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AGRICULTURAL LANDSCAPE, VINEYARDS AND TOURISM FLOWS IN TUSCANY, ITALY: RESULTS FROM AN APPLIED ECONOMIC STUDY

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Agricultural landscape, vineyards and tourism flows in Tuscany, Italy: Results from an applied economic study

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Abstract

It is widely acknowledged that landscape features can play a major role in determining tourism demand. The analysis presented in this work aims at assessing the impact of agricultural landscape and high-quality wine production on regional tourism flows. This paper focuses on Tuscany, a major touristy region in Italy renowned for its pleasant climate and enchanting countryside. Thus, agricultural landscape and high-quality wine production have been included as explanatory variables in a regression model encompassing also the socio-demographic and geographical characteristics of each municipality, accommodation availability, the presence and availability of protected areas and the main types of tourism attraction factors, such as art and proximity to the seaside. This model has been run tourist demand, which has then been disentangled into the international and domestic markets. Results allow concluding that agricultural landscape and the production of quality wines represent a positive externality for tourism flows. A monetary evaluation of the impacts of agricultural landscape and wine production has been performed. The results show that the yearly contribution of these externalities to the revenue of tourism services differs across the provinces. This can have important policy implications for tourism promotion choices and allows drawing a profile of the average tourist visiting different parts of Tuscany.

Keywords: Landscape diversity, corine landcover, European Natura 2000 Network, international tourism, domestic tourism, quality wine production, landscape metrics

JEL classification: L8, Q57, R14, R52

1 Introduction

The landscape profile plays a widely acknowledged role among the attraction factors of any tourist destination. The identification of landscape metrics and indicators has been addressed by a vast array of studies, which highlighted the importance of measuring landscape characteristics, both from a composition and a configuration perspective. The former aspect refers to the different typologies of landscape elements, while the latter addresses their spatial distribution.

The present study aims at describing the impact of landscape diversity on tourist destination choice. The primary objective has been the identification and the construction of a set of appropriate indicators, taking into account the peculiarities of the tourism sector in this area. A secondary objective has been the specification of an econometric model, assessing the impacts of landscape diversity on the volume of tourism flows towards particular destinations, namely the municipalities of Tuscany, Italy.

This paper is organised in two main parts. The first presents a review of the relevant literature on the determinants of tourism demand and of the most widely used landscape metrics, highlighting the appropriateness of each of them for describing specific phenomena. In addition, a detailed description of the indicators computed for the purpose of this study is provided. The second part is devoted to the use of those indicators to analyse tourist behaviour in the various Tuscan municipalities. A description of the features of landscape and tourism flows towards the different areas of Tuscany is provided and, subsequently, an econometric model is estimated to analyse the influence of landscape diversity, among other explanatory variables, on the number of tourist arrivals in each municipality, disentangling them into international and domestic tourism demands and the effects of landscape diversity are assessed on each of them separately.

The outcome of this analysis allows drawing some conclusions on the suitability of the selected landscape diversity indicators in the analysis of the tourism destination choices and on the similarities and differences between the international and domestic segments of tourism flows towards Tuscany.

2. Literature review on the determinants of tourism demand and landscape amenities

The number of tourist arrivals is the most popular measure of tourism demand used in the reviewed literature. This variable can be further disaggregated according to the purpose of

the visit, for instance holiday, business and visiting friends and relatives (Turner and Witt, 2001), the origin of the travellers (Bigano et al, 2007) or the means of transportation used (Rosselló-Nadal, 2001). Some studies adopt tourist expenditure or tourism sector revenue or employment as the dependent variables (Li et al, 2004; Witt et al, 2004).However, most of the reviewed studies include economic variables such as income, tourism prices, distance and cost of transportation, as well as exchange rates as explanatory variables to describe tourist arrivals (Dritsakis, 2004; Witt and Witt 1995; Hamilton et al., 2005 a; Bigano et al., 2007; Lise and Tol, 2002). Income is generally found to affect tourism demand in a positive way, while distance and cost, as well as the price level can be expected to deliver an opposite result.

