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ORIGINAL ARTICLE

Tourism and regional development: a spatial econometric model for Portugal at municipal level

Luis Delfim Santos[1] · Ana Catarina Vieira[2]

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Abstract

This study examines the importance of tourism as a factor for regional economic development in Mainland Portugal, emphasizing the inter-regional spatial spillover effects. A spatial analysis of the main variables of the tourism sector revealed strong evidence of positive spatial autocorrelation across the municipalities of Portugal. A significant spatial clustering of these activities on coastal locations was identified, leading to the formation of hot spots in coastal regions and cold spots in inland regions. Furthermore, this work specifies spatial econometric models aiming to estimate the relevance of the tourism sector in regional economic development, on a municipal level. The econometric model, which highlights the role performed by interregional spatial spillovers, regresses the regional gross value added against a group of variables, which reflect the contribution of the tourism sector and, furthermore, control variables for the classic determinants of income, for the 278 municipalities of Portugal. The results show that tourism is a significant driver of regional economic development. Moreover, they revealed the presence of positive and significant inter-regional spillover effects, which strongly enhance tourism's economic impact.

Keywords Tourism sector · Spillover effects · Spatial econometrics · Portugal

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1 Introduction

The role of tourism in the process of economic development at a regional level has been extensively emphasised in economics literature. Indeed, the study of regional development

✉ Luis Delfim Santos
luisd@fep.up.pt

[1] CEF.UP and Faculdade de Economia, Universidade do Porto, Porto, Portugal

[2] Faculdade de Economia, Universidade do Porto, Porto, Portugal

in many cases cites tourism as offering great potential in boosting this development, which is why many economies focus strongly on this sector aiming to stimulate economic growth.

The relationship between tourism and economic development and, in particular the tourism-led growth hypothesis (see, for instance, Brida et al. 2016), has been analysed and tested using a wide variety of methods. This analysis has essentially been performed at a national level; nevertheless, even when conducted at a regional level, the spatial issues are very often ignored. The tourism sector is heavily dependent on spatial and local factors and not merely on resource endowments (Capone and Boix 2008). Effectively, these factors tend to play a crucial role in determining the impact of tourism on a given region, as the spatial structure of the tourism sector is closely related to the nature and extent of the impact that it may generate. The presence of spatial patterns in the distribution of tourism activities has been observed in various countries where neither the regional tourism demand nor the supply are even across the country, but exhibit diversified spatial patterns and clusters of tourism regions, which can be identified through appropriate spatial statistics. As expressed by Lazzeretti and Capone (2009), the spatial agglomeration of tourism activities has been identified as an essential engine of regional tourism's growth, providing notable cost savings and convenience for tourists. The authors have shown that the rate of local tourism's growth depends more strongly on economies of location - benefits derived from the spatial agglomeration of related companies or industries - than on natural resource endowment.

In Portugal, the tourism sector is of critical importance in the national and regional economy. In 2014, the number of guests in tourist accommodation reached 17.3 million, with a total of 48.8 million overnight stays and the "Travel and Tourism" item of the Balance of Payments recorded a positive balance of 7075.67 million euros (4.1% of GDP) (Turismo de Portugal 2015). In 2013, the tourism sector accounted for almost 13% of the number of companies, 5% of turnover and 10% of the number of people employed in all the non-financial companies in Portugal (Banco de Portugal 2014). Over the last decade, the significance of the tourism sector has increased for all the indicators considered, especially in terms of the number of people employed. According to the World Economic Forum, in 2014, Portugal held the 15th place worldwide in the Competitiveness Index of the Travel and Tourism sector, and 9th place at European level (World Economic Forum 2015).

The Portuguese tourism sector is characterised by major disparities of development among regions, with the existence of localised spillover effects, which lead to the spatial agglomeration of economic activities. As analysed by Andraz et al. (2015), interregional spillover effects in the tourism sector are essential to understand the relationship between tourism and economic development. In fact, the economic and tourism development of a particular region will tend to be influenced by the performance of neighbouring regions in these same aspects, through spillover effects considered as spatial interaction between regions.

