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THE EFFECT OF TOURISM ON THE HOUSE MARKET: THE CASE OF SARDINIA[1]

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[1] Though the work is the result of a joint effort of the two authors B. Biagi is responsible for the writing of sections 1, 2 and 5, while A.Faggian of sections 3 and 4.

1. Introduction

Tourism activity involves consumption of many goods and services, all of them supplied by different firms (hotels, restaurants, travel agencies, local public and private services) and required by different consumers (tourists and residents). For this reason the tourism product is defined as a basket of goods and services (Gilbert 1990, Candela 1996, Sinclair and Stabler 1997) which includes natural, cultural and man-made resources. This heterogeneity makes it not an easy task to calculate the actual and overall effect of tourism on a local economy. Generally, the impact of tourism has been studied applying standard approaches, such as input–output and keynesian multipliers which calculate the direct, indirect and induced effects of the activity at local, regional or national level. One part of the literature goes in the direction of applying - or considering the possibility of applying- other methodologies in order to include non-priced goods in the economic evaluation of tourism (Stabler, 1998). Nevertheless, all these approaches do not take into account the economic relationship between house prices and tourism.

The main purpose of the paper is to investigate the correlation between house prices and tourism in order to confirm the general expectation that local housing market should benefit from the presence of the vacation industry, i.e. the more tourist the urban area is, the higher the prices of houses located there are. Using the HPM, we estimate the implicit value of tourism which is embodied in house prices for the case of Sardinia (Italy) at municipality level. Before reaching the final estimations, however, we pass through one fundamental step: the creation of a reliable tourist index through which discriminating in a scientific manner among the locations under analysis. The purpose here is to go beyond the too general binary classification based on the subjective knowledge of the region or on rough data to create objective indices using different methodologies. In the final step, the two indices are included in the hedonic model to test the effect of tourism. Both performed as we expected confirming the hypothesis of positive and significant correlation between tourism activity and house price.

The organisation of this paper is as follows:

- section 2 introduces the theoretical framework of HPM;
- section 3 explains the methodologies on the basis of the two indices and the hedonic regression used in this case;
- section 4 describes the results obtained for the Sardinian municipalities;

❖ section 5 highlights the main conclusions and further development of the paper.

2. HPM: a theoretical framework

In the case of heterogeneous goods, hedonic price measures the contribution of each qualitative attribute to the total price. From a technical point of view the implicit price of attributes are obtained regressing them against the total price of the good itself. One of the first studies on HPM is due to Waugh's work in 1929 (Sheppard, 1999). However, the term "hedonic" dates back to 1939, when Andrew Court used it, for the first time, to indicate "the analysis of prices and demand for the individual source of pleasure" (Sheppard 1999, p. 1597). After Court's contribution HPM is not applied until the 1960s, in which Griliches (1961, 1971) gives the popularity to the method[2]. Until that moment, however, HPM is considered exclusively a statistical technique not linked to any economic theory. It is Rosen (1974) to offer the fundamental theoretical framework for hedonic analysis. In his theoretical framework, consumers see heterogeneous goods as bundle of quantitatively measurable characteristics. The prices difference among similar goods reflects the concentration and composition of characteristics.

The HPM has not been broadly used in tourism studies. Some contributions analyse the price competitiveness of holiday packages promoting London and Paris (Clewer et al 1992), others calculate the competition between Mediterranean resorts starting by the inclusive tour holidays supplied by tour operators (Papatheodorou 2002, Espinet et al. 2003, Clerides et al. 2003, Mangion et al. 2003) and other studies estimate hedonic price models for tourist resorts (Sinclair et al. 1990 for the case of Malaga).

Conversely, the hedonic literature on housing is quite extensive, the implicit price of each characteristic find through the regression represents the equilibrium between demand and supply. As in Rosen the consumer's utility is represented by:

$$u = u(Z, Y, \alpha) \qquad (2.1)$$

where: Z = characteristics of the house;

[2] According to Goodman (1998), the reasons behind this gap in time is due to the major interests of academic world during the 50s and 60s for more macroeconomic themes along with the difficulty to apply techniques requiring sophisticated computer programmes which allow to individuate the most suitable functional form and the most significative variables among the explicative ones.

