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THEY ARRIVE WITH NEW INFORMATION

TOURISM FLOWS AND PRODUCTION EFFICIENCY IN THE EUROPEAN REGIONS

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They arrive with new information

Tourism flows and production efficiency in the European regions

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Abstract

It is well known that firms productivity is influenced by information spillovers generated either by other firms located nearby or by direct contacts with final demand or by foreign demand in the case of traded products.

In this paper we investigate a new channel of efficiency - enhancing information spillovers: tourism flows. The idea is that tourists, in general, have preferences for high quality goods and differentiated products which are revealed when they buy local products in the tourism destinations, thus transmitting relevant information to the local firms. The latter, in turn, exploit this new information generating a positive impact on the efficiency level of the local economy.

More specifically we examine the effects of tourist flows on regional total factor productivity, within a spatial dynamic model, controlling also for other intangible factors (such as human, social and technological capital) and for the degree of accessibility. We apply the analysis to 199 European regions belonging to the EU15 member countries, plus Switzerland and Norway.

The econometric results show the positive impact of tourism flows on regional efficiency levels together with the positive role played by intangible assets, infrastructures and spatial spillovers.

Keywords: tourism, information, total factor productivity, European regions
JEL: L83, D83, O33, R10

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1. Introduction

In the modern economy, knowledge is commonly recognized as the most important factor in the competition among firms and regions. Thus a growing attention has been devoted to the mechanisms through which firms acquire information on new products and processes in order to enhance their productivity. Following different theoretical approaches, the literature has identified and analysed several channels of knowledge diffusion. These mechanisms operate, often in a complementary way, via contacts with other firms and final consumers, both at the national and the international level. Information can be conveyed through direct contacts in the local market, via trade when it is embodied in goods, through foreign direct investment (FDI), or by direct contacts with the final consumers in the local market or in the external ones in the case of exporter firms.

It is worth remarking that all these mechanisms present several shortcomings which may limit the possibility to acquire valuable information for some firms. In particular small and medium enterprises in closed local markets receive a limited amount of useful information given the small number of firms and final consumers, and this influences negatively their efficiency levels. At the same time the presence of fixed costs to access the large international markets prevents them from being exposed to international knowledge spillovers.

In this paper we investigate a different channel which can be exploited by local firms to extract information on consumer preferences and thus to enhance their efficiency: contacts with tourists. Tourism flows have the peculiar feature of being foreign (external) demand coming directly to the local region and this represents a remarkable advantage for the local firms. Moreover, these final consumers usually come from relatively richer countries and, compared to local consumers, exhibit preferences for higher quality goods. In this case even firms too small to afford high fixed costs to export their goods can enjoy the information spillovers generated by tourist flows and this exposure produces beneficial effects on the efficiency level of the whole local economy.

There are a number of newspaper stories and anecdotic evidence on how small local firms have extracted information by direct contact with tourists. The wine sector in Sardinia, a small island in the Mediterranean sea which recently specialised in tourism, provides a significant example. Wine production, based on excellent autochthon grapes, has a long tradition but the product was sold mainly in the local market which was characterised by a preference for low-quality, very strong and thick red wine. On the contrary tourists revealed directly in the local market the preference of the international wine demand for less strong, smoother and more flavoursome wine and this information on the international preferences gave rise, among the local producers, to a rapid change in their products. Today wine is one of the most important exported good in Sardinia and the continuous contact with tourism flows functions also as a significant marketing vehicle.

According to Brau (2008) tourists also signal their preferences for high quality natural environment destinations. This may induce local governments to design specific policies in order to support firms which are willing to adopt environmentally-friendly production processes, which are the ones that make intensive use of the most innovative, efficiency enhancing production technologies.

To the best of our knowledge, this is the first time that the influence of tourism flows on the regional production efficiency level, measured by total factor productivity (TFP), is analysed. The microeconomic mechanisms which link the information spillovers to production efficiency are similar to those analysed in the literature on international trade.[1] The crucial difference here is that the tourism demand conveys information on international consumer preferences to local firms without additional costs for them and this has positive effects on production efficiency.

More specifically, the aim of the paper is to examine the effects of tourist arrivals on regional efficiency levels, controlling also for other specific characteristics of the region - like human, social and technological capital; infrastructures – which are supposed to influence TFP levels (Easterly and Levine**,** 2001). We apply the analysis to 199 European regions belonging to 15 member countries of the EU15 plus Switzerland and Norway over the period 2002-2004.[2] Moreover, we control for the presence of spatial association by estimating a spatial dynamic model.

[1] For a survey on the empirical literature on the microeconomic links between trade, knowledge diffusion and total factor productivity see Barba Navaretti and Tarr (2000).

[2] We follow the NUTS classification provided by Eurostat and select a combination of NUTS 0, 1 and 2 levels, characterized by an adequate degree of administrative and economic control. See Appendix 1 for details.

The paper is organised as follows. Section 2 briefly reviews the background literature. In section 3 we present a detailed description of the data. In section 4 we discuss some methodological issues and present the estimation results. Concluding remarks are presented in Section 5.

2. Literature background

In this section we shortly review four channels of information diffusion already proposed by the literature and then we suggest a new channel of knowledge transmission based on tourism flows.

