THE RELATIONSHIPS BETWEEN TOURISM AND HOSPITALITY SECTOR ELECTRICITY CONSUMPTION IN THE SPANISH PROVINCES (1999-2013)

María del P. Pablo-Romero[a], Rafael Pozo-Barajas[b], and Javier Sánchez-Rivas[c]

1. Introduction

There is a recent interest in studying the relationships between energy consumption and growth from a sectoral point of view (Azlina et al. 2014, Pablo-Romero et al. 2017; Nie and Kemp, 2014; Tso and Guan, 2014). Nevertheless, there is a relatively smaller strand of the literature studies referring to the tourism sector (Gössling, 2002; Becken et al.2003) More recently, some authors have explored the econometric relationships among international tourism and energy consumption (Katircioglu , 2014, Katircioglu et al.2014; Zaman et al.2016).

Following these studies, the aim of this paper is to analyze the relationships between tourism growth and electricity consumption in the hospitality sector in the Spanish provinces along the period 1999-2013. With this aim, econometric panel data techniques are used in order to estimate an electricity consumption function for the hospitality sector which depends on tourism growth, income and climatic variables. Additionally, the squared value of the tourism growth is also included. The inclusion of this variable gives greater flexibility to the model allowing to determinate if there are a linear, increasing or decreasing relationships between electricity consumption in the hospitality sector and tourism. In that sense, the inclusion of the squared variable allows us to test an Energy-tourism Kuznets Curve hypothesis. An Energy-tourism Kuznets Curve would show that tourism growths will determinate reducing electricity consumption from a threshold point. In this paper is tested whether this happens or not, which at our knowledge have not been test before.

In addition, the elasticities of hospitality sector electricity consumption with respect to the tourist visitors are calculated. These elasticities are calculated for each year and province, analyzing whether there is a different behavior between provinces along time.

2. Data

Data of the hospitality sector electricity consumption came from the Annual Electrical Statistics published by the Spanish *Ministerio de Energía, Turismo y Agenda Digital* (2017). Figures are expressed in natural logs of MWh per thousands inhabitants, being population data from INE (2017). The series of Hotel Occupation Surveys offered by the Instituto de Estudios Turísticos (2017) provide information about number of travelers and also number of overnights stays along a year. In this study, total overnights stays are considered as a measure of tourism variable. Figures are expressed in overnights stays per thousand inhabitants in natural logs.

GDP per capita came from INE (2017). Figures are expressed in million of constant euros per thousand inhabitants in natural logs. Finally, a climatic variable has been considered. Average temperature has been considered. Nevertheless, an additional temperature measure which reflects the absolute value of the difference between the average annual temperature of each province and the national average has been also considered. Temperature data are calculated from INE database (2017).

2. Model

The general specification model for testing the influence of tourism in the hospitality sector electricity consumption may be expressed as follows:

$$E_{it} = A_{it} + \beta_1 Y_{it} + \beta_3 T_{it} + \beta_4 T_{it}^2 + \beta_3 tem_{it} + e_{it} \quad \textbf{(1)}$$

where E is the hospitality sector electricity consumption in per capita terms expressed in logarithms, Y is the GDP per capita expressed in logarithms, T is the variable representing the province tourism, in this case the number of overnight stays in per capita terms expressed also in logarithms, *tem* is the annual average temperature, A represents the sum of the *time effect* and *country or individual effect* and i and t denote Spanish provinces and years, respectively. Finally, e is a random error term.

In this paper, multicollinearity among the explanatory variables has been analyzed by using the values of the variance inflation factors (VIFs). The second column in Table 2 shows the VIF values obtained for the variables, all exceeding 10 for the variable T and T^2. In order to mitigate this problem, the data were converted to deviations from the geometric mean of the sample. The third column in Table 2 shows the VIF values for the transformed variables do not exceed the value of 5.

Table 2
Variance inflation factors.