The objective of this study is to estimate the importance of the tourism sector in the regional economic development of Mainland Portugal, through the estimation of econometric models at municipal level.[1] Based on a spatial econometric model, which

[1] Mainland Portugal (hereafter referred to simply as Portugal) is divided into 278 municipalities, with an average surface area of 371 km^2, corresponding to the administrative division of the country at the level of LAU 1 (Local Administrative Unit level 1, former NUTS 4).

highlights the role performed by interregional spatial spillovers, the regional gross value added is regressed against a group of variables which reflect the contribution of the tourism sector and, furthermore, control variables for the classic determinants of income, for the 278 municipalities of Portugal.

Therefore, the aim is to appraise the extent to which the inclusion of these spatial effects in an econometric model affects the estimated impact of tourism development on regional economic performance, assessing the proportion of the economic impact of tourism that is due to the direct effects of tourism development and the indirect effects derived from spatial spillovers.

2 Literature review

The importance of tourism activity and the analysis of its impact on economic development motivated a considerable number of publications, aimed, in particular, at examining whether there is a relationship between tourism development and economic growth and, if so, the causal links of this relationship (Song et al. 2012; Lee and Chang 2008; Oh 2005).

Various theoretical analyses argue that the expansion of tourism contributes positively to economic growth (Balaguer and Cantavella-Jordà 2002; Dritsakis 2004), giving rise to the tourism-led growth hypothesis, which postulates tourism development as a strategic potential factor for economic growth (Antonakakis et al. 2015; Payne and Mervar 2010; Brau et al. 2007; Lanza and Pigliaru 2000). Nevertheless, other studies have questioned this positive relation between tourism development and economic growth, mostly influenced by long-term impacts of tourism development and specialization on local or regional economic structures (Adamou and Chlorides 2010; Figini and Vici 2010; Capó et al. 2007; Romão et al. 2016; Milio 2014).

As mentioned above, the structural dimension of the tourism sector of an economy, in particular the spatial structure of tourism demand and supply, is closely related to the nature and extent of the impact that tourism might have. Effectively, if tourism production and consumption is spatially concentrated, its impact will likewise be concentrated (Pearce 1995).

In the context of the tourism sector, the spillover effects represent indirect effects that the tourism activities of a region exert over the tourism flows of regions in the vicinity (Yang and Fik 2014). As a result, a region may benefit from the growth of the tourism sector of its neighbours, in the presence of spatial autocorrelation. These spillover effects may be explained by the existence of spatial externalities between regions (Fingleton and López-Bazo 2006). In fact, tourism development usually exhibits a highly clustered structure (Hall 2005) where tourists and their expenditure tend to be concentrated in large cities, while other regions specialised in nature and rural tourism are more likely to remain relatively peripheral. In this context, in an analysis of the economic impact of tourism, it is fundamental to examine its geography and dispersion in terms of production and consumption patterns.

Using exploratory spatial data analysis, normally based on Geographic Information Systems (GIS), various authors have demonstrated the existence of spatial autocorrelation in resource endowment and tourism flows, and detected tourism clusters with significant spillover effects and other positive externalities between regions. On this issue see, for example, Zhang et al. (2011) and Yang and Wong (2013), who researched the spatial dependence and mechanisms of tourism's distribution in Chinese cities; Gavilán et al. (2015) who studied tourism flows and their impact on municipalities of the Spanish Autonomous Community of Andalusia; Constantin and Reveiu (2015) for an analysis of tourism activity in Romania; or Shi et al. (2016) who analyse urban tourism crowding in Shanghai.

The focus on location and spatial interaction has recently gained a more central role in econometrics. Anselin (1999, 2003) highlights the importance of including spatial effects from an econometric perspective, because, if the underlying data is based on processes which incorporate a spatial dimension, and this is omitted in the model, the estimates may be based in inconsistent or biased estimators.

Although spatial econometrics is highly relevant in the context of regional science (Anselin 1988), the use of these techniques is not very widespread in the analysis and modelling of the tourism sector. Nonetheless, there are some studies based on this type of research.

Studies that use spatial econometric models in modelling the tourism sector or its impact, and explicitly consider the presence of spatial effects, include those by Chhetri et al. (2008) who examined the spatial patterns of tourism and the role of geography in the modelling of tourism employment in Australia; Yang and Wong (2012) and Yang and Fik (2014) who investigated and estimated the spillover effects on tourism flows and regional tourism growth for various cities in China. Zhang (2009) also employed a spatial econometric approach to study the effects of regional spatial interaction on tourist flows in China. In turn, Ma et al. (2015) investigated the impact of tourism and its spatial autocorrelation on urban economic growth, in the context of a β convergence model, also in China. It is also important to stress the contribution of Paci and Marrocu (2013) who analysed the impact of domestic and international tourism on the process of economic growth in 179 European regions.