A first channel focuses on the transmission of knowledge between firms at the local level. A growing body of literature emphasises the local nature of knowledge which is still costly and difficult to transmit across areas (Jaffe *et al.*, 1993). There is a wide evidence which suggests that location and proximity are crucial in explaining knowledge spillovers[3]. Firms tend to agglomerate in a specific place to facilitate the exchange of information and expertise based on two types of externalities. One is the Marshall specialisation kind of externality: the concentration of a particular industry within a given region facilitates the diffusion of technologies and knowledge across similar firms since geographical proximity eases the interaction between individuals sharing similar specific competences. The other is based on Jacobs diversity externalities and considers inter-industry spillovers as the most important source of new knowledge creation since the exchange of complementary knowledge leads to cross fertilisation of ideas, which in turn favours innovation. Overall, localised knowledge spillovers constitute an important foundation for the competitive advantage of the regions (Maskell and Malmberg, 1999). More generally, knowledge can be considered as a public good and therefore information spillovers are not locally bounded but can freely move across borders. In such a case, knowledge flows do not necessarily imply economic transactions since knowledge is essentially intangible and not embodied in specific transactions and circulates with no need for investments or exchange of goods[4].

[3] For a recent survey see Audretsch and Feldman, 2004. Evidence for the European regions are provided by Bottazzi and Peri, 2003 and Moreno *et al.*, 2006.

[4] A recent analysis of knowledge flows, proxied by patents citations, among the European regions is presented by Paci and Usai 2008.

A second channel of knowledge diffusion is identified at the international level through the trade of goods. The idea is that an economy can enhance its level of total factor productivity through trade flows since it can benefit from the stock of knowledge of partner countries embodied in traded goods (Coe and Helpman, 1995). This mechanism may be reinforced in the case of less developed countries which can extract more valuable information on consumer demand and technology by exchanging goods with richer markets (Nicita and Olarreaga, 2007). However, it has been remarked that trade is costly and, especially, that small firms located in traditional sectors and in backward regions may not afford the fixed costs required to entry in the foreign markets.

A third channel of technology transfer is represented by FDI, which is essentially a form of international movements of the firms. In this case the local economy can benefit from the knowledge transfer originated by multinationals through a general contagion and imitation effect (Findlay, 1978) and also via employees mobility (Glass and Saggi, 2002).[5] At the same time multinational firms may locate their plants in a foreign market to take advantage of knowledge spillovers from the local area since they are closed to both local firms and consumers. In this sense the FDI transmission channel can be seen as a connection between the national and the international channels.

A fourth channel for information diffusion is the contiguity between firms and final consumers. In the so called customer-active paradigm (von Hippel, 1978) firms tend to see in customer and users the most important source of information for innovation, for generation of new products and for increasing the quality of existing products (Foxall and Johnston, 1987). Thus the strategic problem faced by producers is to elicit preferences and other information from consumers and to incorporate them in their products (Randall et al., 2007).

These mechanisms present various drawbacks which may prevent some firms from taking advantage of knowledge spillovers. In particular firms which operate exclusively in the local market are exposed to limited information flows especially if the local market is relatively poor. At the same time it is not an easy task to operate in large

[5] Among several empirical studies which have investigated FDI as a sources of international knowledge spillovers see Van Pottelsberghe and Lichtenberg 2001; Lee 2006.

international markets since firms have to face fixed costs, which represent an entry barrier primarily for small firms.

In this paper we suggest an additional mechanism of information diffusion based on tourism flows. According to this hypothesis, tourists generate a positive effect on regional TFP levels since local firms benefit from the information on international demand extracted from tourists' revealed preferences. As a matter of fact, the literature on the tourist sector has focussed on the effects of tourism on the economy growth rate (Lanza and Pigliaru 1994; Hazari and Sgro 1995; Sinclair 1998). In particular, for the so called Tourism-Led Growth Hypothesis (TLGH) significant empirical support has been found for many countries[6]. The positive role of tourism on growth appears particularly strong for the case of small economies (Brau *et al.* 2007). The mechanisms behind such a positive relationship between tourism and long run growth are: the relevant inflows of foreign currency, the stimulation of inter-industry linkages, the incentive for investment in infrastructure, the multiplicative effects on employment.

3. Data and descriptive analysis

In this section we present a brief description of the main features of the variables included in the estimation analysis. We start with the total factor productivity variable, we will then focus on the tourism flows one and eventually on the control variables at the regional level (intangible assets and infrastructures). In describing the characteristics of the data a great deal of attention is devoted to their spatial features. These are depicted in Maps 1-3 and they are formally tested by means of the Moran's *I* test.[7] This is computed by employing both the distance

[6] Among the studies which have tested the role of tourism on growth for the European countries see: Balaguer and Cantavella (2002) for Spain; Cortez-Jimenez (2008) for Spain and Italy; Dritsakis (2004) for Greece; Proença and Soukiazis (2005) for Portugal. For a recent study on the OECD countries see Lee and Chang (2008).

[7] The Moran's *I* test for a given variable *x* is calculated as follows:

$$I = \frac{N}{S_0} \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{N}(x_i - \bar{x})^2}$$

and the contiguity matrices as a spatial weight matrix . The results are reported, along with the basic statistics, in Table 1: evidence of significant positive spatial association is found for most of the variables. In the next subsections we discuss each variable in turn.