Population density is assumed to affect international tourism determining a proportional increase in departures (Hamilton et al., 2005 a). However, as far as inbound tourism is concerned, its impact is more ambiguous since, on the one hand, tourists may be attracted towards densely populated countries, as this implies a larger number of towns and cities as well as of tourism facilities and infrastructure. On the other hand, if a high population density entails a lack of natural and wilderness areas, those areas may become unattractive to tourists (Hamilton, 2004).

Several studies have been focusing on the relationship between climate and tourism demand. Temperature is often considered as the most relevant climatic variable, since most climate parameters, such as humidity, cloudiness and weather extremes tend to depend on temperature. In addition, this variable is generally well monitored and the relevant data are available and reliable (Bigano et al., 2007). Hamilton et al. (2005 a; b) found that climate change shifts international tourist towards higher altitudes and latitudes. Lise and Tol (2002) include temperature, precipitation and number of average number of sun hours per day in order to describe the climatic conditions of the destination.

Environmental amenities are considered by most studies as a relevant component of tourism demand determinants and they can be viewed as a growth factor for the tourism industry (Wunder, 2000; Naidoo and Adamovicz, 2005; Green, 2001). Tourists appear to attach a value to different types of landscapes. Hamilton (2006) analysed the impact of different types of coastal landscape on the price of tourism accommodation and found out that the length of open coast contributes to increase this value.

However, and in addition to its productive function, agricultural land provides public amenities, in the form of natural habitats, open spaces, pleasant scenery and cultural

preservation. This link between agricultural activities and landscape value proves to be particularly strong in European countries, where rural areas are mostly characterized by farmed landscape (Vanslembrouck *et al.*, 2005). Agricultural landscape has been found to exert an influence on visitors' decisions (Fleitscer and Tsur, 2000; Hellerstein et al., 2002). Madureira (2006) and Job and Murphy (2006) pointed out that the traditional vineyard landscape is one of the major tourism attraction factors of the Douro valley in Portugal and of the Mosel valley in Germany. Analogous arguments have been made for olive grows, which were found to be positively correlated to tourism flows towards the Greek islands (Loumou et al., 2000).

Furthermore, among the relevant tourism pull factors, several studies consider the types of tourism attractions of which a destination can take advantage, for instance art and local culture (Medina, 2003; Poria, 2003; Hamilton, 2004). Moreover, different segments of the tourism market can be identified depending on the characteristic landscape of the destination. For example, mountain and seaside destinations can be analysed with reference to their capacity to attract different types of tourism, whose consumption behaviour may differ (Manente *et al.*, 1996).

Finally, tourists may be attracted by specific products, particularly wine and gastronomic productions, linked to the territory of the region they chose to visit. An example, are the "wine routes"[1]. Tourists who follow a wine route have the opportunity to visit wine farms, to take part in wine tasting, purchase wine, visit a vineyard or a local museum that provides them with information about the wine traditions and history of the region. Williams (2001) analysed the evolution of wine region imagery during the 1990s and concluded that emphasis has shifted from wine production and related facilities to the experience of rural lifestyle, encompassing leisure, cuisine, scenery and outdoor activities. Getz and Brown (2006) argue that proximity to wine regions influences travel, but the tourist's perception goes beyond the mere presence of vineyards and wineries. As a matter of fact, wine tourists typically seek a bundle of benefits, including destination appeal, accommodation with regional character, gourmet restaurants and traditional scenery, in addition to the wine product.

Often there is also an opportunity to stay in agri-tourist accommodations, taste the culinary specialities of the area and buy typical products of the region (Brunori and Rossi, 2000;

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[1] Wine routes are defined as sign-posted itinerary, through a well defined area, whose aim is the 'discovery' of the wine products in the region and the activities associated with it (Brunori and Rossi, 2000).

Telfer, 2001; Correia *et al.*, 2004). Bessière (1998) considers traditional food and gastronomy as elements of tourism development at the local level, since they can act as identity markers of a given geographical area or community.