Y = composite good;

α = vector of consumer attributes (such as education, income, social status).

The budget of each individual is constraint by the income, the price of Y (all the other goods) and the price of housing (function itself of housing characteristics). Therefore, for each level of income and utility the willingness to pay (θ) for housing or "bid rent function" is:

$$\theta = \beta(Z, M, u, \alpha) \qquad (2.2)$$

where: Z= the quantity of attributes of the house;

M= consumer's income;

u= the satisfaction of buying other goods;

α= individual's preferences.

Implicitly the (2.2) assumes that consumer's utility is:

$$u = u(Z, M - \beta, \alpha) \qquad (2.3)$$

where: Z= vector of attributes of the house

M – β= amount of income used for other goods

α= consumer's preferences

The first derivative of the bid rent function is $\partial\beta/\partial Z_i$, i is the finite number of house attributes. This derivative indicates the consumer's willingness to pay each attribute maintaining constant the level of his total utility. Given preferences and income, the maximisation of individual's utility in consuming both, the house and the composite good is:

$$\max_{Z,Y} u = u(Z, Y, \alpha) \qquad (2.4)$$

s.t.

$$M \geq P(Z) + Y$$

where: P(Z)= income used to buy the house

Y = income used to buy others goods

The first order condition in this case is:

$$\frac{u_i}{u_Y} = P_i \forall_i \qquad (2.5)$$

where: $u_i = \partial u/\partial Z_i$

$P_i = \partial P/\partial Z_i$

The derivative P_i represents the demand implicit hedonic price for characteristic *i* (while P(Z) represents the hedonic function of the total price).

If we equal the first order condition (2.5) to the derivative of the bid rent function we obtain the consumer optimum:

$$\frac{\delta\beta}{\delta Z_i} = \frac{u_i}{u_Y} = P_i \qquad (2.6)$$

To introduce the supply side in the model, let us start by defining the cost function of each firm:

$$C = C(Z, N, \gamma) \qquad (2.7)$$

where: Z= characteristics of the house;

N= number of houses already produced

γ = vector of producer attributes which are different among producers (the cost of the production factors and the parameters of the production function).

Each producer is price-taker with respect to the total market price P(Z), the optimum profit is obtained when the difference between total revenue and total cost is maximised:

$$\max_{Z,N} \pi = P(Z) * N - C(Z, N, \gamma) \qquad (2.8)$$

The first order condition to maximise the profit is:

$$P_i = Ci \qquad (2.9a)$$

$$P(Z) = C_N \qquad (2.9b)$$

where: C_i= marginal cost of an additional unit of characteristic *i*;

C_N = marginal cost of an additional house.

Equation (2.9a) implies that each characteristic will be produced until the marginal cost to produce will be equal to the marginal price (the hedonic price). The (2.9b) means that a new house will be produced until the marginal cost of producing an additional house is equal to the total market marginal price of the house (which itself depends on the characteristics embodied in the house).

Given the profit, the producer bid rent function is the combinations between house attributes and the price the firm is willing to receive for each type he produces:

$$\phi = (Z, \pi, \gamma) \qquad (2.10)$$

where: *Z*= quantity of attributes of the house

π= desired profit;

γ= costs of production.

The supplier is price- taker with a market price equal to P(Z) and, in order to maximise the profit, the total market price has to be equal to the his willingness to receive for each attributes (the reservation price):

$$P(Z) = \phi(Z) \qquad (2.11)$$

Finally, in the equilibrium situation for each house type exists an hedonic price function P(Z) for which demand is equal to supply (the willingness to pay, the willingness to accept and the hedonic price are the same).