3.1 Total factor productivity

The measure of total factor productivity for the European regions has been computed by Dettori et al. (2008) and it is based on the estimation of a spatial Cobb-Douglas production function model for a panel of 199 European regions over the period 1985-2006. The estimation was carried out within a spatial lag model framework controlling for spatial dependence, time series non-stationarity and endogeneity. The derived measure of TFP, which has the nice advantage of not using *a priori* restrictions on the inputs elasticities, is represented by the estimated panel regional intercepts. For completeness the estimated Cobb-Douglas model is reproduced in Table 2[8]. The geographical distribution of the TFP variable is shown in Map 1, where we report the average values for the period 1986-2006, these are computed as index values with respect to the European mean. Denmark is the leading region, with values nearly triple the European average, followed by Zurich and the capital regions of Luxembourg, Belgium (Brussels) and Norway (Oslo). The TFP index shows very high levels for all Norwegian regions, North Eastern and Eastern Scotland, a cluster of regions in the southern area of UK, three Dutch regions (Groningen, Utrecht and Noord-Holland), Lombardia (Italy) and the capital regions of France (Île de France), Sweden (Stockholm) and Austria (Wien). A concentration of high values is also observed in the centre of Europe, Switzerland and Western German regions. Good results are also displayed by the Swedish regions, the French regions of Rhône-Alpes, Provence-Alpes-Côte d'Azur and Alsace, the western regions of Aquitaine and Midi-Pyrenees, and the centre-north of Italy (Trentino, Lazio, Val d'Aosta and Emilia Romagna). Most of the regions of

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where w_{ij} is the weight between region i and region j and S_0 is the sum of the all weights, $S_0 = \sum_{i=1}^{N}\sum_{j=1}^{N} w_{ij}$. The standardized version of I, under the null hypothesis of no spatial correlation follows a standard normal distribution.

[8] For more details on the estimation procedure see the quoted paper by Dettori et. al. (2008).

Portugal, Spain (except for the capital Madrid), Southern Italy and Greece (except for Sterea Ellada) exhibit the lowest values.

3.2 Tourism flows

Tourism is one of the most important service sector in the European economy and tourist flows are growing at a continuously increasing rate. In the 17 European countries analysed in this study, the total number of nights spent in the year 2007 by tourists (resident and non resident) in total collective tourist accommodation establishments is over 2 billion, with 1.7% annual growth rate over the period 1998-2007. In Map 2 we present the spatial distribution of tourist flows among the 199 European regions considered. The data used in the econometric analysis refer to the year 2002. In order to take into account the different size of the regions, tourist flows are divided by population. Among the top ten regions in terms of tourism normalised by resident population (see also Table 3.a) we found Isles Baleares and Canaries in Spain, Cornwall in UK, the Greek islands in the Aegean sea (Notio Aigaio and Ionia Nisia), the Alpin region of Tirol in Austria, Algarve in Portugal. It is also interesting to notice that the Spanish Islands are at the top ranking also in terms of absolute value of tourist flows (see also Table 3.b) with Canaries in the first place with 84 million of nights and Baleares in the third with 59 millions. A high value is also shown by Île de France with Paris (62 millions) followed by some Spanish (Cataluña, Andalucia) and Italian regions (Veneto, Toscana, Emilia Romagna). Finally, Table 3.c reports the ten regions with the highest annual growth rate over the period 1998-2006. Surprisingly, in the first four places are UK regions, which started with quite low flows at the beginning of the period. It is worth remarking that among the top destinations listed in panel B, only the two Spanish regions entirely specialised in the "sea and sunshine holiday" product (Baleares and Canaries) present negative growth rates, while for the other regions the number of tourists has increased.

3.3 Regional characteristics

In this section we briefly examine the three types of intangible capital - social, human and technological capital – and the degree of public infrastructure which were included in the estimated equation as they are supposed to improve the level of efficiency by creating a more favourable economic environment for firms.

The literature provides several definitions of social capital (Glaeser *et al.* 2002); in general, it is considered as a shared set of informal norms and values which increase the level of trust among members of a community and allow them to cooperate (Tabellini 2008, Guiso *et al.* 2008). A high level of social capital in a certain area facilitates cooperation, reduces transaction costs for both firms and consumers, promotes a wider diffusion of knowledge and therefore enhances the economic performance (Knack and Keefer 1997). In this study we adopt as a proxy for social capital the notion of social participation, measured by the share of population that has taken part at least once in the last 12 months in social activities such as voluntary service, unions and cultural associations meetings over total population. The spatial distribution of social capital across the European regions presented in Map 3.a appears quite variegated. The regions showing the highest values are located in the Scandinavian peninsula, in the four regions of Germany's Baden-Württemberg, in France's Mediterranean and Pyrenees areas and in the South-West of the United Kingdom.

The positive role of human capital on productivity level and growth has been widely studied in the literature (Mankiw et al. 1992; Benhabib and Spiegel 1994). At the regional level a higher availability of well educated labour forces represents an advantage for the localization of innovative firms, thus promoting local productivity (Rauch 1993). As a proxy for human capital we use the share of population that has attained at least a university degree (ISCED 5-6) over total population. The distribution of human capital across the European regions is represented in Map 3.b. Note the outstanding performance of Norway, Scotland, Finland's southern regions (Etela-Suomi and Lansi-Suomi) and eastern Spain (Cataluña, Aragona, Navarra, Pais Basco and Cantabria). Italy stands out for having all regions in the lowest class, while all other nations with values below the European average show greater variability and at least one region higher up in the rankings. This is the case for Portugal (with the Lisboa region) and Greece (with Attiki and Kentriki Makedonia).

