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DIFFERENT TOURISTS TO DIFFERENT DESTINATIONS.
EVIDENCE FROM SPATIAL INTERACTION MODELS

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Different tourists to different destinations

Evidence from spatial interaction models

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Abstract

As tourism is becoming one of the most important sources of economic growth at the local level, it is imperative to identify and assess the relevant determinants of tourism flows. This paper investigates this issue by carrying out an econometric analysis based on the origin-destination (OD) spatial interaction models, which fully account for the spatial dependence generally featured by tourism flows. We contribute to the current debate by analyzing the tourism flows for the complete set of 107 Italian provinces (11449 OD flows) in terms of 2009 arrivals. Besides geographical distance, the explanatory variables include both pull and push locations' characteristics to assess their relative role in determining the distinctive traits of emissiveness and attractiveness for all the provinces. We thus consider income, density, accessibility (low-cost flights, transport infrastructure), a set of cultural (museums) and natural (park areas, coasts, well-preserved beaches) factors and other amenities (renowned restaurants).

The main results point out that there is a great deal of spatial correlation induced by neighboring provinces at both origin and destination, which is systematically overlooked if one relies only on the gravity specification. Once one controls for such a complex kind of dependence, most of the explanatory variables exhibit the expected effect, with distance and population density showing a negative impact on tourists' decisions when choosing a specific destination, while amenities, accessibility and income turn out to be effective determinants of tourism flows.

Keywords: tourism flows, spatial origin-destination interaction models, product differentiation, amenities, Italy

JEL classification: C21, D12, L83, Q26, R11

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1. Introduction

The tourism sector is becoming one of the most successful sources of economic growth at the local level. According to the World Travel and Tourism Council (2012) the direct economic contribution of the tourism industry to the global economy has reached 2 trillion US dollars generating more than 100 million jobs. When the indirect impacts are also considered the number of jobs increases to 260 million, yielding 9% of global GDP. The most relevant component of total tourism flows is the domestic one, which generated 70% of tourism GDP in 2011. Considering Europe, the holiday trips of EU residents in 2010 reached the remarkable number of more than one billion. As most Europeans spend their holiday trips in their own country domestic tourism flows represent 77% of total trips (European Union, 2011). The tourism industry is also one of the most important economic activities in Italy; in 2010 total tourists trips amounted to 96 million journeys and 366 million nights; also in this case the main component being the domestic holiday.

It is thus important to identify and assess the relevant determinants of these rising tourism movements, which also have significant implications for decision-makers, economic operators and policy authorities alike, especially in destination locations.

The tourism literature has initially devoted more attention to the demand factors in explaining tourism flows between pairs of countries (see the survey by Lim, 1997); namely, income in the originating country, population, relative prices and geographical distance as measure of transport cost between the origin and destination countries.

However, the demand approach overlooks the fact that the supply side - i.e. the tourism destinations - is extremely differentiated and, at the same time, consumers are characterised by heterogeneous preferences. Therefore, the diverse features of the leisure products play a key role in determining the flows of different tourists to different destinations (Smith, 1994; Papatheodorou, 2001). The tourism market increasingly operates as a monopolistic competition market where destinations at different territorial levels (country, regions, cities) try to offer to heterogeneous consumers leisure products which are effectively, or artificially, differentiated. This key aspect of supply differentiation has been extensively analysed by the literature on destination management; see, among many others, Dwyer et al. (2000) and Dwyer et al. (2009), Ritchie and Crouch (2000),Enright and Newton (2004). In general, tourism flows can be considered as trade of services since they are equivalent to goods exporting activities for regions receiving the incoming tourists. Therefore, as in trade theory, both the demand and the supply side of the market must be considered; more specifically, in the case of tourism flows the demand factors are related to the origin, while the supply factors are linked to the destination.

The main purpose of this study is to examine the combined effects of demand and supply factors on the domestic tourism flows for the complete set of 107 Italian provinces (11449 origin destination flows) using the 2009 arrivals. In our study we consider a highly disaggregated territorial level and this allows us to investigate in a more detailed way the characteristics of the destination area that are supposed to attract tourists. In our analysis, besides geographical distance, the explanatory variables include both pull and push kind of locations' characteristics to assess their relative role in determining provinces' emissiveness and attractiveness traits. We thus consider income, density, accessibility (low-cost flights, transport infrastructure), a set of cultural (museums) and natural (park areas, coasts, well-preserved beaches) endowments and other amenities(renowned restaurants).

An important and original feature of our contribution is that we investigate tourism flows by carrying out an econometric analysis based on the recently proposed origin-destination (OD) spatial interaction models (LeSage and Pace, 2008 and 2009). Such models permit to fully account for the spatial dependence, generally featured by tourism flows, which exhibits a quite complex pattern since tourists movements are affected not only by geographical distance and by origin and destination specific features, but also by the characteristics of neighboring locations at both origin and destination. Consequently, tourism flows may be simultaneously affected by two different kinds of spatial dependence, which so far have been neglected by most of the empirical tourism literature. One arises from the supply side and thus in the destination regions and the second is related to the demand side in the origin areas.

At the micro level this kind of dependence is likely to arise as the result of learning (at destination) and communication (at origin) processes as tourists share their travel experiences within family and friends networks.[1]More specifically, it is likely that a tourist during her vacation in a certain destination visits also adjacent destinations, acquiring direct information on the neighbouring places which may became her tourist destination in future trips.[2] As for the demand side, it is common that people talk about their vacations recommending their travel destinations to other potential tourists, such as friends or relatives in the places of origin. The information on the destinations spreads around the origin area, hence decreasing the uncertainty for potential visitors to that destination. This generates a spatial spillover in the origin since it influences the propensity to travel to that destination among consumers in the contiguous areas. In the marketing literature

[1] The process of knowledge exchange related to tourism flows which may generate spatial spillovers in the destination regions is examined by Marrocu and Paci (2011). See also Pinna (2012) for the knowledge effects of tourism flows on trade.
[2]In this respect the tourist destinations are considered 'experience suppliers' (Ryan, 1997).

repeated purchases or recommendations to other consumers are usually referred to as consumer loyalty and are seen as a key indicator of the marketing strategy success (Yoon and Uysal, 2005). Note also that consumers in the origin neighbouring regions are likely to share similar social and economic conditions and to have common preferences, this is particularly the case for homogenous groups, such as those of migrants.[3] These kinds of similarities are likely to be taken into account by tourism operators in designing their offers to target customers in neighbouring provinces, and this in turn may induce spatial dependence or strengthen spatial pattern generated by other sources.

Moreover, the tourism industry, like many other production activities, is characterised by agglomeration externalities and this generates productive specialization patterns, especially for territories endowed with natural resources. Tourism activities tend to form territorial clusters which allow to share large sized infrastructures (airports, ports, conference centres, museums). This agglomeration process produces spatial dependence at the macro level and generates spatial spillovers across the destination provinces.[4]

For all these reasons, the widely applied gravity model is underspecified as it relies on just one function of the OD distance in order to clear spatial correlation. Although this issue has been long acknowledged (Curry, 1972), especially for trade and migration flows, very limited evidence has been offered so far for tourism activities.The only exceptions are the very recent papers byDeng and Athanasopoulos(2011) and de la Mata and Llano-Verduras(2011). However, in both papers only the strength and significance of the spatial correlation is discussed, no measure is provided on how such correlation affects the impact of the tourism determinants. Therefore, considering the case of the Italian domestic tourism flows, the main original contribution of our paper is to assess empirically the relevance of both destination and origin spatial spillovers, along with their possible interaction, and to adequately estimate how the effects of the provinces own internal determinants are enhanced by the positive influence of neighbouring areas.

