greek tourism revenue $R = EP_{gr}q_T^{opt}$ moves in the same direction as E and P_{gr} if demand is inelastic, but in the opposite direction if demand is elastic, and the opposite holds for the source country price level P_{us} . An increase in air travel cost α lowers q_T^{opt} and R , with P_{us} , P_{gr} and E constant.

Tourism revenue R as a general function of the exogenous variables is

$$R = R(e, Y^*, \alpha, \epsilon) \quad (1)$$

and tourism revenue is estimated in log linear form as

$$\ln R = a_0 + a_1 \ln e + a_2 \ln Y^* + a_3 \ln \alpha + a_4 \epsilon \quad (2)$$

Expected signs are $a_2 > 0$ and $a_3 < 0$. The sign of a_1 depends on the price elasticity of tourism revenue. The euro effect in a_4 may also be positive or negative. Variables in natural logs imply parameter estimates are elasticities. Regression (2) is spurious but the series are difference stationary and an error correction model generates reliable parameter estimates.

Stationarity analysis

Variables in Figure 1 are rescaled to unit value the final year for comparison. Tourism revenue R trends upward from the middle 1980s. The lack of a bump with the 2004 Olympics is worth noting. Dummy variables for 2004 and the following are insignificant. The real exchange rate e is irregular but tends to rise or fall consistently with some momentum over a number of years. Tourist source country income Y^* increases steadily. Air travel cost α increased sharply during the late 1970s and early 1980s with the price of fuel and has increased steadily since then. The apparent trends in Figure 1 suggest regression (2) should be spurious.

Variables in a time series regression should be stationary, converging to a dynamic equilibrium. If not, standard errors are understated, as developed by Enders (2004). Stationarity is analysed by the autoregressive AR(1) stationarity tests reported in Table 1. Tourist income Y^* and air travel cost α are stationary with white noise residuals. Residuals are checked for white noise with zero mean, low autocorrelation by Durbin Watson tests ($2.74 > DW > 1.26$ for a lack of autocorrelation) and homoskedasticity by ARCH(1) tests. Tourism revenue R and the real exchange rate e are not AR(1) stationary.

Plots of differences in Figure 2 appear stationary. All variables except Y^* are in fact difference stationary by the augmented Dickey–Fuller (ADF; 1979) tests reported in Table 1. Tourist source country income Y^* is difference stationary with a Peron (1989) structural break in 1980, typical for a number of macroeconomic variables.

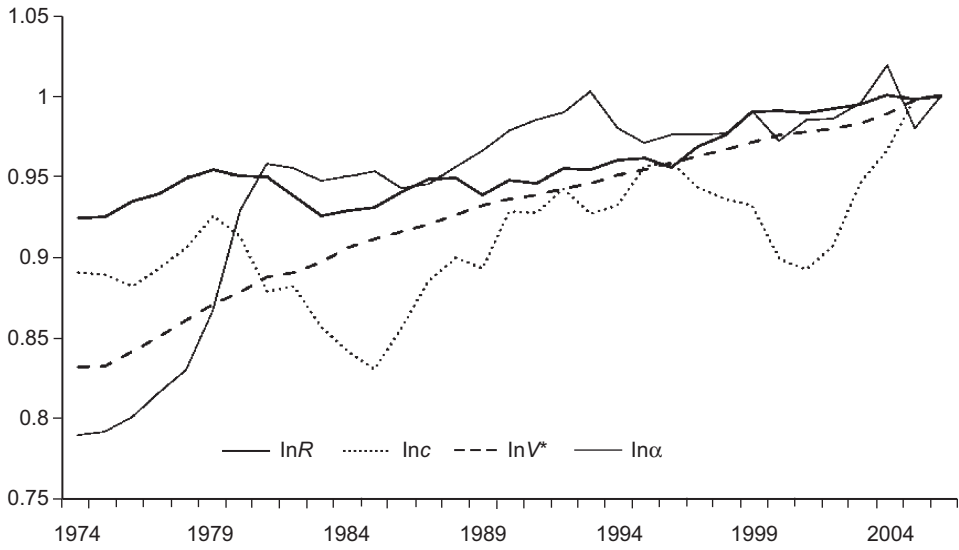


Figure 1. Variable series.