Following the seminal contribution by Griliches (1979) technological capital has been considered as an explanatory variable of the performance at firms level and also at regional and country level. The idea is that technology is partly a public good, firms benefit from a higher degree of knowledge capital available in their areas because it leads to an increase in productivity[9]. As an indicator for technological

[9] Recent contributions on the knowledge capital model include Madsen (2008) for the OECD countries; Fischer et al. (2009) for the European regions.

capital we use the number of patent applications at the Patent Cooperation Treaty calculated as the stock in the previous five years over total population. The data have been regionalised on the basis of the inventors' residence; in the case of patents with multiple inventors proportional quotas have been attributed to each region. The distribution of technological capital in Map 3.c shows a large high-performance cluster, starting in France from Rhône-Alpes through all Swiss regions and ending at the South-central part of Germany. These top performing regions are surrounded by other high performance countries. Detached from this cluster, one finds the capital region of Paris (Île de France). Sweden, Finland and Denmark show top-high innovation performance, suggesting the presence of a Scandinavian cluster. All southern European regions are characterised by very low levels of technological capital.

Finally, the presence of a good network of public infrastructure is also a key element in influencing the regional efficiency level. Starting from the seminal contributions by Aschauer (1989), the literature has investigated the role of infrastructure, and more generally of public capital, on regional performances. See, among others, Eberts (1990) for the Unites States, Marrocu and Paci (2009) for the Italian regions; a useful survey is in Gramlich, 1994. The positive role of transport infrastructure on tourism flows is analyzed by Khadaroo and Seetanah (2008) within a gravity model. As a proxy for infrastructures in this paper we use an index of accessibility (developed within the ESPON project 2.4.2) which allows also to take into account the geographical position of each region which is an important element in relation to tourism flows. The index is based on the potential accessibility by road, train, air and by the time necessary to reach the market (with a negative sign). It takes the value 1 when the accessibility is very low and reaches the value 5 for a very high accessibility level. Map 3.d shows the presence of a central European core area consisting of parts of the Netherlands, Belgium, Germany, France and Switzerland with values significantly above the European average. The region with the highest accessibility indicator is Brussels, followed by Düsseldorf, Île de France, London and Utrecht. Countries with low accessibility are Ireland, Greece, Finland and Norway with lowest regional values in Pohjois-Suomi (Finland), Nord Norge (Norway) and Övre Norrland in Sweden.

4. Econometric estimation and results

In this section we present the econometric analysis carried out to assess the effects of tourism flows on total factor productivity. As mentioned in the previous section, our measure of TFP exhibits a significant degree of spatial association, as detected by the Moran's *I* test (see Table 1). Assuming that such dependency is mainly due to the existence of spillovers arriving from neighbouring regions, we estimate a spatial lag model, specified as follows:

$$a_{it} = c + \beta_1 tf_{it-k} + \beta_2 x_{it-k} + \delta W a_{it} + \varepsilon_{it} \quad \text{with } i=1,2\ldots.. N=199 \qquad (1)$$

where small letters indicate values in logs; *a* is the value of total factor productivity in each region in the year 2004, *tf* are tourism flows and *x* is the matrix of the other explanatory variables used as controls; these include the main intangible assets, which are supposed to effect the efficiency level of the regional economy, namely social capital, human capital and technological capital. All right-hand side variables are normalised to population in order to control for different size of the regions and refer to the year 2002. We also include an index of accessibility to control for regional differences in the endowments of public infrastructures.

The presence of spatial dependence is accounted for by including the spatial lag of the dependent variable, *Wa*, where *W* is the spatial matrix. The elements of the *W* matrix are the spatial weights, given by the square of the inverse of distance in kilometres; the square values are supposed to be more informative and more powerful in discriminating between neighbouring and distant regions as they increase the relative weights of the closest ones. The weight matrix is normalised by dividing each element by its largest eigenvalue to maintain the symmetry of the distances and the interpretation of the spatially lagged term based on a "distance decay"- type of economic behaviour (Anselin, 1988). Note that in estimating model (1) we have to deal with two possible sources of endogeneity; one is typical of spatial lag models, which are characterized by the two-way causality in the neighbour relation in space ("each region is the neighbour of its neighbouring regions"), while the other is due to the presence of system feedbacks or measurement errors in the explanatory variables. When only the first source of endogeneity is present, model (1) can be estimated with the ML method or, alternatively, by the 2SLS one. When endogeneity is caused by both sources only the second estimation method can be applied[10]. We tested for endogeneity of the regressors by applying the well-known Durbin-Wu-Hausman test, which turned out to be highly significant (p-value=0.0004). Following Fingleton and Le Gallo (2008), in this work the instruments for the explanatory variables are derived by applying the 3-group method proposed by Kennedy (1992). For each variable the instrument takes the value -1, 0, or 1 according to whether the value of the instrumented explanatory variable is in the lower, middle or upper third of its distribution. Spatial lags of the 3-group method instruments are used to deal with the endogeneity of the spatially lagged dependent variable (Kelejian and Prucha, 1999).