Variables	**VIF (variables)**	**VIF (deviations from the geometric mean)**
Y	1.20	1.20
T	251.86	2.13
T^2	254.43	1.99
tem	1.49	1.49
Mean VIF	127.25	1.70

This transformation is included in the equation by using a top line over variables.

Additionally, in order to estimate properly the equation (1), the stochastic nature of the variables has been examined. Firstly, Pesaran CD test has been used to test the existence of cross-section dependence among the variables. Table 3 shows the results. The null hypothesis of cross-sectional independence is rejected for all series.

Table 3

Panel cross-section dependence tests.

Variables	CD test
Y	69.35***
T	34.53***
T^2	9.89***
tem	67.21***

Note: *** denotes significance at the 1% level

Table 4 shows the results of applying the panel unit root tests (CIPS tests) to the series in levels and first differences. The results show that variables are I(1), as they are stationary in first differences and non-stationary in levels.

Table 4

CIPS test

Variables	Level		First Differences	
	Intercept	**Intercept and trend**	**Intercept**	**Intercept and trend**
E	-1.061	-2.130	-2.783***	-3.271***
Y	-2.165*	-2.467	-3.118 ***	-3.242***
T	-1.667	-2.291	-3.254***	-3.553***
T^2	-1.959	-2.157	-3.147***	-3.210***
tem	-2.511***	-2.777*	-3.925***	-3.782***

Note: *t*-bar statistics *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level. Lags included in each individual regression calculated with an iterative process from 0 to 4 based on F joint test. The truncated version of the test is applied limiting the excessive influence of extreme values.

Finally, the co-integration Westerlund test has been implemented. As can be observed in Table 5, the null hypothesis of no co-integration cannot be rejected for tree of the four statistics.

Table 5

Co-integration Westerlund tests.

Dependent variable	Independent variables	Cointegration tests			
		Gt	**Ga**	**Pt**	**Ga**

E	Y, Y^2, Y^3, C	-1.487	-4.134	-9.331	-3.989

Note: Test regression fitted with constant and trend. Kernel bandwidth set according to the rule 4(T/100)2/9. The *p*-values are for a one-sided test based on 200 bootstrap replications. *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level.

The previous tests results suggest that it is adequate to estimate the model by using first-differences. Using Δ to indicate the first differences, equation **(3)** may be rewritten as follows,

$$\Delta\overline{E}_{it} = \Delta\overline{A}_{it} + \beta_1\Delta_1\overline{Y}_{it} + \beta_2\Delta\overline{T}_{it} + \beta_3\Delta\overline{T}_{it}^2 + \beta_4\Delta\overline{tem}_{it} + e_{it} \quad \textbf{(2)}$$

where $\Delta\overline{A}_{it} = \delta_t$.

Once the equation **(2)** is estimated, the β coefficients obtained may inform about the relationships between the electricity and tourism variables. If β_2 and β_3 coefficients are positive, then an increasing relationship exists between *E* and *T*. Likewise, the estimate results also allows us to calculate the per capita hospitality sector electricity consumption elasticities with respect to tourist overnight stays for each Spanish province and year. It may be obtained as follows:

$$ela_{it} = \beta_2 + 2\beta_3\overline{T}_{it} \quad \textbf{(3)}$$

Therefore, these elasticities measure the electricity consumption sensitivity of the hospitality sector respect to the tourism growth for each province and year.

4. Results

Table 6 shows the results of estimating the equations **(2)** to test the Energy-tourism Kuznets Curve existence for the hospitality sector electricity consumption in the Spanish provinces from 1999 to 2013. The feasible generalized least squares model (FGLS) have been used to estimate (3).

Column (a) shows the estimate results when the average annual temperature is used to measure the climate effect on the electricity consumption. Alternatively, columns (b) and (c) show the estimate results when the *absolute* variable or no climatic variable is included in the model.