This theoretical framework is behind the following general hedonic function use by the housing literature[3]:

$$HP = f(S, QE) \qquad (2.12)$$

where: HP = vector of housing price

S = vector of structural characteristics of housing

3 For a survey on this literature see Sheppard (1999).

QE = vector of location characteristics (level of amenities and disamenities which affect housing price).

Among the several functional forms expressing the (2.12), the most common one is the linear:

$$HP = \alpha + \beta' S + \gamma' QE \qquad (2.13)$$

where: β = vector of coefficients of the structural factors S

γ = vector of coefficients of external factors QE

As said before, the implicit price of each attribute indicates how much the total price increases if the characteristic k (either structural or environmental) increases of one marginal unit. The expected signs of the vectors are:

$\beta' > 0$ ($\partial P/\partial S$)

$\gamma' > 0$ ($\partial P/\partial QE > 0$) if the QE factor represents an amenity

$\gamma' < 0$ ($\partial P/\partial QE < 0$) if the QE factor represents a disamenity

3. Methodology

3.1. Indices of Tourism

To achieve the first goal of the paper, i.e. building reliable tourism indices for the Sardinian municipalities, we apply two different methodologies and compare the final classifications resulting from them.

The first of the two methodologies is based on a ranking procedure. Firstly, we collect data on six variables linked with tourism: expenditure in the recreation and tourism sector, number of summer houses, total number of recreational structures (hotels, campings and tourist villages), number of employees in the tourism industry (which was used to calculate location quotients), distance from the coast and altitude of each municipality. Secondly, we create six different rankings, one for each variable, for all municipalities. To do this, we used the Van der Waerden ranking scores (VdW), which is a type of fractional rank. In order to understand what a fractional rank is, let us call

our observations y_i and the corresponding case-weight[4] W_i with i=1,2,…,377. After defining $A=\sum_{i=1}^{377} W_i$, a "fractional rank" can be expressed as $RF_i = R_i / A$ where R_i is the rank of each observation. Van der Waerden slightly modified this index proposing the following formula:

$$VdW_i = R_i /(A+1) \qquad (3.1)$$

The VdW fractional rank is simply a way of standardising scores[5] so that they range from 1/(n+1) to n/(n+1). In our case, with n=377, the domain of the scores is between a value of around 0.0026 to a value of 0.9973. Note that a higher score corresponds to less touristic areas and vice versa. After having calculated the VdW index for each touristic variable separately, we average out the six scores to obtain the final index of tourism (INDTUR4):

$$INDTUR4_i = \sum_{j=1}^{6} VDW_{ij} / 6 \qquad (3.2)$$

The second methodology borrowed the idea of Euclidean distance, which is at the core of cluster analysis. Cluster analysis is a statistical procedure used to create groups of similar cases from a sample of observations. Our initial thought was to use cluster analysis to create different groups with increasing levels of tourism (from low to high tourist locations). However, this would not provide a sequential ranking of all the municipalities, which is essential for a comparison with the previous VdW index. Even tough cluster analysis calculates the distance of each observation from the centroid of its corresponding cluster, it says nothing about the direction away from the centroid. Therefore, it is impossible to know whether the distance means that the specific municipality is more or less touristic than the central observation of its cluster. To overcome this problem, we selected a priori the municipality with the highest values for the 6 tourist variables under analysis and we then calculated an n-dimensional (n=6)

[4] We decided to give the same weight to all cases, but this hypothesis can be removed and weights like the population or the surface of each municipalities can be used to create a more sophisticated index.
[5] For alternative ways of standardising scores see Tukey (1962) and Blom (1958)

Euclidean distance from this top-touristic municipality and each of the observations[6]. The municipality we selected as a benchmark was Alghero. This urban area has 61 recreational structures, a location quotient of 2.14 for the tourism sector, an index per-capita expenditure for recreational activities of 25.01, an average of 0.19 summer houses per inhabitant, a distance from the coast of just 0.54 km and an altitude of 7 meters. After we select Alghero as a benchmark, we calculate the Euclidean distance from it and the rest of the municipalities. The Euclidean distance between two items, i and j, is the square root of the sum over the 6 variables of the difference in values squared. In our case the Euclidean distance between Alghero (point A) and another municipality (point y_m) is expressed as:

$$E_{Ay_m} = \sqrt{\sum_{j=1}^{6}(A_j - y_{mj})^2} \qquad \text{m=1, 2,..,377} \qquad (3.3)$$