Table 1. Stationarity analysis.

	AR1 coef + 2(se) < 1	ADF $-3.60 < t < 0$ $F < 7.24$	PERON $a_1 - 1/se$ $t_p = -3.76$
<i>R</i>	$0.98 + 2(0.05) > 1$	$t = -1.87$ $F = 1.33$ DW = 2.10 ARCH = 0.03	
<i>e</i>	$0.95 + 2(0.09) > 1$	$t = -2.45$ $F = 3.30$ DW = 2.20 ARCH = -1.39	
<i>Y*</i>	$0.97 + 2(0.01) = 0.99$ DW = 1.84 ARCH = -0.31	$t = -3.75$ $F = 13.4^*$	$t = -3.40$ DW = 2.04 ARCH = 1.54
<i>α</i>	$0.88 + 2(0.04) = 0.97$ DW = 1.84 ARCH = 1.16	$t = -2.38$ $F = 3.41$ DW = 2.20 ARCH = 0.80	

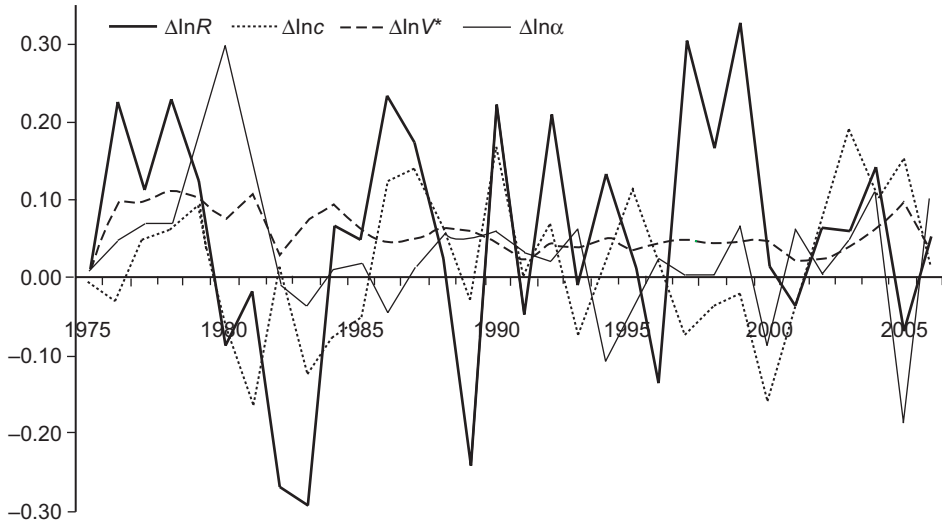


Figure 2. Differences of variables.

Tourism revenue error correction model

Regression (2) is spurious and variables are not cointegrated by the Engle–Granger (EG; 1987) test, but the regression with lags of independent variables is cointegrated. Lagged independent variables are sensible if tourists make decisions for summer vacations in Greece during the previous calendar year. This regression in Table 2

$$\ln R = a_0 + a_1 \ln e_{-1} + a_2 \ln Y^*_{-1} + a_3 \ln \alpha_{-1} + a_4 \epsilon + \epsilon_R \quad (3)$$

is spurious, as expected according to the DW statistic. Coefficient estimates are somewhat larger and statistics stronger with the lagged independent variables relative to the contemporaneous regression. Spurious model regressions with various other lags and combinations of lags produce no significant results.

The inelastic effect of the real exchange rate e suggests Greek tourism is price inelastic. Foreign income and air travel costs appear to have anticipated effects, and the switch to the euro appears to have a positive effect.

The residual ϵ_R from the spurious model (3) is stationary by the Engle–Granger test, satisfying the critical EG statistic -3.18 . This residual ϵ_R is included in the error correction model (ECM) reported in Table 3,

$$\Delta R = b_0 + b_1 \Delta Y^*_{-1} + b_2 \Delta e_{-1} + b_3 \Delta \alpha_{-1} + b_4 \Delta \epsilon_{-1} + b_5 \epsilon_{R-1} + \epsilon_{ECM} \quad (4)$$

Table 2. Spurious model.