The results of the econometric analysis are reported in Table 4. The first model is a sort of benchmark model based on a simple OLS regression without accounting for spatial dependence or possible endogeneity of the regressors. All the explanatory variables - including tourism - exhibit a positive impact on the dependent variable; however, both the LM test for error spatial correlation and the Moran's *I* test carried out on the estimated residuals point out that the regression errors are significantly correlated across regions.

The second model is our preferred one, it accounts for both sources of endogeneity at the same time and it does not exhibit evidence of misspecification as far as the spatial pattern of the residuals is concerned, as shown by the value of the Moran's *I* test. Note that the reported value of the test is based on the variant proposed by Anselin and Kelejian (1997) for the case of IV residuals. In model 4.2 the most interesting result is that tourism flows have an estimated impact of 0.09, which is 60% higher than the impact associated with technology, thus confirming the important role played by tourist - transmitted information in determining total factor productivity in the European local economies. All intangible assets display a positive and significant effect on total factor productivity: 0.19 for human capital, 0.13 for social capital and 0.05 for technological capital. As expected, a positive and significant influence is also exerted by the degree of accessibility.

[10] Note also that when the explanatory variables are exogenous spatial dependence can also be accounted for by specifying a spatial error model, the selection between the spatial error and the spatial lag model is based on the residual diagnostic of the simple OLS model. On the other hand, when the regressors are endogenous only the 2SLS method can be applied within a spatial lag specification (see Fingleton and Le Gallo, 2008).

In model 4.3 we evaluate which is the *crucial* distance to allow the benefits of one region to spill over the neighbouring ones by including four different spatially lagged terms calculated according to disaggregated distances among the regions. The weight matrices refer to four 300 kilometer wide ranges, the first (0-300 km) is the shortest distance considered; we then consider the non zero links among the regions in the ranges 300-600, 600-900 and 900-1200. The 300, 600 and the 1200 km distance correspond approximately to the first decile, the first quintile and the median of the distances distribution, respectively. The elements of each matrix are represented, as in the previous regressions, by the inverse of the square distance and are divided by the largest eigenvalue for normalization. The results point out that the relevant links which allow neighbouring spillovers to have a significant impact on the regional economies are those within the 300 km distance. The coefficient of the first lagged term is estimated in 0.95 and all the other explanatory variables – tourist flows and regional TFP determinants – show estimated elasticities of almost the same order of magnitude as those obtained for specification 4.2. The Moran's *I* test for model 4.3 does not signal residual spatial autocorrelation.

Overall, the results reported in Table 4 provide relevant evidence supporting the novel idea that tourists flows are an important channel for transmitting valuable information on final foreign consumers' preferences to firms located in the destination economies. These firms can thus engage in the production of high quality goods, introduce innovative changes in their productive and marketing strategies yielding to increasing levels of total factor productivity for the regional economy as a whole. Note that such beneficial effects from tourist flows are not confined to the tourism-specialised regions, but are also transmitted to the neighbouring regions by means of spatial spillovers.

5. Concluding remarks

In this paper we provide empirical evidence supporting the new idea that tourists flows can function as a complementary channel in the diffusion of knowledge spillovers among firms and regions. It is by now well known that knowledge is one of the most important factor in the competition among firms as it allows to acquire information on new products and processes in order to enhance productivity. Following different theoretical approaches, the literature has identified and found empirical evidence on a number of knowledge transmission channels, such as those based on direct contact with other firms and final consumers, both at the national and the international level, or those represented by trade or by foreign direct investments. However, such mechanisms present several shortcomings which may limit the possibility of some firms, particularly the smaller ones, to acquire valuable information and this prevents the occurrence of the expected positive effects on their efficiency levels. On the other hand, the information conveyed by tourist flows is costless for local firms: tourism flows have the advantage of being foreign (external) demand coming directly to the local region. Moreover, these final consumers usually come from relatively richer countries and exhibit preferences for higher quality goods compared to local consumers. In this case even firms too small to afford the high fixed costs necessary to access the international markets can exploit the information spillovers generated by tourist flows and this exposure produces beneficial effects on the efficiency level of the whole local economy.

The empirical evidence provided in this paper is based on the estimation of spatial lag models for the total factor productivity of 199 European regions, where tourist flows enter as a main explanatory variable, along with other tangible (public infrastructures) and intangible (human, social, technology and knowledge capital) forms of inputs. The empirical models for TFP yield an estimated impact for tourist flows which is comparable in size to that of technology or knowledge, thus offering support to the novel idea that tourist flows are an important channel in transmitting valuable information to the destination economies' firms. These can thus acquire such information at no cost, and exploit it in order to improve their individual efficiency level and the productivity of the local economy as a whole; the latter, in turn, can generate beneficial effects also for the neighbouring regions thanks to the presence of spatial spillovers.