These distances can be easily calculated by creating a cluster for each observation in the sample (i.e. 377 clusters in our case) and using the distance matrix that is included in the outcome of the cluster analysis. The distance matrix gives all the distances between pairs of observations. By looking at the column (or row) corresponding to Alghero, we had all the distances needed for our index (INDTUR5).

$$INDTUR5_{y_m} = E_{Ay_m} \qquad (3.4)$$

with A=Alghero, m=1,…,377

This index has a lower bound of zero (specifically Alghero with itself), but no upper bound since the distance can take any value. In the future, one might consider standardising this index, but we are not concerned with that here. All we care about is that a lower value of INDTUR5 corresponds to a higher degree of tourism vocation of the area as the case for the previous INDTUR4 index.

3.2. Hedonic Regression

[6] The top-touristic location is also included

The indices described in the previous section, INDTUR4 and INDTUR5, are now incorporated in an hedonic regression of type:

$$HP_i = f(S_i, E_i, QL_i, T_i) \qquad (3.5)$$

with i=1,2,…,377

where HP=housing market variable

S=Vector of structural characteristics of the housing market

E=Vector of economic and location characteristics of the municipality

QL=Vector of quality of life variables at the municipality level

T = municipality tourist indices (either INDTUR4 or INDTUR5)

The function in equation (3.5) can be expressed using a variety of different forms. In this work, we choose a simple linear form, not having any a-priori reason to assume a different functional form. Equation (3.5) becomes therefore:

$$HP_i = \alpha + \beta'^{(k)} S_i^{(k)} + \gamma'^{(m)} E_i^{(m)} + \delta'^{(p)} QL_i^{(p)} + \phi T_i + \varepsilon_i \qquad (3.6)$$

with i=1,2,…,377

where k=number of structural characteristics

m=number of economic and location characteristics of the municipality

p=number of quality of life variables

Notice that β, γ and δ are vectors and ϕ is a scalar, which gives us the effect of tourism on the house market. We expect tourism to have a positive effect on housing market, which means, recalling the way tourist indices have been built, that we expect $\frac{\partial HP_i}{\partial T_i} = \phi < 0$.

4. Results of the empirical Analysis

Before analysing the results of our empirical analysis, it is important to give some information about Sardinia. Sardinia is the second main island of Italy and is seven hours away from the mainland by boat (around one hour by plane). It has a surface of 24.089 square km. (7,9% of the national surface) and a coastal line of 1.731 km.

Bathing water is safe in 847 kilometres of the coast (17% of the Italian safe coasts). The island belongs to that group of Italian regions having a special statute (that means among other legislative autonomy). Administratively the island is divided in four provinces: Cagliari (in the South), Nuoro (in the East), Oristano (in the West) and Sassari (in the North). The province of Cagliari has 108, Nuoro 104, Oristano 78 and Sassari 90.

More than one and half million people live in Sardinia (1,651,888 in 1999, 2.8% of Italian population). 50% of these live in the province of Cagliari and 28% in the province of Sassari. The average population density is less than one third[7] the average population density of Italy (67 inhabitants per km^2 versus 191). Sardinia relies upon five ports (Arbatax, Cagliari, Golfo Aranci and Olbia) and three airports (Alghero, Cagliari and Olbia). Since the 1960's, when the tourism industry started developing very fast, the province of Sassari has been the strongest attraction of Sardinia. Nowadays, 50% of tourist demand is concentrated in Sassari and so are 50% of all the tourist beds (hotels, camping sites and tourist villages).