Our results, based on the estimation of OD spatial interaction models, show that the tourism flows across Italian provinces are indeed characterised by a spatial dependence at both origins and destinations. This result confirms previous findings, mainly based on case studies and qualitative evidence, that bilateral tourism flows are influenced by learning and communications processes and by spatial agglomeration externalities. Once we control for the resulting complex pattern of dependence, most of the explanatory variables exhibit the expected effect. More specifically, we

[3] This aspect, for the case of Italy, is particularly important for the Northern areas of the country where immigrants from Southern regions are clustered according to a well defined spatial pattern.

[4] Relevant examples in Italy of first tourist destinations which have generated the diffusion of tourism activities in contiguous areas are Rimini in the Adriatic coast and Costa Smeralda in Sardinia.

find that tourism exhibits the connotations of a luxury good as income elasticity at origin turns out to be significantly higher than unity. Moreover, our results indicate that tourist arrivals are enhanced by the existenceof well-preserved beaches, parks, museums and renowned restaurants, while overcrowded places and geographical distance have an adverse effect on tourists' decisions when choosing a specific holiday destination.

The paper is organised as follows. In section 2 we briefly outline the recent literature on the determinants of tourism flows. Section 3 presents the main features of domestic tourism flows across the Italian provinces, while the selection of destination and origin determinants is discussed in section 4. In section 5 we outline the empirical model along with our preferred estimation strategy. The econometric results are presented in section 6 and some concluding remarks are offered in section 7.

2. Related literature

The determinants of both domestic and international tourism flows have been extensively studied and the results are documented by a vast empirical literature. As highlighted in Song and Li (2008), time series analyses received large attention as forecasting was the main focus of most studies, followed by the assessment of both supply and demand factors within multivariate regression frameworks. As might be expected, the evidence provided is quite differentiated given the wide range of methodologies adopted, the differences in time periods considered or in the coverage of geographical areas. In what follows we summarize the main results proposed in the most recent works, which serve as the basis to compare the findings of our analysis, while an exhaustive survey of the previous empirical studies can be found in Crouch (1994).[5] In order to facilitate the comparisons across the reviewed contributions, for each of them we report in Table 1 the main features of the analyses conducted, along with the most salient results.

The international tourist flows are examined by Eilat and Einav (2004) who apply a multinomial logit model to an ample set of destination countries, which are considered as differentiated products suppliers. Having controlled for the relevance of trade flows between any two countries in the sample, the presence of a common language and border, the climate and the perceived risk of the destination country, their findings point out that GDP elasticities are positive and statistically significant for both destination (0.81) and origin (1.29) countries. The latter result, with an elasticity above one, suggests that tourism is a luxury good.Moreover, the coefficient of

[5] Another relevant stream of the literature emphasizes the differentiation of the supply side and deals with the destination marketing(Murphy et al., 2000), the market positioning analysis (Chen and Uysal, 2002) and the destination competitiveness (Enright and Newton, 2004;Gomezelj and Mihalic, 2008).

geographical distance is negative (-0.98) signalling the effectiveness of transport costs in determining tourism flows. The important role played by transport infrastructure in influencing tourists' arrivals is confirmed by Khadaroo and Seetanah (2008), who examine bilateral tourism flows across 28 countries over the period 1990-2000. For the whole sample they find that tourism flows are negatively affected by distance and prices, while their elasticity with respect to income in the origin country turns out to be positive (0.81), although lower than in other studies.[6]

Zhang and Jensen (2007), by adopting an international trade perspective, test the hypothesis that supply side factors are the main determinants of international tourism arrivals; therefore, these are considered as a trade flow of services in the form of final consumers travelling to the destination countries to buy the local products. In their regression analysis, they do not include any demand variable (like GDP or population size) and thus the potential of looking at tourism as a flow determined simultaneously by both origin and destination factors is somehow missed.

A different approach is followed by Garin-Muñoz (2009), who analyses the inflow of domestic and foreign tourists in a specific region, Galicia, during the period 1999-2006. Considering total nights spent, the estimated elasticities show that both domestic and foreign tourism flows are very sensitive to income in the origin markets and to prices. More specifically, in the case of foreign tourists both elasticities indicate a greater responsiveness due to the presence of a higher number of alternative destinations at international level.

Massidda and Etzo (2011) examine the determinants of the domestic tourism flows across the Italian regions over the period 2004-2007 within a GMM panel estimation framework. The estimated elasticity for GDP in the origin region is equal to 1.42, indicating that domestic tourism has the connotation of a luxury good, with an impact that turns out to be much higher than that found in the previous cited studies. Tourism flows are also positively influenced by characteristics of the destination region like cultural expenditures, attractiveness, transport infrastructure and population density, confirming the crucial role played by the supply side factors. The negative impact of distance (-0.07) is also confirmed, but with a magnitude much smaller than in other studies. Finally, they found a negative impact of relative prices, but this result should be considered with caution since prices are measured by a consumer price index, which allows comparisons only across different periods in time for the same region and not across different regions.

[6] It is worth remarking that Khadaroo and Seetanah's contribution (2008), like most papers based on panel estimations,includes the time lag dependent variable to control for consumers' persistence in the destination choice; past tourism flows turn out to be positive and significant in most studies.

As stated in the introduction, the issue of spatial dependence in tourism flows is directly tackled only in two recent articles, both published in 2011, one by De la Mata and Llano-Verduras and the other by Deng and Athanasopoulos.

De la Mata and Llano-Verduras (2011) analyse the domestic flows across the Spanish regions in two distinct years, 2001 and 2007, by using a Bayesian spatial autoregressive model. Although they find evidence of positive spatial autocorrelation, they do not model separately the spatial dependence which may affect in different ways the origin and the destination regions, as they impose from the beginning that the two spillover mechanisms are not separable. Instead of analyzing the standard indicator represented by tourism arrivals, they compute a monetary measure of tourists expenditure; surprisingly, GDP is introduced only for the destination regions, while the value added of the hotel industry and the beach length are included as explanatory features only for the origin.Their results confirm the negative influence of geographical distance (elasticity equal to -1.69). Deng and Athanasopoulos (2011) propose a more complex analysis of Australian domestic and international tourism flows, which is based on a dynamic spatial lag panel model applied to quarterly data for the period 1998-2008. The model accounts for both temporal and origin-destination spatial dependence that is also allowed to feature seasonal variation and asymmetry between capital-city and non-capital-city neighbors. Significant evidence of time-spatial correlation is found along with positive effects of income and of time dummies controlling for two specific events, the Bali bombings and the Sidney Olympic Games. Note that no explicit measure of distance is included, even when the analysis is confined to domestic flows.

Although both De la Mata and Llano-Verduras (2011) and Deng and Athanasopoulos (2011) present analyses based on spatial autoregressive specifications, they only report estimated coefficients and not long run equilibrium values of the explanatory variables impacts, as recommended by LeSage and Pace (2009). In our analysis we will provide such kind of measures as they permit to assess the role of spatial spillovers and hence to distinguish between the effects due to provinces' internal determinants from those generated by interactions among neighbors.