The present study is consistent with the reviewed literature in the selection of dependent and explanatory variables to be included in the model. Nonetheless, the reviewed studies rarely take into account simultaneously all the different aspects that could influence the tourists' destination choice, such as climate, landscape features, socio-demographic characteristics of the destination, tourism attraction factors and the presence of cultural amenities provided by agriculture, such as typical wines and gastronomic products, as it is done in the present paper. In addition, another innovative aspect of this analysis is the disaggregation of tourism flows in their international and domestic components, with the aim of identifying differences in their choice patterns.

2.1 Review of existing landscape metrics and construction of indicators

Landscape can be defined as a spatially heterogeneous area presenting at least one factor of interest (Turner et al., 2001). The spatial structures of landscapes are associated with the composition and configuration of landscape elements; the former refers to the number and occurrence of different types of landscape elements, while the latter encompasses their physical or spatial distribution within a landscape (McGarigal et al. 1994).

A whole set of mathematical indices have been developed in order to provide an objective description of different aspects of landscape structures and patterns (McGarigal et al. 1994), and it is important to note that no single metric can adequately capture the pattern on a given landscape. Several suggestions have been made for a meaningful set of metrics that minimize redundancy while capturing the desired qualities (Riitters et al. 1995). A vast array of previous studies has reviewed the most commonly used landscape metrics, highlighting advantages and shortcomings of each (Hargis, 1998; Turner, 2005; Botequilha Leitão and Ahern, 2002).

Landscape richness, namely the number of land cover classes, is the simplest way of capturing the diversity of the earth's surface, counting the number of different classes per unit area. This measure seemed to be more likely to influence tourist perceptions and choices than other more complex indicators, which would have been more appropriate if the objective was to analyse functionalities and the degree of fragmentation of landscapes and ecosystems.

It has been chosen to use the data provided by the CORINE to construct two composition indicators, landscape richness and the share of agricultural land covered by complex agricultural patterns[2]. This landscape type is characterised by a mosaic of patches of different permanent crops, such as fruit trees, berry plantations, vineyards and olive groves and can be expected to exert a positive impact on tourists' perception.

This paper applies the selected indicators to the Tuscany region in Italy and the unit of analysis is the municipality geographical scale. Landscape richness has been computed as the number of different land cover categories recorded in each municipality divided by the number of classes recorded in the whole region. All the classes included in the CORINE Land Cover database have been considered and Table 1 shows the ones existing in Tuscany, which have been used in the calculation of the landscape richness indicator.

Insert Table 1about here

The scores for both landscape richness and complex agricultural patterns can be read on a scale ranging from 0 to 1. A high landscape richness score indicates that all the different landscape categories existing in Tuscany are present on the territory of the municipality. This can be interpreted as high landscape diversity.

3. The Tuscany case study

The remainder of this paper is devoted to the assessment of the impact of the landscape metrics described in the previous section on international and domestic tourism flows towards the Italian region of Tuscany adopting 2007 as a reference year. To begin with, a description of the explanatory variables and of the data sources will be provided. Then, an econometric model is estimated in order to describe the number of tourist arrivals as a function of a set of explanatory variables and its results are analysed.

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[2] The CORINE Land Cover Inventory is the only data set providing a synoptic but broad overview of land cover and land use at European level, enabling cross border investigations and comparisons at European level (EEA 1994, 2010). For this reason, within the scope of this analysis, it has been chosen to use this information in order to construct landscape diversity indicators. The CORINE Land Cover Inventory is based on satellite images as the primary information source[2]. The data presented in the inventory is clustered into 44 classes covering agricultural areas as well as urban and natural surfaces.

3.1 Description of the selected variables and data sources

A large cross-section dataset has been constructed, using a set of different sources, and adopting 2007 as the reference year. As regards international and domestic tourism arrivals, data have been retrieved from the Tuscany regional administration, as well as data on the number of available accommodation per municipality, the share of budget accommodation solutions out of the total offer, and the types of tourism attraction characterising each municipality.