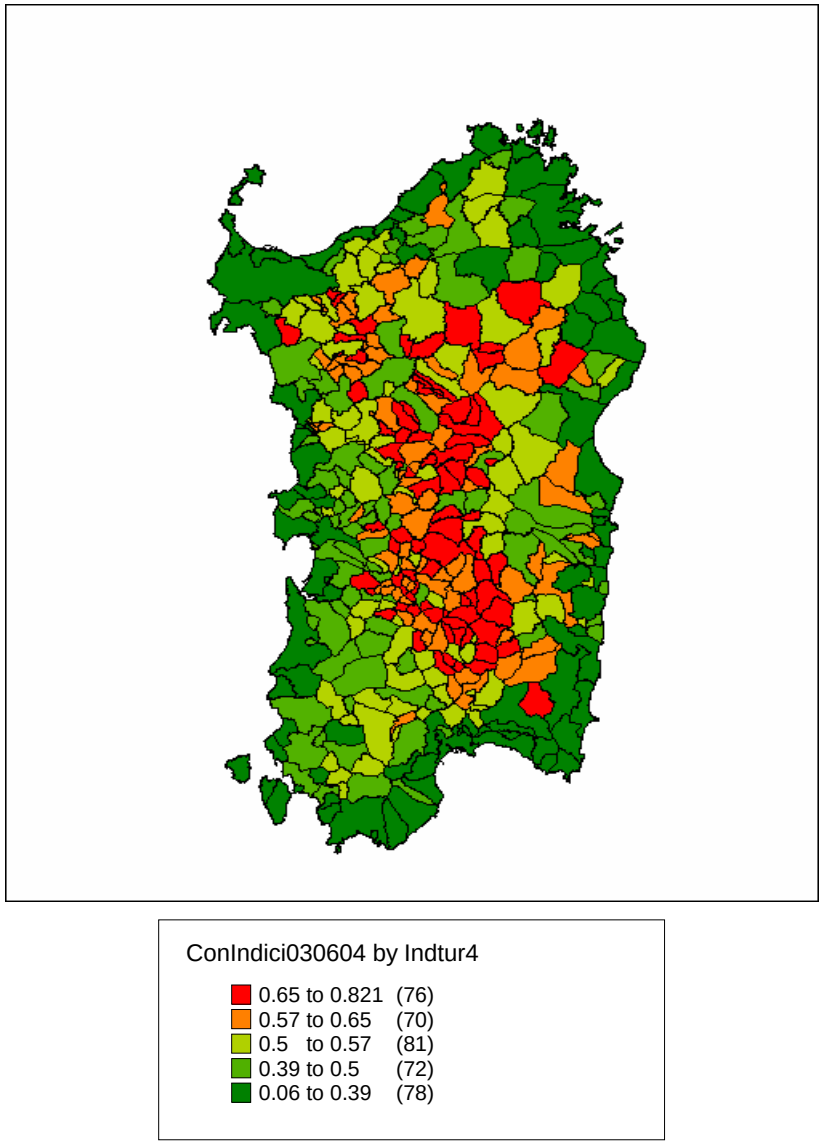
This background information on the economy and tourism industry in Sardinia helps us better understand the results of the empirical analysis, which are presented in the next two sections.

4.1 Tourism indices

As already explained in the previous paragraph, we devised two different methodologies to create an index of how "touristic" each municipality is. The results of the first index (INDTUR4), based on the Van Der Waerden proportional ranks, are given in Figure 1 (see Table A.1, Appendix A, for a full list of the indices by municipality).