Table 6

Estimate results of equation **(3)**

	GLS Equation [3] (Average temperature) (a)	**GLS Equation [3] (Absolute temperature) (b)**	**GLS Equation [3] (No climatic variable) (c)**
Y	0.688*** (0.164)	0.705*** (0.161)	0.711*** (0.160)
T	0.203*** (0.038)	0.202*** (0.037)	0.201*** (0.037)
T^2	0.050* (0.029)	0.054* (0.029)	0.052* (0.029)
Tem/abs	0.008 (0.006)	0.002 (0.004)	-

Note: Standard errors are shown in parenthesis, *** denotes significance at the 1% level, ** at the 5% level and * at the 10% level. All estimates include time dummies.

Column (a) shows that β_1 coefficient associated to the GDP per capita is positive and significant with a value equals to 0.688. Therefore, the hospitality sector electricity consumption elasticity with respect to GDP per capita is positive in the central point of the sample. Column (a) also shows that β_2 and β_3 coefficients, those associated to the tourist variables, are both positive and significant. Therefore the Energy-tourism Kuznets Curve hypothesis is refused as an increasing relationship between the hospitality sector electricity consumption and overnight stays is supported, with no turning point observed. Finally, column (a) also shows that the temperature variable is positive but not significant.

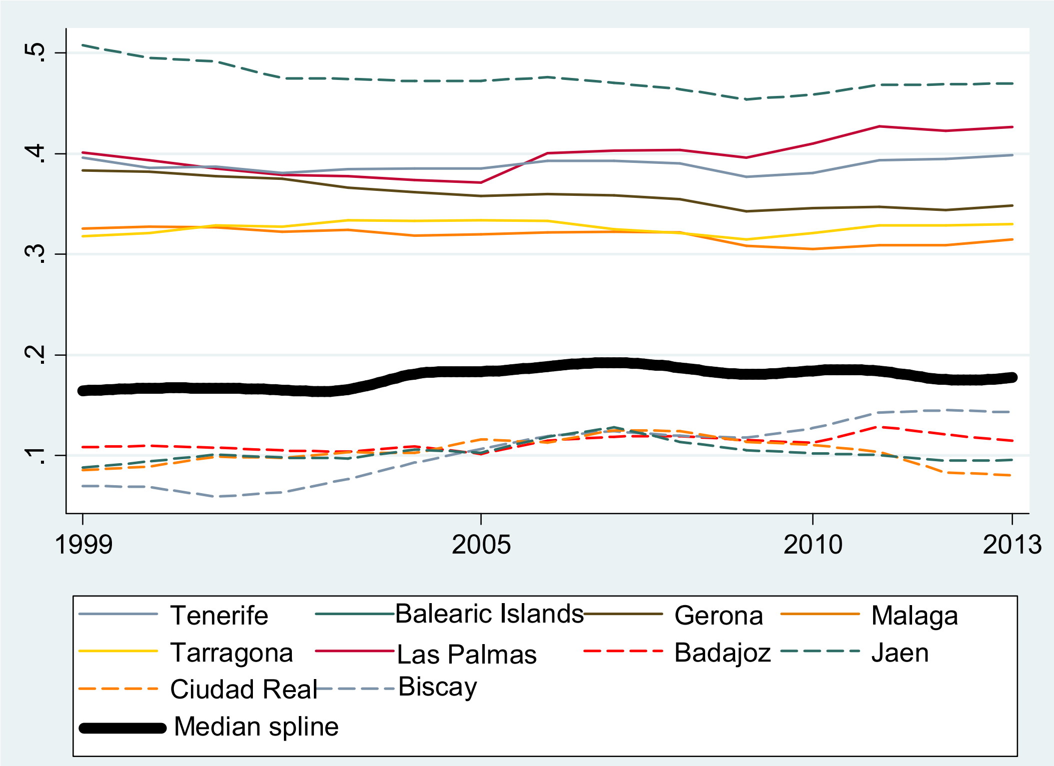
Columns (b) and (c) report the results of these estimates. As shown in column (b), the coefficients for the *absolute* variable is positive but also non significant. However, the use of this climatic variable instead of the average temperature does not change the estimate values for the rest of variables, which are very similar to previous estimate values. Likewise, as shown in column (c), eliminating the climatic variable for the estimate does not affect the value and significance of the rest of variables included in the model.