The surfaces covered by each land cover category and the information needed to construct the selected landscape metrics have been obtained from the CORINE Land Cover database, as discussed in the previous section. The share of municipal territory covered by Natura 2000 sites has been computed from the information contained in the Natura 2000 database and overlapped to the area of the municipality, using ArcGis. The same procedure has been followed to compute the number of existing Natura 2000 sites in a range of 10, 15, 20, 25 and 50 km around the municipality.

Average yearly temperature and precipitation have been computed with a spatial resolution of 1 squared km. Each grid point is associated to a single meteorological observation in a dataset covering the period 1996-2007.[3] Finally, the information on the number of high quality wines, DOCG and DOC[4] wines in this specific case, produced on the territory of each municipality has been retrieved from the Italian federation of sommeliers and hotel and restaurant owners (FISAR, 2007). Table 2 displays the variables used in this study and the data sources.

Insert Table 2 about here

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[3] Entries of this dataset are daily observed values of minimum and maximum temperature and precipitation. This data has been provided by the Department of Agronomic Sciences and Agro-Forestry Territorial Management of the University of Florence, Italy.

[4] Quality wine produced in a specified region (QWPSR) is the generic EU term for quality wines such as the French AC, the Italian DOC/G, the Spanish DO/DOCa, and the German QbA/QmP. For DOC wines the "Disciplinare di Produzione" establishes the zones of production and collection of grapes, the cultivars allowed for wine-making, the type of land on which cultivation is possible, a maximum yield, production and ageing technologies, the characteristics of the final product and the possible label qualification of the commercialized product. DOCG wines have achieved, in addition to the DOC qualification and peculiar qualities, a well-established international reputation.

The administrative territory of Tuscany is divided into ten provinces, namely, Arezzo, Florence, Grosseto, Livorno, Lucca, Massa Carrara, Pisa, Pistoia, Prato and Siena[5]. Complex cultivation patterns cover 38% and 29% of agricultural land in Lucca and Massa Carrara provinces and more than 20% of agricultural land in Arezzo, Florence, Livorno, Pistoia and Prato provinces, therefore it has been considered representative of the Tuscan agricultural landscape.

The scores of landscape richness are quite similar across the different provinces, ranging from 0.22 in the Pistoia province to the 0.27 of the Livorno province. This indicates that the number of landscape categories recorded in each province is relatively similar, which is not surprising, considering the limited geographical extension of the study area. The scores of landscape diversity indicators are reported in Table 3.

Insert Table 3 about here

As regards the volume of tourism flows, 2007 data show that the Florence province is attracting the highest number of tourist arrivals in absolute terms, and they mostly visit the city monuments and art works. Other provinces that experience considerable inbound tourist flows for cultural purposes are Pisa, Siena, Arezzo and Lucca. Seaside tourism proves to be relevant for the provinces of Livorno, Grosseto, Lucca and Massa Carrara, while countryside tourism flows appears to be particularly significant for Siena, Florence, Pisa and Pistoia (Regione Toscana, 2008). The relevant figures are displayed in Table 4.`

Insert Table 4 about here

According to the World Tourism Organization in 2007 worldwide tourism flows have experienced an expansion, thus confirming the medium and long term growing trend, with international arrivals growing by 6 % with respect to 2006. In absolute terms, Italy has achieved a good position in the international scene, recording a 3.3 % increase in international inbound tourism flows. However, this variation appears to be below the one achieved in 2006, as well as below the global trend for 2007 (WTO, 2008).

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[5] There are thirty-nine municipalities in the Arezzo province, forty-four in Florence province, twenty-eight in the Grosseto province, twenty in the Livorno, thirty-five in the Lucca province, seventeen in the one of Massa-Carrara, thirty-nine in the Pisa province, twenty-two in the Pistoia province, seven in the Prato province and thirty-six in the Siena province.

In the specific case of Tuscany, 2007 can be considered as a good year with increases in both, the international and the domestic component of tourism flows, scoring an increase of 2.7% and 1.1% respectively. However these gains have not been homogeneously distributed across the different provinces and types of tourism resources, such as art, mountain, coast and countryside. Those provinces characterized by mountainous territory have recorded a very good performance during 2007, while the increase in tourism arrivals in coastal areas has slowed down with respect to the previous year. The Tuscany regional administration states that tourism in Tuscany is gradually expanding to areas with lower tourism intensity and lower level of economic development, for instance mountain areas.