3. Domestic tourism flows in Italy

In Italy the tourism industry represents one of the most relevant economic activities in terms of value added produced, employment, multiplier effects on several other manufacturing and services sectors. In 2010 Italy reaches 96 million of total arrivals of tourists and 366 million of nights (Table 2). Over the period 2001-2010 all tourism indicators considered - domestic and international, arrivals and nights spent - have increased, showing a steeper trend for the foreign component and a decrease in the length of trips. Looking at the territorial breakdown, most arrivals are concentrated in the North of Italy (54%), whilst the South shows the longest average duration of the trip due to its specialisation in summer vacations. Domestic tourism represents the most relevant component in terms of both arrivals (54.9%) and nights (55.2%), although the domestic share has shown a slight tendency to decrease in the last decade.

In this study we concentrate our attention on domestic tourism flows which, for a specific region, represent an important channel of inflow of external revenue. The Italian Statistical Office (ISTAT) publishes an annual report with the flows of domestic tourism disaggregated by province of destination and region of origin (ISTAT, 2009a).[7] To apply the OD spatial interaction models provincial bilateral flows are required, thus our first task is to estimate tourist flows by province of origin starting from the regional value. First, we used the annual survey on domestic vacation in Italy (ISTAT, 2009b) to compute the propensity to travel of the population in different age classes; secondly, we used the actual age distribution at provincial level to estimate the tourist flows by province of origin. In this way we obtain a square matrix for the 107 Italian provinces with 11449 Origin-Destination tourism flows in terms of domestic arrivals for 2009.

The geographical distribution of total domestic arrivals in the destination and origin provinces are depicted, respectively, in Map 1.A and Map 1.B, while the top ten provinces are listed in Table 2. Among the top ten provinces we find tourism destinations with well defined specialisation and supply characteristics. These include large cities, like Milan, Rome, Turin, Naples and Florence, with world renowned cultural and historical attractions, but also destinations attractive for their natural endowments, like mountains (Bozen, Trento) or sea and sun (Rimini) or for religious sites (Perugia). If we look at the top provinces of outbound tourism flows it turns out, as expected, that among the top ten we find the Italian metropolitan areas characterised by the largest population (Rome, Milan, Naples, Turin) together with Northern provinces with high income levels. It is interesting to remark that some Southern provinces with a large population but a low income level (Palermo, Salerno, Catania) do not show high outward tourism flows.

This descriptive evidence suggests that some characteristics of the demand - and thus of the origin, like population and income - clearly affect the general propensity of outbound tourism flows. At the same time, other supply factors - like cultural, historical and natural amenities - are relevant in influencing tourism inflows.

[7]According to the Eurostat classification the 107 provinces in Italy correspond to the NUTS 3 territorial level and the 21 regions to the NUTS 2 level. It is important to remark that also the provinces in Italy have administrative authority especially for tourism activities.

However, as we have emphasized before, the idiosyncratic characteristics of each bilateral OD flow need to be assessed in a framework allowing to account for the influence of neighbouring areas. For instance, in a "sea & sun" destination like Rimini there is a high inflow of tourism arrivals (once normalised by population to get rid of the size effect) from mountain areas like Bozen, Trento and Aosta, while there are very low inflows from other nearby provinces characterised by similar coastal supply, as it is the case for Ancona or Pescara. Thus, both demand and supply characteristics have to be considered as joint determinants of tourism flows, as well as their spatial interaction. We provide a more general and rigorous evaluation of these spatial interactions as we discuss the econometric analysis results.

4. Destination and origin characteristics

As highlighted in reviewing the empirical literature, tourists' flows depend on a set of variables that accounts for various characteristics of both origin and destination areas in terms of economic, natural, cultural and geographical features. In this section, following previous studies (Table 1), we motivate the selection of the main explanatory variables included in the empirical models by distinguishing between origin and destination factors. The complete list of all the variables considered as determinants of tourism flows, along with the data sources, is reported in Table 4.

Destination variables

GDP. The income level in destination regions represents an indicator of the economic development in the receiving area and thus it may be interpreted as a proxy for the quality of the public services available for the incoming tourism flows; for instance: health care, public transport, law enforcement. For tourists the provision of these services is an important component of the product characteristics and thus we expect a positive elasticity.

Density. The concentration of the population per km^2 is an indicator of the degree of congestion of a tourism destination. If tourists have preferences for less crowded areas then we expect a negative sign.

Accessibility. An easy to reach destination certainly benefits from a factor which enhances tourism inflows. To measure this variable we have computed the number of direct flights offered by low cost companies. This is clearly a partial indicator of accessibility but we have to bear in mind that we also include the distance for each pair of provinces and thus, on the whole, we have already taken into account the degree of accessibility by car, which is the most common mode of transport for the traditional summer vacation. Indeed, the low cost flights indicator is more effective for other kind of journeys which are becoming increasingly important, like short breaks. We have also used an alternative indicator, a five-group discretevariable that measures the potential accessibility of each province by road, train, air and time to the market (it takes values from 1=very low, up to 5=very high accessibility). For both indicators we expect a positive coefficient since a higher accessibility should improve tourism inflows.

Natural elements. Tourists are attracted by the natural environment of the destinations, which we have measured by the number of protected natural areas located in the province; alternatively we have used the dimension of the natural parks in km^2.

Cultural elements. The destination area may implement specific policies to acquire a competitive advantage in supply side factors able to attract tourism flows and it is well known that one of the most important cultural attractors is represented by museums. In the empirical models we include such cultural elements by proxying them by both the number of museums and the number of museum visitors, which may be seen as a more accurate indicator of the quality of the cultural attraction.

Coast. Beach tourism is one of the most common tourism products in Italy; therefore, to assess the potential attractiveness of each destination for this widespread product, we have included a variable that measures the share of coastal municipalities over the province total.

Beach quality. The previous indicator measures the quantity of coastal supply but it is not adequate to account for its quality level. Therefore we have also included a variable that is supposed to capture such a quality level of the coast, it is given by the number of beaches awarded the "bandiera blu" (literally, “blue flag”) quality certificate by Legambiente (the most important Italian environmentalist association).

Amenities. To assess the role played by other types of recreational amenities in attracting tourism flows - in addition to the ones related to natural and cultural elements - we have included the number of restaurants with at least 1 Michelin star at provincial level. In general, the presence of restaurants with high reputation in a certain area signals the availability of high quality local products and of a widespread attention to the quality of life.

Origin variables

GDP. Income in the origin region is one of the most important economic determinants in explaining tourist flows since it measures how the demand of consumers for travelling reacts to a change in their wealth. In general we expect a positive income elasticity and it may turn out to be above one in case tourism is perceived as a luxury good.

Density. We also control for the size and the density of population in the origin area.

Origin-Destination variables

Geographical distance. In most analyses of domestic and international tourism flows the distance for each pair of destination and origin areas is included as a proxy of transport costs and thus it is excepted to have a negative impact on tourism movements. Within the gravity model framework the geographical distance is also expected to account for spatial correlation among the observational units. However, as highlighted in the introduction, when quite complex patterns of spatial dependence are featured by the data, these have to be explicitly tackled within an adequate spatial econometric framework, which is presented in greater detail in the next section.