[7] More precisely 112 in Cagliari, 61 in Sassari, 60 in Oristano and 39 in Nuoro

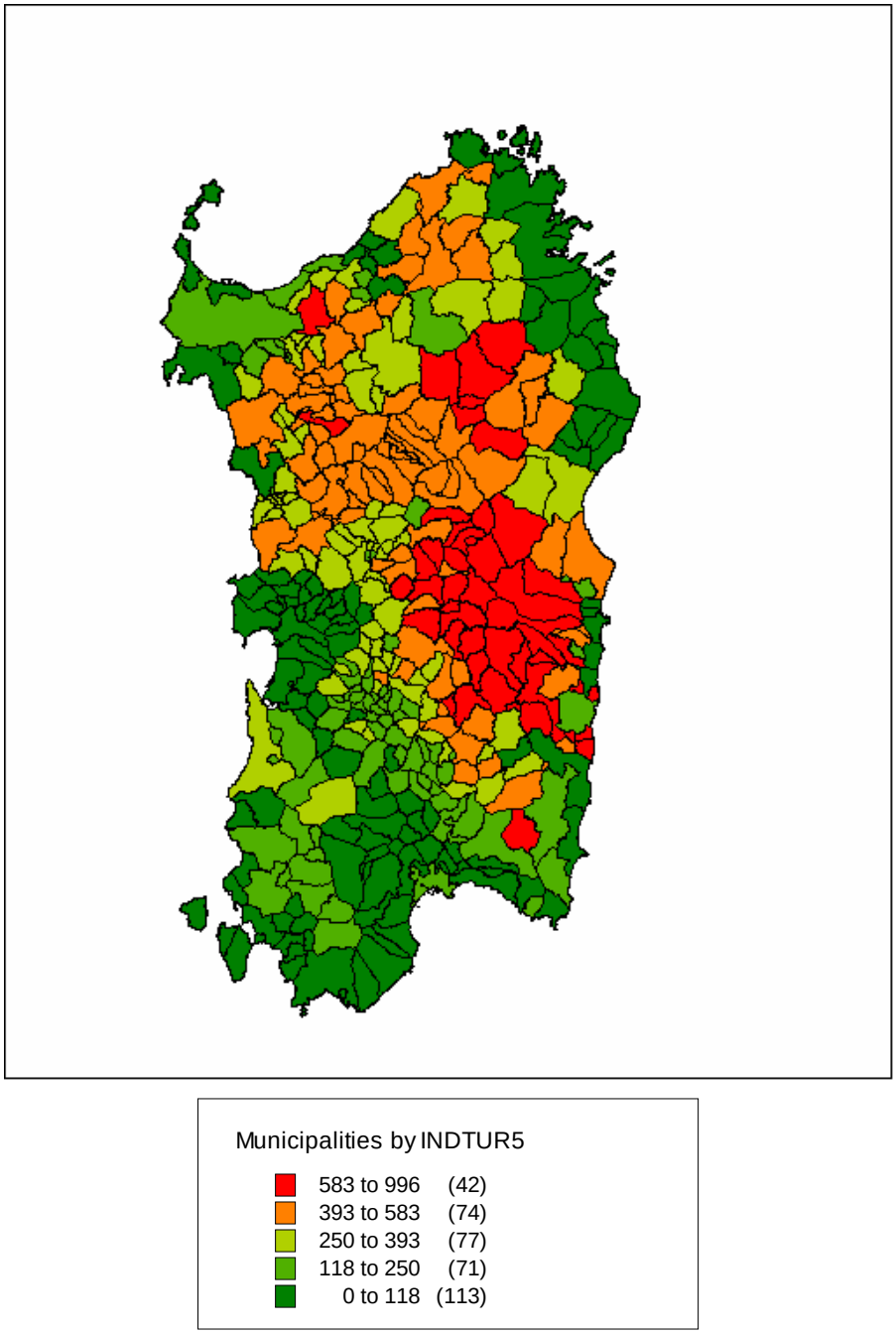
Figure 1: Classification of Sardinian municipality according to INDTUR4



Tourist municipalities are mainly located along the coastal line, as it is reasonable to expect, while the central municipalities, more rural and less densely populated, are the least tourist.

A similar result is obtained by applying the second methodology based on cluster analysis (INDTUR5). Figure 2 presents the outcome of this (see Table A.2, Appendix A, for a full list of indices by municipalities).