4. Model specification and estimation results

In order to estimate the impact of landscape diversity and agricultural amenities on the tourism destination choice, a model has been constructed according to the specification displayed in Equation (3):

$$\ln Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + u_i \tag{1}$$

In the above equation, the number of tourist arrivals in each municipality is adopted as the dependent variable[6]. The selected explanatory variables are the socio-demographic and geographical characteristics of each municipality(x_1), accommodation availability and price levels[7] (x_2), the share of protected area on the municipal territory and the number of neighbouring protected sites (x_3), landscape metrics (x_4), the number of DOCG and DOC wines produced in each municipality (x_5) and the types of touristic attraction factors (x_6)[8].

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[6] The logarithmic transformation of the number of tourists was performed as this appeared to fit the data better than the linear form; this choice is consistent with the majority of recreation studies that apply this functional form.

[7] Price levels are measured by the Consumer's Price Index for each province of the region, as computed by the Italian bureau of statistics (ISTAT). This index is expressed as the change in the price of a selected basket of goods with respect to the base year.

[8] It would have been interesting to include a variable referring to tourist income. However, the data on tourist flows has not been retrieved from a survey, therefore such an information was not available. Moreover, the country of origin of international tourists and the region of origin of domestic ones was not available too.

Clear differences appear between domestic and international tourism flows. According to the obtained results, the municipality's spatial dimension appears to be positively influencing the number of domestic arrivals while it is not significant in explaining international tourism flows. The accommodation availability turns out to be positively significant for both international and domestic tourist arrivals as well as the presence of protected areas in the municipality or in its surroundings.

When it comes to landscape metrics, it can be noted that landscape richness is significant and exerts a positive influence on the number of incoming visitors, both in the international and in the domestic case. On the contrary, the surface characterized by complex cultivation patterns has a positive and significant impact only on international arrivals and the same can be said about the number of DOCG wines produced in the municipality. This result conveys the idea that the popularity of Italian wines, and not only their quality, may be a substantial pull-factor especially for international tourists. As far as the types of tourism attractions are concerned, art destinations appear to attract both international and domestic tourists. Table 5 and 6 present these results.

Insert Table 5 and Table 6 about here

4.1.2 Monetary evaluation of the impacts of agricultural landscape and quality wines on tourism revenues

Since the results of the econometric analysis showed that agricultural landscape and quality-wine production positively influence tourism flows, it seems interesting to attach a monetary value to these externalities. This results in an economic valuation of the impacts of landscape and wine production in the different provinces of Tuscany.

The total revenues generated by tourism in 2007, aggregated at the province level, were retrieved from the Tuscany regional administration's statistical service. This amount has been multiplied by the share of complex cultivation patterns out of the total agricultural land in each province and by the coefficient obtained in the regression model. The same procedure has been followed for the number of DOCG wines produced on the territory of each province, according to Equation (2):

$$\textit{Monetary value}_{j,i} \ = \ \text{Re}\,venue_i *\ \overset{\wedge}{\beta_i}\ *\ score_{j,i} \qquad\qquad (2)$$

The result is an estimation of the monetary value of the positive externalities represented by agricultural landscape and high-quality wines at the province level. These values appear to be quite significant and they differ quite substantially across the different provinces. This consideration allows ranking the different Tuscan provinces with respect to the monetary values associated to their agricultural landscape and high-quality wine production.

It is worth noting that while Florence and Siena achieve high monetary values in terms of both indicators, all other provinces are ranked in different position when considering agricultural landscape and wine production. For instance, agricultural landscapes achieves high values in the Lucca and Livorno provinces, which score the lowest in DOCG wine production. By contrast, Pisa, Arezzo, Grosseto and Pistoia obtain a better monetary value for their wine production than for their agricultural landscape. These results are displayed in Table 7.