For the Portuguese case, see Andraz et al. (2015) who estimated the regional effects of tourism in Portugal, with the purpose of assessing the role of tourism in reducing regional asymmetries; Soukiazis and Proença (2008) who used non-spatial econometric analysis to examine the impact of tourism on the growth of income per capita in 30 Portuguese regions, at NUTS 3 level and Leitão (2011) who investigated the relationship between tourism arrivals and economic growth in Portugal and 20 partners, using static and dynamic panel data models. For the study of the tourism sector in Portugal, using non-spatial models, see Corfu et al. (2006), Barros and Alves (2004) and Kastenholz et al. (1999).

Based on the empirical studies that incorporate the spatial aspect into the analysis of the tourism sector, it is evident that spatial spillovers play a particularly important role in this sector and its economic impact at regional level, and that its explicit consideration in econometric models is fundamental to investigate the economic impact of tourism.

3 Spatial analysis

Since the objective of the econometric model presented in section 4 is to estimate the impact of tourism on regional economic development, the gross value added (GVA) of the companies in each municipality was used as a proxy for the economic performance of each region.[2]

The number of overnight stays or the capacity in accommodation establishments were used as representative variables of the tourism sector. Although the tourism sector can be defined in a much broader sense, only the accommodation sector will be considered in this analysis. This is mainly due to the fact that the statistics for the accommodation segment are those for which there is more data and the existing information is more reliable, at municipal level, since this segment is a very significant component of tourism. In 2012, the global hotel revenues amounted to 1856 million euros (Turismo de Portugal 2013). Tourist expenditure would also be an evident choice, but there is no data (nor estimates) for this variable at municipal level. Therefore, the accommodation segment is widely used in the analysis of the spatial dimension of these activities (Pearce 1995).

A spatial analysis of GVA and the representative variables of the tourism sector is presented below.

Figure 1 shows the territorial distribution of overnight stays and accommodation capacity at a municipal level.[3] The spatial distribution of the two variables is very similar, exhibiting a well-defined geographic pattern with a strong discrepancy between the coastal areas and the municipalities of the hinterland. There is a clustering of tourism activities particularly along the coastal areas and a concentration of low levels of tourism development in the hinterland. This geographic pattern can be taken as an indication of positive spatial autocorrelation).

Moran's I index is the most frequently used global spatial autocorrelation measure. Considering N spatial units, a variable x and a spatial weight matrix W, this statistic is defined by (Moran 1950):

$$I = \frac{N}{\sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}} \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}\left(x_i-\overline{x}\right)\left(x_j-\overline{x}\right)}{\sum_{i=1}^{N}\left(x_i-\overline{x}\right)^2}$$

The interpretation of this statistic is similar to that of a correlation coefficient (although its value does not necessarily have to vary between −1 and 1), but explicitly considering the spatial dimension by including the component w_{ij} (considering only the interaction between regions that are "neighbours").[4]

[2] In Portugal there is no data on "Gross Domestic Product" at the municipal level, therefore GVA was selected. The suitability of its use stems from the strong correlation between the two variables: for 2012, at NUTS 3 level, these two variables have a correlation coefficient of 0.9935.

[3] All the statistical analyses and econometric estimations were performed using the software GeoDa and SpaceGeoDa, Copyright © 2011–2015 by Luc Anselin.

[4] It is possible to express the degree of spatial proximity of N geographic units through a spatial weight matrix W (NxN). For each location i (in line), w_{ij} = 1 if locations i and j are neighbours and w_{ij} = 0 otherwise. Additionally, it is assumed that w_{ii} = 0, that is, that a location is never its own neighbour. Typically, the criterion used to define whether two geographic units are neighbours or not is based on the geographic arrangement of the observations, more specifically on the contiguity or the geographical distance between them. On the definition of matrix W, particularly on the range of criteria that can be used to define neighbourhood and on the relevance of the matrix, see Getis and Aldstadt (2004), Getis (2009) and Harris et al. (2011).