Prices. Some studies include a measure of relative destination-to-origin prices. However, it is worth remarking that a price index for the tourism sector is not usually available - especially at the regional or provincial level - and, in general, it is not easy to define the price of a complex and differentiated product like tourism. Indeed, quality differentiation is very crucial in tourism supply and this makes the use of aggregate price index more problematic and less informative. Moreover, for the case of Italy it is not correct to use the general consumer price index (CPI) since ISTAT publishes price indexes which permit to measure price dynamics within a certain region, but do not allow for cross sectional comparisons. Only recently, ISTAT (2008) has published an experimental study on the price levels in the Italian regions for some specific products like food, clothes and furniture, which are supposed to allow for inter-regional evaluations. Although we are not fully convinced that this price index is able to capture the effective disparities in the tourism prices among the destinations, we have tested this measure in the econometric analysis. We have also considered an alternative source of data (the website of the municipality of Modena), which gives the price level of widely used products at the provincial level. In this case we have collected the average cost of a "pizza and drink" meal that may reflect the average price of other products demanded by tourists. In any case, it is important to remark that transport costs, which are one of the most relevant components of total tourism costs, are already accounted for by the geographical distance. Moreover, given the high degree of differentiation of the tourism good, it is reasonable to assume that locations' attractions, income and transport costs receive prominent consideration in consumers' evaluations when choosing their holiday destination and that relative prices are assigned second order relevance.

5. The empirical model and the estimation strategy

Before presenting the empirical model, we start by describing how the data is organized to handle bilateral OD flows, as it is the case for tourism.[8]

The provincial tourism flows moving from n origin provinces (with n=107) to each of the n destination ones is represented by the n by n square matrix**Y**. The system is a closed one and we adopt an origin-centric ordering, so that the columns of **Y** represent the origins and the rows the destinations. Note that for the 2009 tourists' arrival we have no cases of zero flows. The diagonal entries of the matrix contain the intra-provincial flows, while the off-diagonal entries the inter-provincial ones. As the two kinds of flows may exhibit different characteristics and can be determined by different explanatory variables we deal with this issue by adopting the empirical specification that allows to account for the different variations in the two kinds of OD flows.[9] The spatial distance between provinces is represented by the symmetric n by n matrix **G** whose entries are the geographical distance in kilometres between each origin and each destination province; in this case the main diagonal is set to zero. Finally, **X** is an n by k matrix containing the k explanatory variables for the tourism flows, described in detail in the previous session.[10]

We start our analysis by considering the simplest empirical specification, which is represented by the gravity model, formalized as follows:

$$y = \alpha \iota_N + c\alpha_i + X_d\beta_d + X_o\beta_o + X_i\beta_i + \gamma\, g + \varepsilon \qquad (1)$$

where y is obtained as $vec(\log(\mathbf{Y}))$,[11] so that the first n observations pertain to the first origin province, the subsequent $n+1$ to $2n$ observations to the second origin province and so on. The $X_d$matrix contains n times the **X** matrix in order to represent the k provinces' characteristic at destination (X_d is an N by k matrix obtained as $X_d = \iota_n \otimes X$, where ι_n is a column vector of ones);

[8] The description in mainly based on LeSage and Pace (2008, 2009).

[9] Different treatments of the internal flows have been proposed in empirical studies. For instance, in the case of migration flows, the intra-regional flows are generally larger than the interregional ones so that the diagonal elements are set to zero in order to avoid the intra-regional flows inducing misleading inference on the interregional ones, which are usually the main focus of the analysis. As will become evident when presenting the spatial autoregressive model, this kind of solution cannot be pursued as it would result in a misspecified spatial pattern.

[10] In presenting the estimated models we will provide details on transformations applied to specific explanatory variables.

[11] *Vec* is the operator which stacks in an n^2 column vector the columns of an n by n square matrix; $\otimes$ indicates the Kroneckerproduct.

analogously, X_o ($X_o = X \otimes \iota_n$) represents the same characteristics at the origin, so that the observations of the first origin province are repeated for the first *n* rows of X_o, the subsequent *n+1* to *2n* rows repeat for *n* times the features of the second origin province and so on. The X_i matrix, containing the intra-provincial observations for the explanatory variables extracted from the matrix **X**, and the intercept term $c\alpha_i$ constitutes a separate model for the intra-provincial flows. In this way the parameters vectors β_d and β_o measure the effects on inter-provincial flows, which are the main focus of our study. Finally, the variable *g* is obtained as *vec*(log(**G**)) and $\alpha\iota_N$ is the intercept term.

The error term, ε, is assumed to be an i.i.d. process since, as stated in the introduction, the gravity model assumes independence among OD flows observations once the effect of distance is controlled for. However, such an assumption is unattainable when neighbouring provinces influence each other at origin, or at destination, or at both origin and destination, generating different and complex kinds of spatial dependence. Following LeSage and Pace (2008, 2009), we tackle the tourism flows spatial autocorrelation by augmenting the gravity model with three additional spatial autoregressive terms, based on connectivity matrices for destination, origin and origin-to-destination dependence; all three matrices are derived from the row-standardized province contiguity matrix (**W**).

The most general OD spatial interaction model can be therefore specified as a Spatial Autoregressive (SAR) model including three different spatial lags ofthe dependent variable:

$$y = \alpha\iota_N + c\alpha_i + X_d\beta_d + X_o\beta_o + X_i\beta_i + \gamma\ g + \rho_d W_d y + \rho_o W_o y + \rho_w W_w y + \varepsilon \qquad (2)$$

where W_d ($W_d = I_n \otimes W$), W_o ($W_o = W \otimes I_n$) and W_W ($W_W = W_d W_o = W \otimes W$) are the three connectivity matrices described above; all the other terms are the same as in (1).

The spatially lagged term $W_d y$ captures destination dependence which arises when flows from an origin to a certain destination activate similar flows to neighbouring destinations; as claimed by Griffith and Jones (1980) the intensity of flows towards a destination are enhanced by the attractiveness degree of nearby destinations. The spatially lagged term $W_o y$, conversely, captures the dependence induced by the fact that the factors determining flows from an origin to a given destination may generate similar flows from neighbouring origins. The third spatially lagged term $W_w y$ is obtained as the interaction between the other two spatial lags as it is the average of flows from neighbours of the origin to neighbours of the destination and is named 'origin-to-destination' dependence by LeSage and Pace (2008).[12]

As model (2) includes interaction terms it allows to account for the fact that bilateral tourism flows do not depend only on the specific characteristics of the origin and the destination province and on their distance, but also on the features of their neighbouring provinces. Such kind of indirect interactions creates links among all the areas included in the system, which are neglected if one relies on the simple gravity specification.

Eight special cases of (2) can be obtained by imposing restrictions on the spatial autoregressive coefficients (LeSage and Pace, 2008); when $\rho_d=\rho_o=\rho_w=0$, the gravity model results; when $\rho_o=\rho_w=0$ or $\rho_d=\rho_w=0$ or $\rho_d=\rho_o=0$ only one kind of dependence is relevant, destination or origin or only their interaction. When $\rho_d=\rho_o$ and $\rho_w=0$ the model becomes a single weight matrix SAR specification, with the weight matrix given by $0.5(W_d+W_o)$ and an autoregressive coefficient equal to $2\rho_d=2\rho_o$, in this case it is assumed that the impacts of the X variables at origin and at destination are not separable and the model features a cumulative impact.[13] This specification is the one adopted by de la Mata and Llano-Verduras (2011) to analyse the Spanish interregional monetary flows due to tourism activities. Note that all the restrictions on the autoregressive coefficients can be tested by means of likelihood ratio (LR) tests since the restricted models are all nested within the general model (2).

In estimating spatial interaction models in section 6.2, we follow a specific-to-general methodology starting from SAR models with only one dependent variable spatially lagged term, which accounts for dependence either at destination or at origin, we then consider a model including both kinds of dependence, thus allowing for distinct impacts at destination and origin. Finally, we propose the estimation of the most general model, as formalized in (2).