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Appendix 1. Regions and NUTS level

Country	NUTS	Regions
Austria	2	9
Belgium	1	3
Denmark	1	1
Finland	2	5
France (a)	2	22
Germany (b)	2	30
Greece	2	13
Ireland	2	2
Italy	2	20
Luxembourg	1	1
Netherlands	2	12
Norway	2	7
Portugal (a)	2	5
Spain (a)	2	17
Sweden	2	8
Switzerland	2	7
United Kingdom	2	37

(a) Territories outside Europe are not considered
(b) Berlin and East Germany regions are not considered
(c) Autonomous provinces of Trento and Bolzano are aggregated

Appendix 2. Data sources and definition

Variable	Source	Years	Description
TFP	Own estimation	2004	Computed from regional fixed effects of production function estimation over the period 1985-2006.
Tourism flows	Eurostat	1998-2006	Total nights spent by resident and non resident in total collective tourist accommodation establishments.
Accessibility	Espon, Project 2.4.2	2001	Regions are classified into five groups (from 1= very low, to 5= very high) according to ther potential accessibility by road, train, air and time to the market.
Human Capital	Eurostat	2002	People with a degree (ISCED 5-6).
Social capital	European Social Survey, Round 1	2002	Population that have taken part at least once in the last 12 months in social activities such as voluntary service, unions and cultural associations meetings.
Technological capital	OECD, REGPAT database	1998-2002	Patent applications at PCT (Patent Cooperation Treaty), stock for the previuos 5 years.

Table 1. Descriptive statistics and Moran's *I* test for spatial association

Variable	Year	Basic descriptive statistics				Moran's *I* test			
		Mean	Std. dev.	Min	Max	Distance matrix		Contiguity matrix	
						Z-values	p-value	Z-values	p-value
Total Factor Productivity	2004	1.159	0.334	0.386	3.451	17.02	0.000	8.30	0.000
Tourism flows	2002	7.06	9.53	1.02	66.67	2.33	0.020	3.77	0.000
Social capital	2002	493.8	154.4	105.3	1000.0	21.00	0.000	11.42	0.000
Human capital	2002	128.2	46.7	44.6	338.5	17.05	0.000	8.37	0.000
Technological capital	1998-2002	0.41	0.47	0.00	3.60	13.87	0.000	8.26	0.000

The Moran's I test is calculated on the log-transformed variables

Table 2. Measuring total factor productivity: a *spatial* Cobb-Douglas model

Dependent variable:	value added
Estimation method	*2SLS*
Sample period: 1985-2006; N=4378	
Capital stock	0.291 ***
	(8.0)
Labour units	0.278 ***
	(11.3)
Spatial lag	0.305 ***
	(3.6)
Fixed effects	included
Time effects	included
Square corr.	0.98
LM test for spatial error dependence	0.174
p-value	*0.677*
Moran's *I* test	0.362
p-value	*0.718*
Sample period: 1985-2006	N=199 N*T=4378

For estimation details see Dettori et al. (2008)
Spatial weight matrix: square of the inverse of distance in km
Aysmptotic t-statistic in parenthesis; level of significance: *** 1%, ** 5%, * 10%
Square correl. is the squared correlation between the predicted and actual values

Table 3. Tourist flows: top ten regions

(a)	Nights over population, 2002		
1	Baleares	Spain	66.7
2	Cornwall, Isles of Scilly	UK	52.1
3	Notio Aigaio	Greece	50.2
4	Canarias	Spain	46.7
5	Tirol	Austria	46.6
6	Algarve	Portugal	40.1
7	Salzburg	Austria	33.8
8	Highlands, Islands	UK	32.7
9	Ionia Nisia	Greece	31.6
10	Valle D'Aosta	Italy	27.5

(b)	Total nights, million, 2002		
1	Canarias	Spain	84.1
2	Ile De France	France	62.1
3	Baleares	Spain	59.3
4	Cataluna	Spain	58.3
5	Veneto	Italy	55.4
6	Andalucia	Spain	44.8
7	Toscana	Italy	38.0
8	Emilia-Romagna	Italy	37.0
9	Provence-Alpes-Cote D'Azur	France	36.4
10	Inner London	UK	34.2

(c)	Growth rate, % annual average, 1998-2006		
1	Greater Manchester	UK	13.1
2	Merseyside	UK	11.8
3	Gloucestershire	UK	11.0
4	Tees Valley, Durham	UK	9.6
5	Navarra	Spain	8.8
6	Corse	France	8.7
7	Asturias	Spain	8.4
8	Umbria	Italy	7.8
9	Kentriki Makedonia	Greece	7.6
10	Bedfordshire	UK	7.3

Table 4. Assessing the impact of tourist flows on Total Factor Productivity

	1	2	3
	OLS	*2SLS*	*2SLS*
Tourist flows	0.052 ***	0.087 ***	0.081 ***
	(2.90)	*(3.94)*	*(3.53)*
Regional characteristics			
Accessibility	0.132 ***	0.099 ***	0.069 **
	(4.35)	*(3.01)*	*(2.12)*
Human capital	0.149 ***	0.188 ***	0.145 ***
	(3.48)	*(3.33)*	*(2.63)*
Social capital	0.218 ***	0.133 **	0.155 **
	(5.81)	*(1.98)*	*(2.41)*
Technological capital	0.017 **	0.053 ***	0.051 ***
	(2.45)	*(3.26)*	*(3.00)*
Spatial dependence			
Spatially lagged dep. variable		0.992 ***	
		(2.86)	
Distances for spatial lag (in km)		all	
Spatial lag - distance 0-300 km			0.952 ***
			(2.74)
Spatial lag - distance 300-600 km			0.312
			(1.14)
Spatial lag - distance 600-900 km			0.059
			(0.17)
Spatial lag - distance 900-1200 km			0.170
			(0.45)
Square corr.	0.472	0.495	0.507
LM test for spatial error dependence	444.12	--	--
p-value	*0.000*		
Moran's *I* test	21.25	-1.640	-1.599
p-value	*0.000*	*0.101*	*0.110*