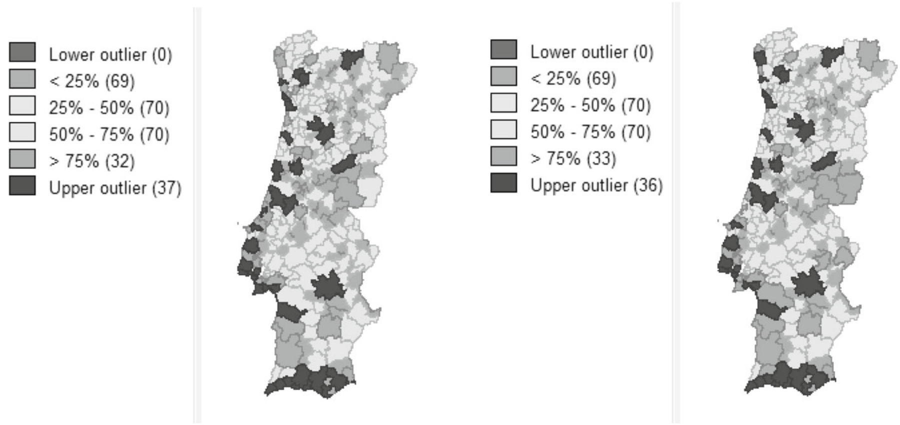

Fig. 1 – Territorial distribution of overnight stays and accommodation capacity at a municipal level

The Global Moran's I was calculated for these variables, using a spatial weights matrix based on the geographic contiguity between municipalities. For any one of the variables, Moran's I statistic is positive and statistically significant,[5] implying the rejection of the null hypothesis of nonexistence of spatial autocorrelation. Therefore, there is evidence of significant positive spatial autocorrelation between the municipalities of Portugal in terms of tourism development.

Moran's I is a global statistic that does not allow an investigation of the spatial autocorrelation structure in each region. Thus, and in order to break down the global measure of autocorrelation into contributions from each region, we used the local Moran I index (see Anselin 1999) which allows us to identify which regions contributed most to the global spatial autocorrelation, the types of local space clusters and the existence of outliers or hot spots for the tourism sector in mainland Portugal.

The local Moran's I cluster map for accommodation capacity (see Fig. 2) was generated in order to break down the global measurement of autocorrelation into contributions of each region (a very similar map was obtained for overnight stays).

Two major clusters of low-low municipalities stand out immediately, referred to as cold spots, i.e. municipalities with an underdeveloped tourism sector surrounded by neighbours with the same features. These cold spots are located in the interior of Portugal, one in the North (highlighted in the maps as cluster number 5) and another in the Centre (cluster number 4). Positive spatial autocorrelation of the high-high type (hot spot clusters) is also detected in the Algarve region (cluster number 1), and to a lesser extent in the Greater Porto (cluster number 3) and Greater Lisbon (cluster number 2) areas, where municipalities with a strongly developed tourism sector are located close to municipalities with the same characteristic. The results reveal the existence of significant local spatial autocorrelation in the tourism sector and confirm the predominance of positive spatial autocorrelation. In terms of robustness of the results, an analysis was also performed through a spatial weights matrix based on the 4 nearest

[5] With a value of 0.114 for overnight stays (p value: 0.013) and of 0.159 for accommodation capacity (p value: 0.003).