Insert Table 7 about here

The policy implications of this analysis involve the definition of priorities in terms of valorisation and branding of two of the main touristic resources in Tuscany, wine and agricultural landscape. The proposed evaluation has the merit of estimating a monetary value for the benefits deriving from the exploitation of those resources.

This evaluation is not intended to be an ultimate measure of the economic value of such resources; nonetheless, it provides a useful benchmark for the definition of the investment choices aiming at promoting the tourism industry. It also helps identifying the type of tourist attraction factor generating the highest revenues in each province and would thus allow the Tuscany region to better calibrate and differentiate its offer to match a complex and composite tourism demand.

6. Discussion and further research needs

The main aim of the present paper was to assess the influence exerted by agricultural landscape and high quality wine production on tourism demand. In addition, it seemed interesting to ascertain the potential differences in the impact of those metrics on the

behaviour of international and domestic tourists. Finally, in order to analyse the policy implications of the achieved results, a monetary evaluation of those impacts was performed on the basis of the revenue generated by tourism services in each province.

It seems possible to draw some conclusions on the use of landscape metrics as explanatory variables in a model explaining the tourists' destination choice. Landscape richness proved to be positively correlated to the number of tourism arrivals in the model concerning total tourists as well as in the models for international and domestic tourists respectively. This outcome suggests that, on the one hand, the indicator succeeds in describing landscape diversity at a level that is easily perceived by tourists, and, on the other hand, that tourists are attracted by the visual component of landscape diversity, regardless their origin.

Complex cultivation patterns turn out to exert an unambiguous positive impact, both for total and international tourists. Complex cultivation patterns encompass small parcels of different annual crops, fruit trees, berry plantations, vineyards and olive groves, thus creating the typical countryside patchwork image. The fact that tourism arrivals are positively influenced by this landscape structure reinforces the result obtained for landscape richness and is consistent with the results of reviewed studies that highlighted the value of rural landscapes as a tourism attraction factor.

An attempt has also been made to assess the impacts of specific landscape categories, such as vineyards and olive groves, on tourism demand. These variables did not turn out to be significant in the model and this can be explained by the fact that the available data did not concern only tourist flows towards rural areas. The same analysis performed specifically on rural tourists may deliver different results. The production of DOCG wines in the territory of a municipality exerts a positive influence on total and international tourist arrivals. This is an important result since DOCG wines represent the most well-known high quality Italian wines and are linked to the specificities of the location.

The second part of this analysis focused on the differences between the determinants of international and domestic tourism demand. The two segments present some clear similarities, since they are both positively influenced by the spatial extension of the municipality, by accommodation availability, by landscape richness and by seaside and art destinations. However some discrepancies can be identified as well, since the international visitors appear to be positively influenced by the presence of vineyard landscape and high-quality and internationally renowned wines. Domestic tourists instead, do not seem to be influenced by high-quality wine production nor by the agricultural landscape. These

differences in perception of tourism pull factors is an interesting outcome of this paper as it suggests that domestic tourists are less influenced by those factors directly linked to the popularity and reputation of the destination. The share of the municipality mapped as Natura 2000 protected area and the proximity of protected sites are significant for both the international and the domestic segment, indicating that tourists are sensitive to the political choices regarding environmental protection.

The relevance of agricultural landscape and high quality wine production in attracting tourism flows is already taken into account when designing policies to enhance the tourism potential of Tuscany. However, further research on the different structures of domestic and international tourist demand would allow the region and its municipality to select and encourage certain segments of tourism. This choice could also profit from an economic valuation exercise, aiming at attaching a monetary value to agricultural landscape and high-quality wine production, since this could help determining the resources having the highest tourism attraction power for each specific location. In order to analyse this issue in more detail, it could be interesting to repeat the analysis including other traditional products, such as meat and cheese products promoted by the slow food movement, as well as variables describing the tourists' behaviour during their stay at the destination, such as the type of preferred accommodation, the activities undertaken and duration of stay.