Dependent variable: total factor productivity, 2004

For tourist flows, human capital, social capital and technological capital the values refer to the 2002 year

N=199; all variables are log-transformed; all regressions include a constant term

In 2SLS regressions instruments are constructed by applying the 3-group method (Kennedy, 1992)

Spatial weight matrix: square of the inverse of distance in km

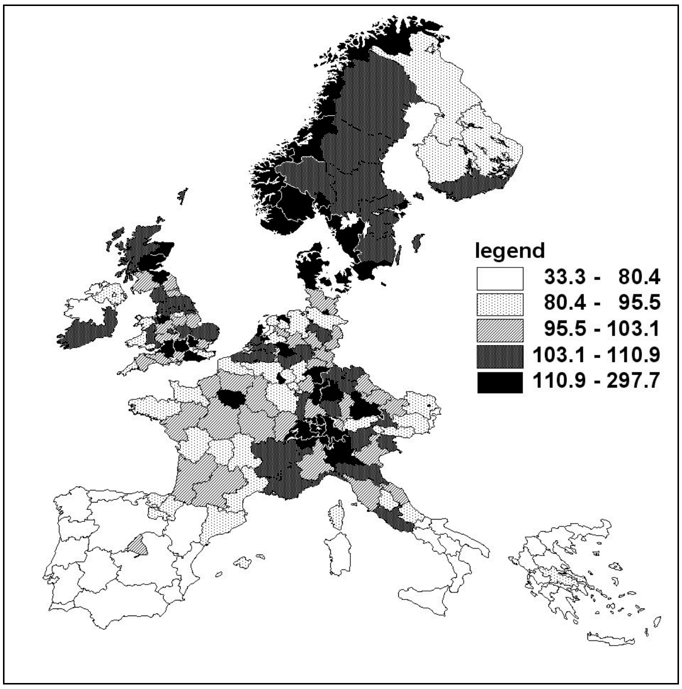
Aysmptotic t-statistic in parenthesis; level of significance: *** 1%, ** 5%, * 10%

t-ratios are computed on the basis of White heteroskedasticity consistent standard errors

Square correl. is the squared correlation between the predicted and actual values

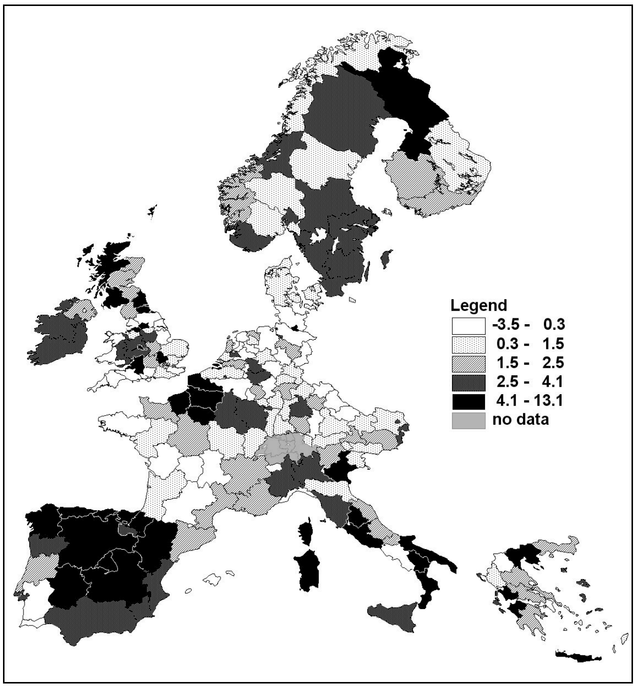
For 2SLS regression the Moran-*I* test is the variant proposed by Anselin and Kelejian (1997) for 2SLS residuals