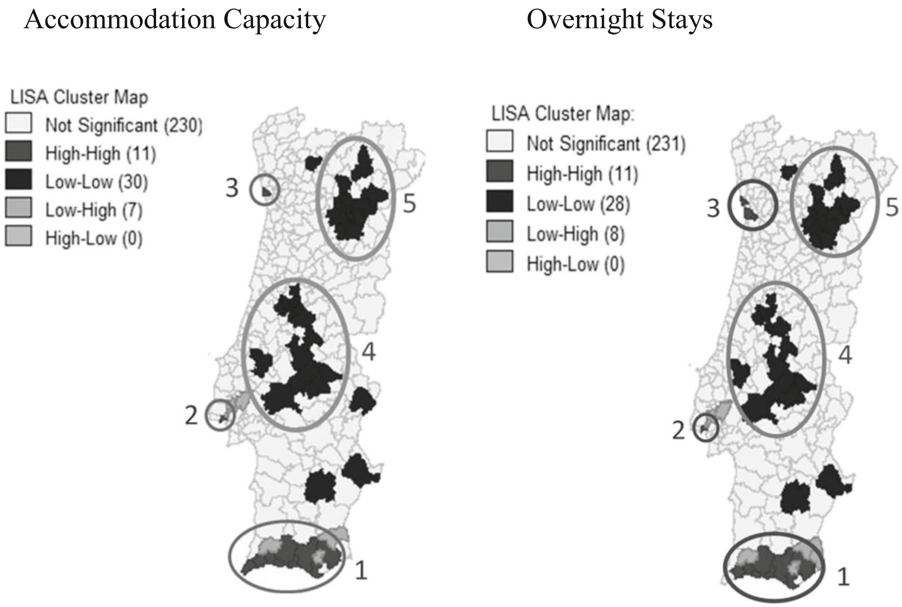

Fig. 2 - Local Moran's I cluster map - Accommodation Capacity and Overnight Stays

neighbours, instead of the contiguity matrix, on the one hand, and through the use of the Getis-Ord statistic (Getis and Ord 1992) as an indicator of autocorrelation, instead of the Moran's I, on the other. The results obtained with these alternatives were substantially similar to those presented herein.

As regards to the dependent variable of the econometric model, it was found that the distribution of GVA between the municipalities of Portugal is strongly asymmetric: the economically less developed municipalities are essentially located in the Interior of the Country, with 29 higher outliers especially along the coastal areas. Global Moran's I is positive and significant (with a value of 0.198 associated to a p value of 0.001), providing evidence of significant and positive spatial autocorrelation between the municipalities of Portugal in terms of GVA.

The map of Local Moran's I clusters (see Fig. 3) confirmed the existence of significant local spatial autocorrelation, enabling the identification of three major clusters of low-low municipalities located in the interior of Mainland Portugal (clusters number 1) and two high-high clusters situated in the coastal areas of Greater Lisbon (cluster number 2) and Greater Porto (cluster number 3).

From the results it can be concluded that both the tourism sector and GVA show a well-defined geographic pattern, consistent with the presence of interregional spatial autocorrelation at municipal level. The economic and tourism hot spots are located in the coastal regions, while the low-low clusters are found in the hinterland.

4 Econometric model of tourism's economic impact

Given the presence of spatial autocorrelation detected in the analysis of the GVA and the tourism sector, at municipal level, a spatial econometric approach was used to

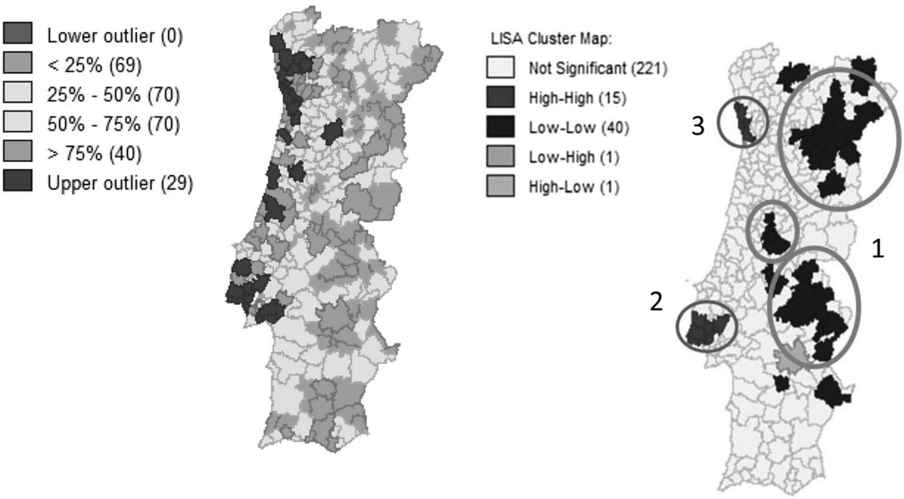

Fig. 3 - Territorial distribution and Map of Local Moran's I clusters – GVA

explicitly consider the role of spatial spillovers in regional economic performance. A spatial econometric model was specified based on data relative to the 278 municipalities of Portugal, in 2012 (the most recent year for which the statistical information was available). It should be noted that the data from some of the municipalities is subject to statistical confidentiality and not made available by the primary source (INE). In such cases, we choose to distribute those variables according to the distribution of the "Index of Tourism Accommodation Capacity" (Marktest database), as the values of the missing observations were less than 4% of the total.