6. Econometric results

6.1 The gravity model

In Table 5 we present the results of the gravity model specifications. Although, as stated in the previous section, they do not properly account for the spatial dependence featured by flows data, nonetheless they constitute the usual starting point for analyzing phenomena whose intensity and direction depends significantly, among other factors, on geographical distance. Moreover, this allows us to compare our findings with most of the existing empirical literature on tourism flows,

[12] Note that when the restriction $\rho_w=-\rho_d\rho_o$ holds the term $W_w y$ arises as the result of applying a double, origin and destination, spatial filter: $(I_N-\rho_o W_o)(I_N-\rho_d W_d)y = \alpha\iota_N+c\alpha_i+X_d\beta_d+X_o\beta_o+X_i\beta_i+\varepsilon$.

[13] This is also the case when $\rho_d=\rho_o=\rho_d$ and the single spatial matrix becomes $1/3(W_d+W_o+W_W)$.

which, so far, has largely overlooked the role of complex spatial interactions in affecting tourists' decisions.

Column (1) of Table 5 reports the basic specification, this includes a comprehensive set of explanatory variables for the destination provinces, namely GDP, density, accessibility measured by the number of low-cost flights, number of parks, number of museums visitors, amenities, coast and beach quality.[14] For origins and intra-province flows we include only GDP and population density, as these turned out to be the most relevant determinants on the basis of a preliminary investigation. In the unrestricted model, where we include the complete set of explanatory variables also for all the three categories of provinces, we found that attractiveness factors were relevant only at destination, while they played a very marginal or insignificant role at origin or for intra-province flows. For this reason we prefer to report results only for the restricted version of the model.

The estimated coefficients of model (1) are all highly significant and they exhibit the expected sign; as for their magnitude, they compare favourably with the results provided by the recent empirical studies, summarized in Table 1. In particular, we find an elasticity of GDP which is just below 1 at origin or above one for intra-province flows, confirming that tourism can be considered a luxury good. The high elasticity for destination GDP signals that tourists' flows are enhanced by high levels of economic development and the availability of public services in the visited locations. Evidence of discouraging and adverse effects, on the other hand, is found for densely populated places, as flows are expected to decrease by 0.4% following a 1% increase in density. The origin-destination distance shows the expected negative effect on tourism flows with an estimated elasticity of 0.79, which is similar to the one reported in Eilat and Einav (2004), while it is much higher than the one provided by Massidda and Etzo (2011) for the Italian regions arrivals; on the other hand, the latter is exceptionally small when compared with the evidence reported in previous studies.

All the six different pull factors considered to assess the destinations attractiveness turn out to be quite effective in promoting tourism, although with different intensities. The lowest effect is found for cultural attractions (0.01%), proxied by the number of museum visitors recorded in previous years[15], whereas higher impacts are associated with the degree of accessibility (0.5%), the presence of parks (0.6%) and the provincial share of municipalities with coastal territories (1.26%). The impact of this indicator is reinforced by the presence of high quality beaches, which contributes

[14] Tourism flows, GDP, population density and the number of museums visitors are logged transformed.
[15] As shown in Table 4, both museums variables (number of visitors and number of sites) are included with a lag of two years as they refer to 2007.

with an additional effect of 3.8%. Finally, cultural amenities, with an estimated effect of 2.3%, represent a very important determinant of tourism flows.

It is worth remarking that it is rarely the case that such a comprehensive set of pull factors is included in the analysis of domestic tourists flows; we think that this is quite a novel and important contribution since it allows for a better understanding of the multiple aspects of a complex and highly diversified product as tourism.[16]

In models (2) and (3) we augment the basic specification by including separately the two alternative indicators for relative prices. They both show an unexpected positive sign, which can be reasonably attributed to the severe limitations that characterize the construction of these variables, as discussed in detail in section 4. Given the lack of reliable data on relative prices specific to the tourism sector and since we believe that they are of second order importance in guiding the decisions of the tourist consumer, we prefer not to go further in dealing with this issue, so that prices are dropped from the next estimated models.

In columns (4)-(6) we check whether the results of the basic model are robust with respect to the inclusion of alternative measures for accessibility, presence of parks and museums. The accessibility variable based on a comprehensive indicator of different transport modalities shows a significant effect, but smaller than the one associated with the number of low-cost flights. The presence of park areas, differently from the number of parks, induces a decrease of tourism flows assessed at about 0.02%; this may be interpreted as a sort of crowding-out effect, in provinces where there are large protected areas the unavailability of space for tourism activities more than offsets the positive effect of parks as a pulling factor. Finally, the number of museums turns out to be not significant (column 6) and this highlights the finding that the attractive force is not the presence of museums per se but their quality, which is adequately represented by the number of visitors. Note that in all the estimated models (2)-(6) of Table 5 the main results of the basic model (1) are generally confirmed.

It also important to recall that the effects of tourism flows determinants discussed so far, based on the standard estimation methods employed in the literature, are likely to be biased, as we still have to account for spatial interactions which, taking the form of spillovers, are expected to amplify them, as discussed in the next section.

[16]Cracolici and Nijkamp (2008) analysing the attractiveness of alternative tourist destination in Southern Italian regions find that tourists evaluation is strongly connected to the complementary features of the tourist product. More specifically, they provide evidence that tourists give high value to information and touristservices, cultural events,quality and variety of products, hotels and tourist safety and to a lesser extent to items like natural and cultural resources.

6.2 Spatial autoregressive models

In the next step in our analysis of the Italian domestic tourists' flows we deal with the issue of spatial dependence by estimating four different specifications of the spatial autoregressive model. We adopt a specific-to-general approach by starting with the simplest SAR models, which account for one kind of spatial dependence at a time. In the first one we include the spatial lag of the dependent variable computed by relying on the destination weight matrix (W_d), while in the second model the dependent variable is obtained on the basis of the origin weights (W_o). The estimation results are reported in models 1 and 2 of Table 6; in order to save space we do not present the estimated coefficients, but the direct, indirect and total effects due to changes in a given province own explanatory variables (direct) and in those of its neighbors (indirect)[17]. Such effects are interpreted as long-run equilibrium values, which result - after all the interactions have taken place - in the underlying spatio-temporal process. Note that for SAR models direct effects are usually quite similar to estimated coefficients[18], their difference is due to feedback loops. When the x variable changes in a certain destination (origin) province, this induces positive changes, through the spatial interconnectivity structure, also in the flows of neighboring provinces (whose x variable has meanwhile remained unchanged), and this, in turn, affects again the flows of that province. The feedbacks exhibit a decaying behavior across space and over time until a new equilibrium value is reached, the direct effect. Note also that, conditional on the strength of the spatial dependence, spillover effects are greater than feedback effects as they measure the impact on a given province of a change in a variable of all other provinces.

Focusing on the estimated total effects of the first model and comparing them with the basic gravity model results, it emerges that most of the explanatory variables' impacts are larger in absolute terms thanks to the existence of the spatial spillovers, estimated by the indirect effects. The only exception is represented by the OD distance; in the case of the gravity model its estimated coefficient is likely to be upward biased as it is not only capturing the effects genuinely associated with distance (such as transport costs) but also those arising from spatial interactions. It is also worth remarking that the estimated coefficient of the gravity model are quite similar to the direct effects obtained from the spatial specifications, this is especially the case for the destination SAR model; this result confirms that the gravity model is too simple to be able to adequately capture the complex dependence structure featured by flows data and this results in unreliable estimates.

[17]The complete set of estimation results is available from the authors upon request.

[18]For instance, in the case of the first model of Table 6, the destination GDP exhibits a direct effect of 1.036, while its (non reported) coefficient estimate is 1.003.