Map 1 Total Factor Productivity in the European regions

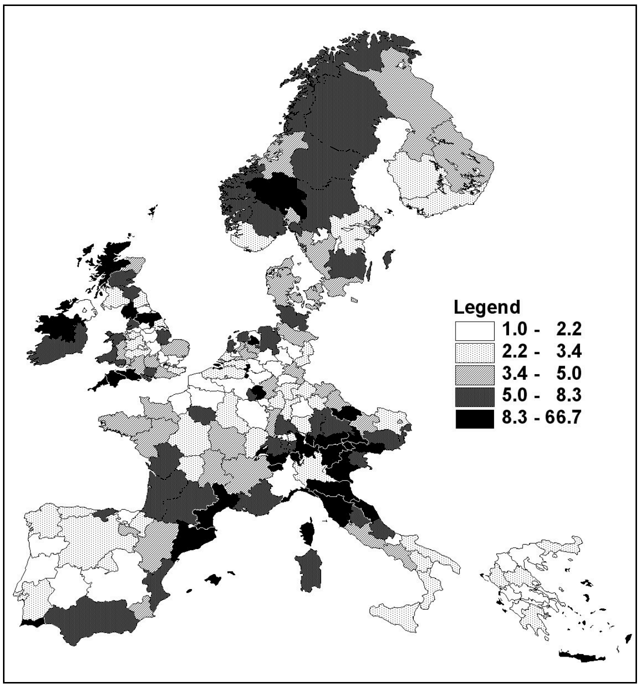


Index, Europe = 100, 2004

Map 2. Tourist flows in the European regions

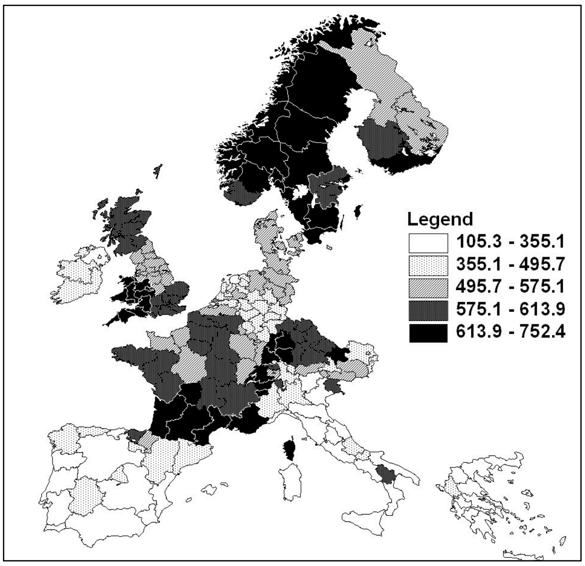


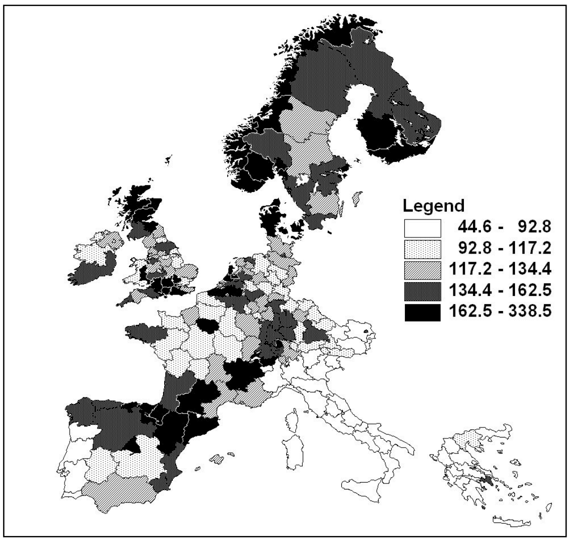
(a) Nights spent by resident and non resident in collective tourist accommodation establishments. Per capita values, 2002



(b) Annual average growth rates, 1998-2006

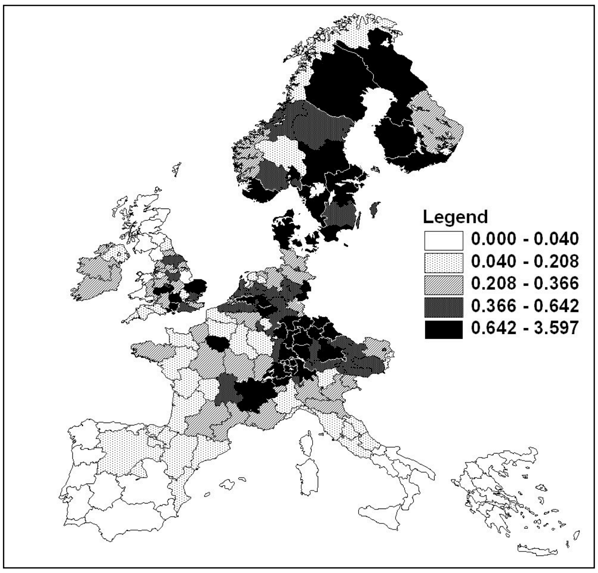
Map 3. Regional characteristics

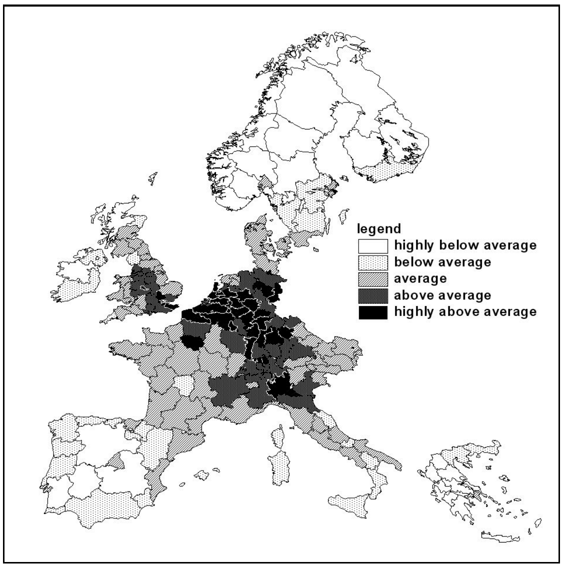




(a) Social capital. Participation to social activities per thousands population, 2002

(b) Human capital. Inhabitants with a degree per thousands population, 2002





(c) Technological capital. Patents per thousands population, 1998-2002

(d) Public infrastructure. Accessibility index. 2001

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