In this model, the value of regional gross value added is regressed against the classic determinants of gross domestic product and a set of variables that specifically reflect the contribution of the tourism sector.

The former are standard variables in the economic literature related to the principal determinants of growth and are derived from the neoclassical approach to growth (Barro 1991; Sala-i-Martin et al. 2004), in particular the variables relative to physical capital and human capital. Regarding physical capital, the low availability of data at municipal level represented a constraint. Thus, the proxy used for physical capital was the total eligible and regionally based investment approved in QREN projects[6] approved between 2008 and 2012 – due to the existence of a time lag between the approval and implementation of the investment project. On the other hand, the focus on quality and quantity of stock of human capital as a source of regional competitiveness is solidly documented in the literature. For this reason, the proportion of employees with college education was selected as the indicator of the qualifications of the individuals comprising the regional labour market.

Additionally, the working-age population, employment and productivity drivers tend to be considered the main inducers of growth in GVA; on this issue, see for example the study of the Regional Economic Forecasting Panel (2010). In order to control for the first two effects, the model included the variable "Activity rate of the

[6] The National Strategic Reference Framework (QREN) was the framework for the application of Community economic and social cohesion policy in Portugal for the period 2007–2013.

resident population" (on the date of the Census 2011), which has implications in the region's pool of active people and, therefore, on its long term productive potential. On the other hand, innovation is usually pointed to as one of the key drivers of productivity. For this motive, and due to the unavailability of data at municipal level for research and development (R&D) expenditure, it was allocated, for each municipality, the annual average value in the 2008–2012 period of "Research and development expenditure of institutions and companies with R&D", in the NUTS 3 where the municipality in question is located. Indeed, although the database used in the model is based on a municipal level of aggregation, R&D activities have an impact which extend beyond the municipalities where the entities developing these activities are located. These R&D activities tend to produce spillover effects that benefit companies located in areas with intense technological activities, and therefore, their effects tend not to be confined to the municipalities where they are conducted, being essentially extra-municipal in scope.

In turn, sectoral specialisation is another variable also seen as relevant in explaining regional GVA, as noted for example by the OCDE (2003). Thus, the proportion of employment in the primary sector and in manufacturing industry was used as a measure of sectoral specialisation, as suggested by Fingleton and López-Bazo (2006) and Bellini et al. (2007). Data on the proportion of the population employed in the primary sector and secondary sector was used in this case (on the date of the Census 2011). As noted by Read (2004), the industrial mix is particularly relevant for the performance of small economies (such as Portugal) where the need to exercise comparative advantages suggests that successful growth could be based on specific patterns of sectoral activity.

The results presented below are based on the variable "capacity in accommodation establishments" and, alternatively, the "overnight stays", as the variable selected to characterise the tourism sector.

The specification of the base econometric models (non-spatial) is as follows:

$$\ln(\mathrm{GVA})_i = \beta_1 + \beta_2\ln(\mathrm{TOUR})_i + \beta_3\ln(\mathrm{Invest})_i + \beta_4\mathrm{Hum\_Cap}_i + \beta_5\ln(\mathrm{R}\&D)_i + \beta_6\mathrm{Activ}_i + \beta_7\mathrm{Prim}_i + \beta_8\mathrm{Ind}_i + u_i,$$

GVA - gross value added;
TOUR - variable selected to characterise the tourism sector;
Invest - approved investment in QREN projects;
Hum_Cap - proportion of employees with college university;
R&D - Research and development expenditure;
Activ – Activity rate;
Prim - proportion of employment in the primary sector;
Ind - proportion of employment in manufacturing industry.

Initially, these models were estimated by OLS, using White's variance-covariance matrix, which provides heteroskedasticity consistent standard errors (results presented in Table 1, together with the spatial models).

Moran's I test,[7] applied to the residuals obtained in these estimations, detected the presence of spatial autocorrelation. Moran's I statistics, equal to 7.071 and 6.651, for

[7] Regarding Moran's I test see, for instance, Cliff and Ord (1972) or Anselin (1999).