	Coefficient	<i>t</i> -statistic
Constant	13.2***	12.1
e_{-1}	0.48**	1.73
Y^*_{-1}	1.16***	4.60
α_{-1}	-1.05***	-3.19
€	0.36**	2.59
EG		$R^2 = 0.877$
$t = -3.41^*$		DW = 1.11*
DW = 1.79		ARCH = 0.21
ARCH = -0.91		

Note: **5%; ***1%.

Table 3. Tourism revenue ECM.

	Coefficient	<i>t</i> -statistic
Constant	0.05	0.77
Δe_{-1}	-0.20	0.69
ΔY^*_{-1}	0.15	0.15
$\Delta \alpha_{-1}$	-0.15	-0.48
€	0.04	0.54
ε_{R-1}	-0.48**	-3.13
		$R^2 = 0.321$
		DW = 1.44
		ARCH = -0.64

Note: **5%.

Only the spurious residual coefficient b_γ is significant. There is no autocorrelation by the DW test and no heteroskedasticity by the ARCH(1) test. The insignificant difference coefficients imply a lack of transitory effects, while the significant error correction coefficient implies there is adjustment relative to the dynamic equilibrium.

The difference model without the spurious residual produces no significant results. Including a Peron (1989) structural break in 1980 for Y^* in the ECM leads to an insignificant coefficient and nearly identical results otherwise. Interaction between the exchange rate and the euro dummy is also insignificant, implying the same exchange rate effects before and after the switch. Various other lags produce no other significant coefficients.

Derived effects in the tourism revenue error correction process

The effects of exogenous variables on tourism revenue in Table 4 are derived by multiplying the error correction coefficient b_γ in (4) by each of the spurious coefficients in (3). The lag on the independent variables from ε_{R-1} in (4) incorporates a lag of two years. Reported *t*-statistics in Table 4 are derived with error propagation calculations.

Table 4. Derived effects on tourism revenue.

	Coefficient	<i>t</i> -statistic
Constant	6.34***	3.03
e_{-2}	0.23*	1.51
Y^*_{-2}	0.56***	2.58
α_{-2}	-0.50**	2.24
ϵ_{-2}	0.17**	2.00

Note: *10%; **5%; ***1%.

The 0.23 elasticity of the real exchange rate implies price inelastic demand. Revaluation or appreciation lowers the number of tourists, but is not enough to lower tourism revenue. Every 1% appreciation lowers the number of tourists by 0.77%, resulting in the 0.23% revenue increase. The elasticity of tourism demand is 0.77.

The 0.56 elasticity of source country income Y^* is evidence that Greek tourism is a normal good but not a luxury. An insignificant interaction term between Y^* and e suggests price sensitivity does not depend on income, and vice versa.

Increased air travel cost α lowers tourism revenue with an elasticity of -0.50 , reflecting its importance for the typical tourist. Lowering the airport tax would increase tourism revenue, and likely total tax revenue as well since net tax collections from the added tourist spending would more than compensate for lost airport tax revenue. Moreover, taxes inside the country could be raised since tourists are insensitive to the real exchange rate.

The switch to the euro raised Greek tourism revenue by 18%. This elasticity is derived from the estimated ϵ coefficient 0.17 and its variance $\sigma^2 = 0.0072$ according to $\exp(\epsilon - \sigma^2/2) - 1 = 0.18$, as developed by Halvorsen and Palmquist (1980) and Kennedy (1981). The ease and stability of euro exchange might be important but the euro also introduced automatic teller machines and credit cards in Greece. The end of the government monopoly on banking increased competition and improved banking services, beneficial to the Greeks themselves.