The relative intensity of both pull and push factors in driving tourist flows is strongly confirmed by the SAR models estimation, although the point estimates of the effects may differ substantially as they are a function of the kind of spatial dependence considered. Note that the strength of origin dependence turns out to be much higher compared to the destination one, the estimated spatial autoregressive coefficients $\rho_{o,d}$ are 0.69 and 0.34, respectively.

Having found significant evidence of origin and destination dependence when analyzed individually, we also consider the empirical specification that encompasses both of them with the inclusion of the two spatial lagged terms for tourist flows described above. The results are reported in the third regression of Table 6, they offer further support to the relevance of both kinds of dependence and to the finding that interconnections at the origin are stronger than those at destination (the spatial autoregressive coefficient are estimated in 0.66 and 0.18). We tested the two-spatial-lag model against the model in which destination and origin weights are collapsed in one single matrix ($0.5W_d$+$0.5W_o$), as imposed in de La Mata and Llano-Verduras (2011), and the LR test (p-value 0.000) provided overwhelming evidence in favor of separable impacts due to destination dependence relations, on one hand, and to origin dependence, on the other; therefore, for the case of the Italian domestic tourists flows we can confidently rule out the presence of a cumulative indistinct impact.

Focusing on the estimated effects, the destination-and-origin spatial model substantiate previous findings on the relative importance of the explanatory variables considered; it is worth noting that now spillover effects are quite predominant, accounting on average for around 80% of the total effect, due to the presence of both destination and origin sources of spatial interaction. Note, however, that spillover intensity is unlikely to be adequately measured, as we still have to account for the third possible type of spatial dependence, the origin-to-destination one. This is tackled by estimating the final model reported in regression 4 in Table 6; with respect to the previous SAR model, it comprises an additional lagged term of the dependent variable, which being computed on the basis of the interaction between origin and destination weight matrices (W_w) represents the average of flows from neighbors to the origin to neighbors at destination.

Featuring all three possible kinds of spatial dependence, the final model, as illustrated in section 4, is the most general one and on the basis of the LR test it is strongly preferred to all the other SAR specifications.[19] Note that for this model the estimated strength of destination (ρ_d=0.62)

[19]The model is estimated by applying the bayesian Markov Chain Monte Carlo method; we are grateful to J. Le Sage for making available to us the Matlab codes. Note that the model is estimated by including the complete set of explanatory variables for destination and origin provinces and for intra-provincial flows. In Table 6 we report the estimated effects

and origin (ρ_o=0.86) dependence is much higher than was the case for the other spatial specifications, however it is partially offset by the origin-to-destination dependence which operates in the opposite direction (ρ_w=-0.65). In terms of the tourist flows this means that the effects of spatial spillovers obtained from previous models were actually overestimated, as the complete set of spatial interactions which permeates the entire provincial system was underspecified. Moreover, as the most general specification accounts for the very complex dependence featured by flows data, total effects now have a multilateral interpretation. This happens because a change at origin (destination) of a push (pull) factor, through the interconnectivity structure, sets in motion a series of both push and pull events spreading across the entire system of provinces.

According to the results reported in regression 4, it emerges that spillovers effects are still quite sizeable accounting for almost three quarters of the total effects. This is in line with the relevance of neighboring features at both origin and destination provinces and on the secondary role played by just bilateral characteristics. Focusing on total effects, income at the origin turns out to be quite effective in activating tourists flows, the associated high elasticity of 2.2% confirms the luxury peculiarity of the tourism product. The detrimental impact of crowded locations is confirmed as the density variable exhibits a negative effect. Once we account for all kinds of spatial interactions, which may run in opposite directions, the empirical results provide further support to the attractiveness traits of accessibility, natural resources and cultural amenities. More specifically, highly preserved beaches are quite effective at attracting tourists' flows, as they may yield an increase of 3.7%, which reinforces the effect due to the presence of coastal areas (1%); renowned restaurants (amenities) by signaling high life quality levels, may activate an additional rise in arrivals of 2.4%; lower, but highly significant, contributions in enhancing tourists flows are due to accessibility (0.4%), parks (0.5%) and museums (0.01%).

When comparing these total effects with the ones obtained from the basic gravity model there are apparently no remarkable differences. However, note that in the case of the gravity specification the effects have to be entirely attributed to each own province determinants, while in our preferred spatial specification they are given by the combined effect of both internal factors and external ones, coming in the form of spillovers from proximate provinces. The distinction between the relative effect of internal and external determinants of tourism flows has important implications for local policies designed to promote tourism activities, as it calls for effective coordination at the upper regional and national government levels.

only for a restricted set of variables in order to facilitate the comparison with the results obtained from the competing models.

Overall, our results offer sound empirical evidence on the most important driving forces of domestic tourists flows in Italy. As it turns out, besides geographical distance and income, a prominent role is played by a varied set of locations' characteristics that provide a better understanding of some key aspects of the composite touristic good and may yield valuable indications on how the tourism sector may significantly contribute to local economic growth.

7. Conclusions

In this study we assess the most relevant determinants of domestic tourism flows for the Italian provinces by applying the recently proposed origin-destination spatial interaction models and simultaneously accounting for both demand and supply side factors.

Although the issue investigated is rather relevant, as tourism is becoming one of the most successful sources of local growth, the existing economic literature, mostly focused on the demand factors, has devoted limited attention to the supply ones. These, however, are increasingly recognised to be key aspects of the 'tourism good' and they may have important implications for policies designed to promote long run sustainable growth by acquiring competitive advantages and making territories attractive to external consumers.

Tourism is a highly differentiated product, and destination places - aside from being greatly diversified among them - are featuring an ever more varied mix of characteristics to meet the preferences of highly heterogeneous consumers as tourists indeed are. For these reasons we analyse the combined effect of both demand and supply drivers of tourism flows, measured by 2009 arrivals in the whole set of 107 Italian provinces (11449 bilateral flows). The determinants considered thus include quite a comprehensive set of both pull and push location characteristics, namely income, density, accessibility (low-cost flights, transport infrastructure), a set of cultural (museums) and natural (park areas, coasts, well-preserved beaches) endowments, other amenities (renowned restaurants) and geographical distance.

Differently from the traditionally applied gravity model, the spatial interaction specifications allow to tackle the issue related to the complex spatial dependence pattern exhibited by tourism flows. Such pattern arises since flows from an origin to a certain location activate similar flows to neighbouring destinations as the intensity of flows towards a destination is enhanced by the attractiveness of nearby places. Conversely, similarly factors determining flows from an origin to a given destination are likely to generate similar flows from neighbouring origins. Moreover, dependence at origin may interact with dependence at destination inducing a third kind of association in flows, the so-called origin-to destination dependence. The complete set of spatial interactions permeates the entire system of provinces, so that tourists' decisions are influenced by multilateral, rather than just bilateral, characteristics of the locations.

At the micro level dependence in space is the result of learning and communication processes as tourists share their travel experiences within relatives and friends networks, inducing consumers' loyalty also in individuals that do not have directly experienced the tourism product themselves. At the macro level the tourism sector is characterised by agglomeration externalities that favour the onset of productive specialization patterns and the formation of territorial clusters, which may extend far beyond the provincial boundaries nourishing spatial spillovers. This is usually the case for areas endowed with natural resources or sharing large scale transport infrastructures.

The estimation of the most general OD spatial model, which entails destination, origin and origin-to-destination dependence, permits to fully account for the presence of spatial spillovers and thus to provide an accurate measure of the multilateral effects of the tourists flows determinants.