Table 1 - Results of the OLS and Mixed-Regressive models

Variable	OLS		Mixed-Regressive	
	Accommodation Capacity	Overnight Stays	Accommodation Capacity	Overnight Stays
Constant	4.838 ***	4.372 ***	3.196 ***	2.640 **
ln (TOUR)	0.089 ***	0.042 ***	0.050 **	0.022 *
ln(Invest)	0.479 ***	0.506 ***	0.443 ***	0.460 ***
Hum_Cap	0.043 ***	0.044 ***	0.039 ***	0.040 ***
ln(R&D)	0.245 ***	0.252 ***	0.148 ***	0.149 ***
Activ	0.045 ***	0.045 ***	0.036 ***	0.037 ***
Prim	−0.055 ***	−0.057 ***	−0.045 ***	−0.047 ***
Ind	0.011 **	0.009	0.011 *	0.009
Spatial Lag GVA	–	–	0.180 **	0.191 ***
Spatial Lag Tourism	–	–	0.104 ***	0.071 ***
R^2	0.792	0.787	–	–
Pseudo R^2	–	–	0.818	0.815

Note: Statistically significant at 1% (***), 5% (**) and 10% (*)

accommodation capacity and overnight stays, respectively, (both associated to a p value of 0.000), are statistically significant (see Table 2). Therefore, the null hypothesis of absence of spatial autocorrelation is rejected. This result was expected as the previous analysis had already revealed the presence of spatial autocorrelation in the tourism sector and in GVA.

As the interregional spatial effects detected are liable to affect the economic impact of tourism, the analysis to be developed must be conducted within a spatial econometric approach. Effectively, in the presence of spatial autocorrelation, each region can't be viewed as a spatially independent observation. Therefore, it is necessary to take into account the processes of dissemination and concentration that occur within the territory. In the presence of spatial autocorrelation, in models that ignore this aspect, the estimators obtained by conventional econometric methods will be biased and inconsistent (Anselin 1999).

The use of spatial econometric models enables, on the one hand, the assessment of the importance of the non-spatial variables, after controlling for spatial dependence and, on the other hand, appraisal of the degree of spatial autocorrelation in the variables of interest, while controlling for the effect of the remaining explanatory variables.

Several alternative spatial econometric models were estimated, with different specifications[8]; the best results were obtained with the specification referred to, following the classification of Florax and Folmer (1992), as the "mixed regressive-spatial cross-regressive" model.[9] This model includes spatial lag operators for the dependent variable

[8] The alternative spatial econometric models used were the spatial lag, the mixed-regressive, the spatial error, the combo spatial lag + spatial error and the combo mixed-regressive + spatial error models (see Anselin 2014) but as mentioned the best results were obtained for the mixed regressive-spatial cross-regressive.

[9] For an in-depth discussion of the various models tested, the estimation methods and the statistical tests used to compare and choose between the different specifications, see Vieira (2016); on the models and estimation methods, see also Anselin (1988 and 1999) and Kelejian and Prucha (1998).

Table 2 – Spatial dependence tests for the OLS model

	Accommodation Capacity		Overnight Stays	
	Value	*p* value	Value	*p* value
Moran's I	7.071	0.00000	6.651	0.00000
Robust Lagrange Multiplier (lag)	2.859	0.09086	2.655	0.09259
Robust Lagrange Multiplier (error)	15.653	0.00008	14.856	0.00012

and for the variable which reflects the contribution of the tourism sector, thus capturing the interregional interactions not only in terms of GVA but also in the tourism sector:

$$\ln(\mathrm{GVA})_i = \beta_1 + \beta_2 \ln(\mathrm{TOUR})_i + \beta_3 \ln(\mathrm{Invest})_i + \beta_4 \mathrm{Hum\_Cap}_i + \beta_5 \ln(\mathrm{R}\&D)_i + \beta_6 \mathrm{Activ}_i + \beta_7 \mathrm{Prim}_i + \beta_8 \mathrm{Ind}_i + \rho\, W_1 \ln(\mathrm{GVA})_i + \theta\, W_2 \ln(\mathrm{TOUR})_i + v_i$$

ρ and θ are the spatial autoregressive coefficients, and W_1 and W_2 are spatial weights matrices. A spatial weights matrix based on the criterion of geographic contiguity between municipalities was used for the spatial lag variable for GVA, while a matrix based on the economic distance between municipalities was used for the spatial lag variable of tourism; more precisely, we used the distance in terms of gross value added in the accommodation segment, to obtain a measurement of the interaction between municipalities with a similar tourism market.