The sizes of typical yearly impacts on tourism revenue can be evaluated at means of the independent variables $(\mu_e, \mu_{Y^*}, \mu_\alpha) = (1.7\%, 5.7\%, 3.1\%)$. The implied average yearly adjustments in tourism revenue from the error correction model are $(0.4\%, 3.2\%, -1.6\%)$, certainly noticeable for source country income Y^* . The corresponding standard errors $(1.6\%, 0.5\%, 1.5\%)$ suggest a somewhat larger positive typical impact for the real exchange rate e and a typically noticeable negative impact of air travel cost α .

Conclusion

Greek tourism demand is inelastic, reflecting market power. Appreciation or higher prices raise tourism revenue, contrary to appeals in Greece to keep prices low for tourists. Greek tourism is a normal good and revenue can be expected to increase as incomes rise around the world. Higher air travel costs lower tourism revenue and suggest lowering airport taxes. The euro switch had a large

positive impact on Greek tourism revenue, and tourism revenue should increase as more countries adopt the euro.

These results hold some general lessons for countries wanting to expand tourism revenue. Monetary unions and financial liberalization have a positive impact. Strategic devaluation of a fixed exchange rate is ill advised and appreciation of a flexible exchange rate may raise tourism revenue, as in Greece. Tourist sensitivity to airfares and insensitivity to real exchange rates suggest a shift from airport taxes to hotel or other taxes inside the country. While airport taxes are viewed as a user tax, their effect is to discourage tourists and most likely lower government tax revenue. Finally, tourism can be expected to expand as incomes rise around the world, suggesting the tourism industry will continue to attract investment.

References

- Air Transport Association (2008), www.airlines.org/pages/home.aspx (accessed 14 October 2008).
- Algeri, B. (2006), 'An econometric estimation of the demand for tourism: the case of Russia', *Tourism Economics*, Vol 12, pp 5–10.
- Balassa, B. (1973), 'Just how misleading are official exchange rate conversions?' *Economic Journal*, Vol 83, pp 1258–1268.
- Dickey, D., and Fuller, W. (1979), 'Distribution of the estimators for autoregressive time series with a unit root', *Journal of the American Statistical Association*, Vol 74, pp 427–431.
- Dritsakis, N. (2004), 'Tourism as long-run economic growth factors: an empirical investigation for Greece using causality analysis', *Tourism Economics*, Vol 10, pp 305–316.
- Dritsakis, N., and Gialetaki, K. (2004), 'Cointegration analysis of tourism revenues by the member countries of European Union to Greece', *Tourism Analysis*, Vol 9, pp 179–188.
- Eilat, Y., and Einav, L. (2004), 'Determinants of international tourism: a three-dimensional panel data analysis', *Applied Economics*, Vol 36, pp 1315–1327.
- Enders, W. (2004), *Applied Econometric Time Series*, Chapter 2, John Wiley, New York.
- Engel, R., and Granger, C. (1987), 'Cointegration and error-correction: representation, estimation, and testing', *Econometrica*, Vol 55, pp 251–276.
- Garin-Munoz, T., and Amaral, T. Perez (2000), 'An econometric model for international tourism flows to Spain', *Applied Economics Letters*, Vol 7, pp 525–529.
- Halvorsen, R., and Palmquist, R. (1980), 'The interpretation of dummy variables in semilogarithmic equations', *American Economic Review*, Vol 70, pp 474–475.
- Kennedy, P. (1981), 'Estimation with correctly interpreted dummy variables in semilogarithmic equations', *American Economic Review*, Vol 71, p 801.
- National Tourism Organization of Greece (2008), www.gnto.gr/portal/site/eot (accessed 15 October 2008).
- Penn World Tables* (2008), <http://pwt.econ.upenn.edu/> (accessed 15 October 2008).
- Peron, P. (1989), 'The great crash, the oil shock, and the unit root hypothesis', *Econometrica*, Vol 57, pp 1361–1401.
- Toh, R., Khan, H., and Goh, L. (2006), 'Japanese demand for tourism in Singapore: a cointegration approach', *Tourism Analysis*, Vol 10, pp 369–375.
- Tse, R.Y.C. (2001), 'Estimating the impact of economic factors on tourism: evidence from Hong Kong', *Tourism Economics*, Vol 7, pp 277–293.