The main results point out that the 'tourism good' has the connotations of a luxury good as income elasticity at origin turns out to significantly higher than unity. Moreover, we find evidence that tourists flows are enhanced by the presence of well preserved beaches, parks, museums and renowned restaurants, while they are discouraged by overcrowding. Considering these elements as a whole, it seems that tourists are attracted by destination places showing a careful and caring attitude towards the environment and the cultural assets of the territory.

We claim that these findings have relevant policy implications at both local and national levels. Policies aimed at supporting long run growth should envisage incentives schemes that, on one hand, encourage activities yielding economic value from the territory's assets, but on the other ensure a careful management of the natural environment, the artistic heritage and cultural resources in order to guarantee their preservation as an enduring source of growth. The relevant presence of spatial spillovers indicates that such policies cannot be effective if they are confined to the provincial level, but need to be coordinated at the upper regional and national levels. The preservation and the enhancement of natural and cultural resources should indeed be a target of the national policy-maker in order to make the whole country attractive also to international visitors.

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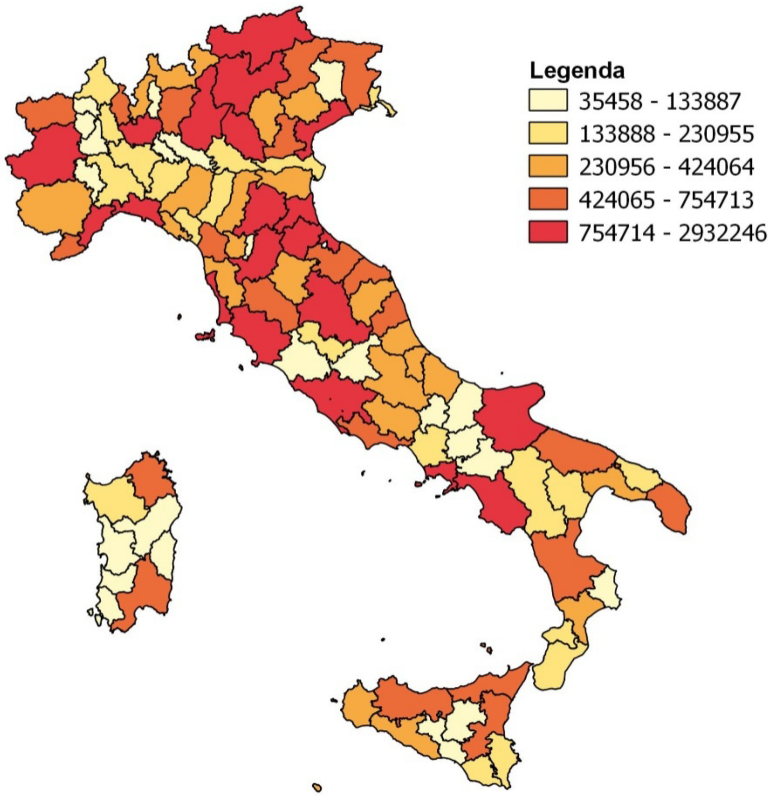
Map 1. Domestic tourism flows (arrivals, 2009)

A. Province of destination



B. Province of origin

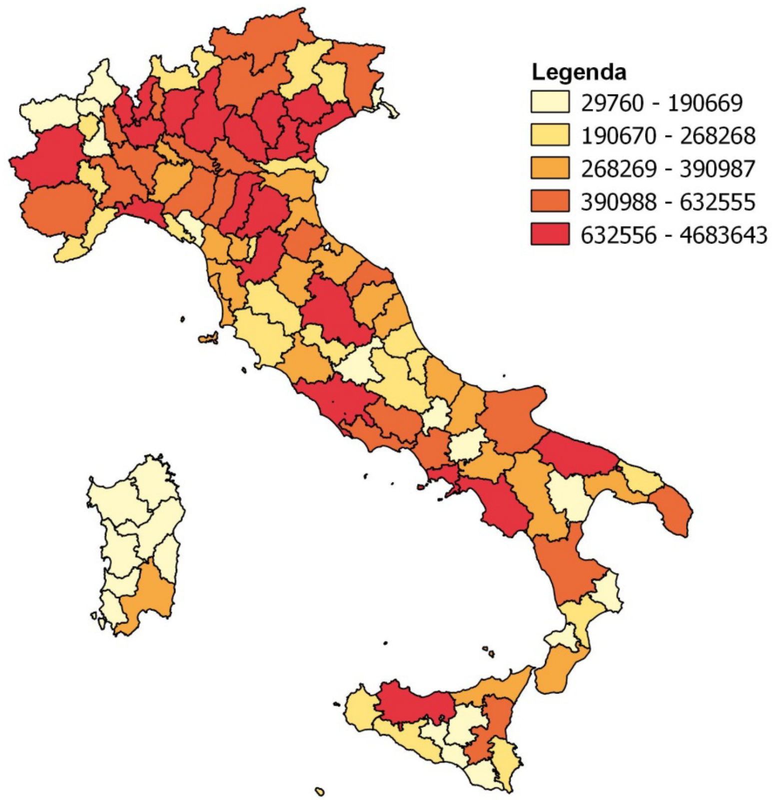


Table 1. Recent econometric studies on the determinants of tourism flows

Paper	Period	Geo	Territory	Data	Method	Dependent variable	Tourists flow	Distance	GDP	Size	Relative prices	Other control variables
Eilat, Einav (2004, Tab 3. 3)	1985- 1998	world	countries	panel	multinomial logit	arrivals	international	-0.98	O: 1.29 D: 0.81	O: no D: k: 0.62	-1.27	language, trade, border, climate, risk
Zhang, Jensen (2007, Tab 4.1)	1982- 2001	world	101 countries	panel	two way fixed effect	arrivals	international	no	O: no D: 0.69	O: no D: p: 1.27	ns	hotel rooms, FDI, openess
Khadaroo, Seetanah (2008, Tab 2.1)	1990- 2000	world	28 countries	panel	GMM	arrivals	international	-0.22	O: 0.81 D: no	O: no D: p: 0.30	-0.73	transport infr., hotel rooms, language, borders
Garin-Muñoz (2009, Tab 2)	1999- 2006	Spain	Galicia	panel	GMM	nights	domestic	no	O: 0.86	no	-0.69	dummy for 2004 (holy year)
Massidda, Etzo (2011, Tab 6)	2004- 2007	Italy	20 regions	panel	GMM	arrivals	domestic	-0.07	O: 1.42 D: no	O: d: 0.43 D: d: 0.71	-8.9	amenities, roads, crime, pollution
de la Mata, Llano (2011, Tab 8, M5_07)	2001, 2007	Spain	18 regions	cross section	bayesian spatial autoregressive	tourists expenditure	domestic	-1.69	O: no D: 0.78	no	no	islands, capital, beach, temperature
Deng, Athanasopoulos (2011, Tab 1)	1998- 2008	Australia	83 statistical local areas	panel	dynamic OD spatial lag panel	nights	domestic	no	O: 19.4 D: ns	no	no	trend, capital-cities interacted with spatial terms, other dummies

Note O: origin; D: destination; ns: not significant; no: not included. Size is measured in terms of either population (p), or density (d), or Km^2 (k)

Table 2. Tourism flows in Italy

A. Shares by macro areas (%)	Arrivals		Nights	
	2001	2010	2001	2010
North	51.0	54.1	46.3	47.4
Centre	29.4	27.9	27.8	26.2
South	19.5	18.0	25.9	26.4
Italy (million)	*79.1*	*96.0*	*340.1*	*366.0*