Tables

Table 1 CORINE Land Cover classification and classes considered in the development of landscape metrics

Code	Description	Landscape richness and Patch Density	Relative abundance
1.1.1	Continuous urban fabric	X	
1.1.2	Discontinuous urban fabric	X	
1.2.1	Industrial or commercial units	X	
1.2.2	Road and rail networks	X	
1.2.3	Port area	X	
1.2.4	Airport	X	
1.3.1	Mineral extraction sites	X	
1.3.2	Dump sites		
1.3.3	Construction sites	X	
1.4.1	Green urban areas	X	
1.4.2	Sports and leisure facilities	X	
2.1.1	Non-irrigated arable land	X	X
2.1.2	Permanently irrigated land		
2.1.3	Rice fields	X	
2.2.1	Vineyards	X	X
2.2.2	Fruits and berries plantations	X	
2.2.3	Olive trees	X	X
2.3.1	Pastures	X	
2.4.1	Annual crops associated with permanent crops	X	
2.4.2	Complex cultivation patterns	X	
2.4.3	Principally agriculture with natural vegetation	X	
2.4.4	Agro-forestry areas		
3.1.1	Broad-leaved forest	X	
3.1.2	Coniferous forest	X	
3.1.3	Mixed forest	X	
3.2.1	Natural grasslands	X	
3.2.2	Moors and heathland	X	
3.2.3	Sclerophyllous vegetation	X	
3.2.4	Transitional woodland shrubs	X	
3.3.1	Beaches, dunes and sand plains	X	
3.3.2	Bare rock	X	
3.3.3	Sparsely vegetated areas	X	
3.3.4	Burnt areas	X	
3.3.5	Glaciers and perpetual snow		
4.1.1	Inland marshes	X	
4.1.2	Peat bogs		
4.2.1	Salt marshes	X	
4.2.2	Salines		
4.2.3	Intertidal flats		
5.1.1	Water courses	X	
5.1.2	Water bodies	X	
5.2.1	Coastal lagoons	X	
5.2.2	Estuaries		
5.2.3	Seas and oceans		

Source: CORINE Land Cover Database

Table 2 Description of the data sources

Variable	Unit	Year	Source
International arrivals	000	2007	Regione Toscana
Domestic arrivals	000	2007	Regione Toscana
Area of the municipality	Ha	2007	Regione Toscana
Population	000	2001	Regione Toscana
Accommodation availability	Number	2007	Regione Toscana
Share of budget accommodation	%	2007	Regione Toscana
Consumer's Price Index		2007	ISTAT
Natura 2000 (share of municipality area)	%	2007	Natura 2000 database; ARCGIS
Elevation above sea level	M	2007	Regione Toscana
No. DOC	Number	2007	FISAR
No. DOCG	Number	2007	FISAR
Landscape richness	0-100 scale	2007	CORINE Land Cover Database
Vineyards	0-100 scale	2007	CORINE Land Cover Database
Olives	0-100 scale	2007	CORINE Land Cover Database
Arable land	0-100 scale	2007	CORINE Land Cover Database
Temperature	°C	2007	University of Florence
Precipitation	Mm	2007	University of Florence
N2000 sites within 25 km	Number	2007	CORINE Land Cover Database; ARCGIS
N2000 sites within 50 km	Number	2007	CORINE Land Cover Database; ARCGIS
Art (main tourism attraction)	Dummy	2007	Regione Toscana
Seaside (main tourism attraction)	Dummy	2007	Regione Toscana
Mountain (main tourism attraction)	Dummy	2007	Regione Toscana
Other (main tourism attraction)	Dummy	2007	Regione Toscana

Table 3 Scores in the landscape metrics for Tuscan provinces

Province	Landscape richness	Complex cultivation patterns
Arezzo	0.24	0.25
Firenze	0.26	0.24
Grosseto	0.24	0.13
Livorno	0.27	0.21
Lucca	0.24	0.38
Massa Carrara	0.24	0.29
Pisa	0.24	0.15
Pistoia	0.22	0.21
Prato	0.25	0.21
Siena	0.23	0.16