The mixed-regressive models were estimated by two stage least squares (2SLS) method with White's variance-covariance matrix, which provides heteroskedasticity consistent standard errors (Kelejian and Prucha 1998; Kelejian and Prucha 2010; Anselin 2014).

The statistical significance of the spatial lag variables of the tourism sector confirms the existence of significant spatial spillover effects in this sector. Moreover, the estimated coefficient is positive, indicating the existence of a positive interaction between municipalities with a similar tourism market.

On the other hand, the statistical significance of the spatial lag variables for GVA indicates the existence of significant spatial spillover effects in terms of GVA. Furthermore, the estimated coefficients are positive, which suggests that regional economic development is regulated by spatial processes through spillovers with a positive effect on neighbouring municipalities.

For the mixed-regressive model, the non-statistically significant value of Moran's I test based on the variant proposed by Anselin and Kelejian (1997) for the case of 2SLS residues (p value of 0.3623 and 0.3765 for accommodation capacity and overnight stays, respectively), led to the rejection of the hypothesis of presence of residual spatial autocorrelation, showing that through this model it was possible to control for the spatial autocorrelation detected in the estimation by OLS.

The results make it possible to break down the economic impact of tourism into direct effects of tourism development in each region and indirect effects derived from spatial spillovers. With regard to the direct effects, the variables accommodation capacity and overnight stays show a positive and statistically significant coefficient, indicating that tourism development has a positive and significant impact on regional economic development. For the indirect effects derived from spatial spillovers in the tourism sector, the coefficients associated with the spatial lag tourism are also positives and statistically significant at the 1% level.

These results lead to the conclusion that tourism development has a positive impact on regional economic development, with this impact being strongly reinforced by the spatial spillovers that occur between the municipalities of Portugal in terms of tourism development.

Comparing the results of the non-spatial econometric model with the spatial econometric model, there is evidence that the regression coefficients were being overestimated by OLS, probably on account of the inability of OLS to capture the spatial spillover effects. Specifically, the estimated regression coefficient of the tourism non-spatial variable decreased significantly with the inclusion of the spatial lag variable for tourism, which would be due to the bias and inconsistency of the results obtained by OLS.

5 Conclusions

This study provides evidence of tourism's strong impact and the role of spatial spillover effects in the regional economic development of Portugal.

The exploratory spatial analysis of the tourism sector and gross value added revealed the presence of a clearly defined geographic pattern, consistent with the existence of spatial autocorrelation at municipal level for these variables. Effectively, using formal measurements of spatial autocorrelation, both the global and local indicators found strong evidence of positive spatial dependence in terms of GVA and the main variables of the tourism sector. Significant spatial clustering of these activities was identified along the coast, leading to the formation of hot spots in the coastal regions, consistent with the accentuated specialisation of Portugal in "sun, beach and sea" tourism. In turn, the cold spots of economic and tourism development were found in the hinterland.

The estimation results provide strong evidence of positive and significant spillover effects in terms of economic and tourism development between the municipalities of Portugal, with tourism's impact on regional economic development being heavily reinforced by spatial spillovers between regions. In fact, the economic impact of tourism derived, to a large extent, from indirect effects; i.e. from the positive externalities that each municipality received from other similar tourist destinations.

As previously mentioned, the analysis was performed using statistical data for the year 2012 (the most recent year for which information was available). It was a regular year regarding the characterization and evolution of tourism in Portugal,[10] so the conclusions drawn from this study have a fifteenth degree of generalization. A future similar study, using panel data, may reinforce the conclusions now presented.

These results could have important consequences on the implementation of policies for tourism development and for the assessment of the potential underlying tourism as a

[10] See, for instance, Banco de Portugal (2014).

key industry of regional growth. The complementing features between regions and the effect of dispersion and inter-promotion among the municipalities of Portugal in terms of tourism development could represent a good opportunity for interregional cooperation. Indeed, it was demonstrated that the growth of tourism in one region benefits other regions with a similar level of tourism development, indicating that tourism is not always competitive between regions. Therefore, tourist destinations could take full advantage of the spatial spillovers derived from other regions to support local economic and tourism development, and internalise these benefits through collaborative efforts. Examples include the joint promotion of several regions by fostering collaborative marketing campaigns and the planning of travel packages with multiple destinations, with the development of tourist routes linking several regions.

The formation of an effective connection between these destinations could increase regional competitiveness and promote a more efficient use of existing tourism resources.

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