From the estimate results, the hospitality sector electricity consumption elasticity with respect to the tourism variable may be calculated according to (3). Therefore, elasticities for each province and year were calculated as follows:

$$ela_{it} = 0.20 + 2 * 0.05 * \overline{T}_{it}$$

Figure 1 shows the evolution of the hospitality sector electricity consumption elasticity with respect to tourist overnights stays in per capita terms by Spanish provinces. These elasticities are not constant over the analyzed period. The black line represents the elasticity median spline trend. It grows since 2000 until the beginning of the financial crisis. From 2007, the trend is slightly decreasing. Figure 1 also shows the elasticity trends for those provinces with higher and lower elasticity values along the period. **Figure 1**

Hospitality sector electricity consumption elasticity with respect to tourist overnights stays by Spanish provinces



5. Conclusions

The relationships between tourist overnight stays (as a measure of tourism earnings) and the hospitality sector electricity consumption are studied for the Spanish provinces along the period 1999-2013. In doing so, an Energy-tourism Kuznets Curve hypothesis, similar to an Environmental Kuznets Curve, is tested.

The results show that the Energy-tourism Kuznets Curve hypothesis is not supported. Instead, an increasing relationship between the hospitality sector electricity consumption and overnight stays is supported. Therefore, as tourist overnight stays grow the electricity consumption in the hospitality sector increasingly grows. The results also show differences among the Spanish provinces. Hospitality sector electricity consumption elasticities with respect to tourist overnights differ among the provinces, being the values within a range of 0.1-0.5. The highest values are observed for Balearic Islands, the Canaries Islands provinces, Gerona, Tarragona and Malaga.

References

Azlina A, Law S, Mustapha N. Dynamic linkages among transport energy consumption, income and CO_2 emission in Malaysia. Energy Policy 2014;73:598-606.

Pablo-Romero, M. P., Cruz, L., & Barata, E. (2017). Testing the Transport Energy-Environmental Kuznets Curve hypothesis in the EU27 countries. *Energy Economics*. Volume 62, February 2017, Pages 257–269

Nie, H., & Kemp, R. (2014). Index decomposition analysis of residential energy consumption in China: 2002–2010. *Applied Energy*, *121*, 10-19.

Tso, G. K., & Guan, J. (2014). A multilevel regression approach to understand effects of environment indicators and household features on residential energy consumption. *Energy*, *66*, 722-731.

Gössling, S. (2002). Global environmental consequences of tourism. *Global environmental change*, *12*(4), 283-302.

Becken, S., Simmons, D. G., & Frampton, C. (2003). Energy use associated with different travel choices. *Tourism Management*, *24*(3), 267-277.

Katircioglu, S. T. (2014). International tourism, energy consumption, and environmental pollution: The case of Turkey. *Renewable and Sustainable Energy Reviews*, *36*, 180-187.

Katircioglu, S. T., Feridun, M., & Kilinc, C. (2014). Estimating tourism-induced energy consumption and CO 2 emissions: the case of Cyprus. *Renewable and Sustainable Energy Reviews*, *29*, 634-640.

Zaman, K., Shahbaz, M., Loganathan, N., & Raza, S. A. (2016). Tourism development, energy consumption and Environmental Kuznets Curve: Trivariate analysis in the panel of developed and developing countries. *Tourism Management*, *54*, 275-283.

Ministerio de Energía, Turismo y Agenda Digital (2017). Estadísticas eléctricas anuales. Ministerio de Energía, Turismo y Agenda Digital: Madrid.

INE (2017). INEbase. Instituto Nacional de Estadística: Madrid

IET (2012) Estadísticas de Demanda Turística Instituto de Estudios Turísticos: Madrid