Source: CORINE Land Cover Database, own elaboration

Table 4 Descriptive statistics of 2007 tourist arrivals in Tuscany by origin and tourism resource

| | Art | | Mountain | | Countryside | | Seaside | | Other | | Tourist arrivals | |
Province	International	Domestic	International	Domestic	International	Domestic	International	Domestic	International	Domestic	International	Domestic
Arezzo	101,711	200,215	8,972	31,709	17,367	21,799	0	0	16,833	13,194	144,883	266,917
Firenze	2,173,899	907,746	38,370	32,057	97,112	83,679	0	0	508,059	270,861	2,817,440	1,294,343
Grosseto	21,275	39,401	18,146	43,318	2,140	4,747	172,264	682,760	10,737	75,107	224,562	845,333
Livorno	0	0	0	0	5,759	10,470	336,057	836,087	8,540	12,516	350,356	859,073
Lucca	151,601	142,508	13,364	36,353	0	0	204,813	337,780	2,881	5,058	372,659	521,699
Massa Carrara	8,529	21,596	108	690	2,506	7,017	50,930	149,942	2,297	7,462	64,370	186,707
Pisa	404,581	337,232	0	0	61,914	49,573	0	0	42,900	46,407	509,395	433,212
Pistoia	40,439	55,975	5,987	43,451	33,485	56,094	0	0	485,238	212,972	565,149	368,492
Prato	132,703	77,027	524	3,387	7,102	7,570	0	0	271	535	140,600	88,519
Siena	404,663	335,393	2,069	17,335	168,665	110,748	0	0	142,701	245,022	718,098	708,498
Total	**3,439,401**	**2,117,093**	**87,540**	**208,300**	**396,050**	**351,697**	**764,064**	**2,006,569**	**1,220,457**	**889,134**	**5,907,512**	**5,572,793**

Source: Regione Toscana, 2008

Table 5 Estimation results for international tourist arrivals

International tourists	Coefficient	P>|t|
Area	0.0000321	0.020**
Accommodation availability	0.0001585	0.000***
Consumer's Price Index	-.0300402	0.126
Natura 2000 (%)	0.8693671	0.179
Landscape richness	3.335082	0.087*
Complex cultivation patterns (% area)	0.3249696	0.006**
No. DOCG	0.0798978	0.000***
N2000 within 25 km	0.6375517	0.003**
Art	0.7716575	0.001**
Seaside	0.3741198	0.306***
Other	0.7834912	0.002**
Constant	9.83585	0.000***
R2		

Statistical significance of 0.1%. 5% and 10% is indicated by ***. **. * respectively

Table 6 Estimation results for domestic tourist arrivals

Domestic tourists	Coefficient	P>|t|
Area	.0000492	0.000***
Accommodation availability	.0001325	0.000***
Consumer's Price Index	-.0342442	0.029*
Natura 2000 (% area)	.992435	0.055*
Landscape richness	2.768308	0.075*
Complex cultivation patterns	.1361711	0.149
No. DOCG	.209011	0.212
N2000 within 25 km	.053343	0.001**
Art	1.069137	0.000***
Seaside	1.317361	0.000***
Other	.6617854	0.001**
Constant	10.41817	0.000***
R2		**0.61**

Statistical significance of 0.1%. 5% and 10% is indicated by ***. **. * respectively

Table 7 Monetary evaluation of the impact of agricultural landscape and high-quality wine production on tourism flows

Province	Agricultural landscape (€/ year)	Province	DOCG wines (€/ year)
Firenze	103,702,920 €	Firenze	36,889,950 €
Lucca	23,403,987 €	Siena	20,235,749 €
Siena	15,263,926 €	Pisa	2,507,084 €
Livorno	10,763,168 €	Arezzo	1,181,911 €
Pisa	8,736,871 €	Grosseto	1,002,834 €
Arezzo	6,768,081 €	Pistoia	626,771 €
Grosseto	3,008,194 €	Prato	411,878 €
Pistoia	2,994,829 €	Livorno	0 €
Massa-Carrara	2,733,104 €	Lucca	0 €
Prato	997,138 €	Massa-Carrara	0 €

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