B. Shares of domestic tourism over total (%)	Arrivals		Nights	
	2001	2010	2001	2010
North	53.1	53.5	50.1	47.9
Centre	51.4	46.3	66.6	65.5
South	70.7	72.5	61.5	58.3
Italy	56.1	54.9	57.6	55.2

C. Annual average growth rate 2001-2010 (%)	Arrivals		Nights	
	domestic	international	domestic	internation
North	3.3	3.1	0.6	1.7
Centre	0.4	3.0	0.0	0.5
South	1.6	0.6	0.4	2.1
Italy	2.1	2.7	0.3	1.5

Source: ISTAT

Table 3. Top ten provinces for destination and origin of domestic tourism flows
(million of arrivals)

Rank	Province of *destination*		Rank	Province of *origin*	
1	Milan	2.93	1	Milan	4.68
2	Rome	2.67	2	Rome	4.08
3	Rimini	2.41	3	Turin	2.50
4	Bozen	2.18	4	Naples	2.11
5	Venice	2.13	5	Brescia	1.48
6	Trento	1.98	6	Bergamo	1.30
7	Turin	1.65	7	Varese	1.04
8	Naples	1.52	8	Bari	1.02
9	Florence	1.25	9	Bologna	0.99
10	Perugia	1.24	10	Padova	0.91

Source: own calculation on ISTAT data

Table 4. Data sources and definition

Variable	Definition	Primary source	Year
Tourism flows	arrivals to destination *i* from origin *j*	Istat	2009
Population	resident population (annual average)	Istat	2009
Density	population per Km^2	Istat	2009
GDP pc	GDP per capita	Istat	2008
Accessibility	low cost flights (number of direct destinations)	Companies web sites	2009
alternative measure	potential accessibility by road, train, air and time to the market; five groups (from 1=very low, to 5=very high accessibility)	Espon	2006
Parks	number of protected natural areas	www.parks.it	2009
alternative measure	size of protected natural areas (in km^2)	www.parks.it	2009
Museums	number of visitors in museums	Istat	2007
alternative measure	number of museums	Istat	2007
Amenities	number of restaurant with at least 1 star Michelin	www.michelin.it	2009
Coast	share of costal municipalities	Istat	
Beach quality	number of beaches with "bandiera blu" quality certificate	www.legambiente.it	2009
Distance	distance in km between the centroids	Istat	
Prices	regional prices level	Istat	2008
alternative measure	average price of "pizza & drink"	www.comune.modena.it	2009

If not otherwise specified, the territorial unit of observation is the Province

Table 5. Determinants of tourism flows. Estimated effects from gravity models
Dependent Variable: Tourism flows to Destination *i* from Origin *j*

	1	2	3	4	5	6
Destination						
GDP	0.997 ***	0.994 ***	0.945 ***	1.048 ***	1.057 ***	1.029 ***
Density	-0.366 ***	-0.384 ***	-0.362 ***	-0.390 ***	-0.431 ***	-0.381 ***
Accessibility: flights	0.005 ***	0.006 ***	0.006 ***		0.005 ***	0.005 ***
Accessibility: dummy				0.001 *		
Parks: num	0.006 ***	0.006 ***	0.006 ***	0.006 ***		0.005 ***
Parks: area					-0.016 ***	
Museums: visitors	0.009 ***	0.012 ***	0.011 ***	0.009 ***	0.006 ***	
Museums: num						-0.001
Amenities	0.023 ***	0.017 ***	0.022 ***	0.022 ***	0.042 ***	0.024 ***
Coast	0.013 ***	0.013 ***	0.013 ***	0.014 ***	0.013 ***	0.013 ***
Beach quality	0.038 ***	0.039 ***	0.036 ***	0.028 ***	0.037 ***	0.040 ***
Origin						
GDP	0.917 ***	0.944	0.977	0.917 ***	0.917 **	0.916 ***
Density	0.066 ***	0.064 ***	0.050 ***	0.066 ***	0.066 ***	0.066 **
Intra province						
GDP	1.608 ***	1.698 ***	1.773 ***	1.608 ***	1.608 ***	1.608 ***
Density	-0.386 ***	-0.392 ***	-0.428 ***	-0.386 ***	-0.386 ***	-0.386 ***
Distance OD	-0.790 ***	-0.793 ***	-0.793 ***	-0.785 ***	-0.788 ***	-0.794 ***
Relative prices DO: ISTAT		4.091 ***				
Relative prices DO: pizza			0.810 ***			
Adj. R^2	0.724	0.728	0.729	0.722	0.721	0.723

Number of provinces: 107; total number of observations: 11449
Estimation method: OLS with White heteroskedasticity-consistent standard errors
The variables GDP, density, park area and number of museums visitors are log-transformed
All regressions include a constant and a dummy variable for intra-province flows
Level of significance: *** 1%, ** 5%, * 10%

Table 6. Determinants of tourism flows. Estimated effects from spatial autoregressive models

Dependent Variable: Tourism flows to Destination *i* from Origin *j*

	1			2			3			4		
Dependence	*destination*			*origin*			*destination* and *origin*			*destination, origin* and *origin*-to-*destination*		
Spatial autoregr. coef.	$\rho_d = 0.344$	0.021		$\rho_o = 0.692$			$\rho_d = 0.177$	$\rho_o = 0.665$		$\rho_d = 0.623$	$\rho_o = 0.864$	$\rho_W = -0.647$
Effects	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Destination												
GDP	1.036	0.492	1.528	0.368	0.626	0.994	0.376	1.758	2.134	0.221	0.616	0.838
Density	-0.398	-0.189	-0.587	-0.128	-0.218	-0.347	-0.142	-0.663	-0.804	-0.077	-0.215	-0.292
Accessibility	0.007	0.003	0.011	0.002	0.003	0.005	0.003	0.013	0.016	0.001	0.003	0.004
Parks	0.005	0.002	0.007	0.002	0.004	0.006	0.001	0.007	0.008	0.001	0.004	0.005
Museums	0.011	0.005	0.016	0.004	0.007	0.010	0.005	0.021	0.026	0.002	0.006	0.007
Amenities	0.023	0.011	0.034	0.010	0.017	0.026	0.009	0.043	0.052	0.006	0.018	0.024
Coast	0.014	0.007	0.021	0.004	0.007	0.012	0.005	0.023	0.028	0.003	0.007	0.010
Beach quality	0.032	0.015	0.047	0.016	0.027	0.042	0.012	0.054	0.066	0.010	0.027	0.037
Origin												
GDP	0.626	0.298	0.924	1.039	1.766	2.804	0.790	3.696	4.486	0.596	1.661	2.257
Density	0.046	0.022	0.068	-0.021	-0.036	-0.058	-0.029	-0.134	-0.162	-0.055	-0.154	-0.209
Intra province												
GDP	1.445	0.687	2.132	1.368	2.326	3.694	1.179	5.511	6.690	0.036	0.100	0.136
Density	-0.456	-0.217	-0.673	-0.324	-0.552	-0.876	-0.343	-1.602	-1.944	-0.163	-0.455	-0.618
Distance OD	-0.521	-0.248	-0.769	-0.223	-0.379	-0.602	-0.069	-0.322	-0.391	-0.190	-0.531	-0.721

Number of provinces: 107; total number of observations: 11449

Estimation method: ML for the first three models, Bayesian Markov Chain Monte Carlo for the last model

The variables GDP, density and number of museums visitors are log-transformed

All regressions include a constant and a dummy variable for intra-province flows

All estimated effects are significant at the 1% level

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