Figure 2: Classification of Sardinian municipality according to INDTUR5



The division between coastal-tourist municipalities and central-non tourist areas is still evident, though with some exceptions on the East coasts (Orosei and Dorgali). The least tourist municipalities now are mainly "centred" around the Nuoro area. The two indices, though giving slightly different results, show a significant degree of correlation[8].

[8] The Pearson's correlation between the two indices is 0.509, significant at the 0.01 level (two-tailed).

4.1 Hedonic regression analysis

The main aim of this section is to evaluate the effect of tourism on local house market, i.e. are prices affected by tourism and, if so, is this effect significant?

To answer this question, we add the two statistical indices of tourism created in the previous section in a hedonic regression analysis in which we regress the average house rents on structural characteristics of houses, quality of life variables and economic characteristics of the municipalities. A list of the explanatory variables used in the analysis is shown in Table 1.

Table 1: definition of explanatory variables

Variable name	**Definition**	**Type of variable** *(see equation 3.6)*	**Source**
MEDSUPOC	Average surface of houses (square meters)	S	ISTAT
MEDROOM	Average number of rooms per houses	S	ISTAT
RED_ABI	Average individual income (Euros)	E	ISTAT
DENS	Population density	E	Tagliacarne Institute
CONS_ABI	Average individual consumption	E	Tagliacarne Institute
CRIME	Average of attack from 1994 to 1998 to institutional persons and their properties	QL	UNCEM - ANCI Sardegna
DISTPRO	Distance from the province	E	Our elaboration (MapInfo G.I.S)
RAIN	Yearly rain (mm)	QL	Istituto Agro Meteorologico della Sardegna
INDTUR4	Index of tourism based on Van Der Waerden ranking procedure	T	Our elaboration
INDTUR5	Index of tourism based on Euclidean distances	T	Our elaboration

Table 2 presents the results of the final regression models. Model 1 includes structural house characteristics (medsupoc and medroom), economic and location variables (red_abi, dens, distpro) and quality of life variables (rain and crime) both at municipality level. Model 1 gives us an idea of how the explanatory variables perform

without the tourist indices. In Models 2 and 3 the equations have been run introducing the indices of tourism activity developed in the previous section, respectively INDTUR4 in the second model and INDTUR5 in the third one.

Table 2: Regression analysis results

Dependent variable: ***Pmedio***

	Model 1	Model 2	Model 3
Constant	-300.62** (-9.939)	-267.04** (-8.536)	-294.231** (-9.692)
MEDSUPOC	2.143** (8.957)	2.211** (9.352)	2.105** (8.793)
MEDROOM	2.030 (0.528)	2.985 (0.786)	2.653 (0.689)
RED_ABI	0.00208** (10.306)	0.00206** (10.357)	0.00220** (10.383)
DENS	-0.00469** (-2.663)	-0.0064** (-3.561)	-0.0057** (-3.113)
CONS_ABI	-4.806** (-4.113)	-6.557** (-5.229)	-5.558** (-4.494)
CRIME	-2.143 (-0.338)	-6.139 (-0.986)	-2.388 (-0.385)
DISTPRO	-0.00016 (-1.380)	-0.0002* (-1.637)	-0.00015 (1.274)
RAIN	-1.373** (-3.586)	-1.351** (-3.583)	-1.405** (-3.677)
INDTUR4	-	-48.859** (-3.515)	-
INDTUR5	-	-	-0.019* (-1.811)
$Adjusted - R^2$	**0.423**	**0.441**	**0.427**
R^2	**0.436**	**0.454**	**0.441**

As the table highlights, both indices are significant and have the expected sign. The negative sign[9] of the coefficient confirms the positive effect of tourism on the house market. Moreover, the overall significativity of the model is increased, though the effect of INDTUR4 is much stronger than INDTUR5 (the adjusted R-squared increases from 0.423 to 0.441, while with INDTUR5 it increases only up to 0.427). Among the other explanatory variables, the most significant one is the average municipal income (RED_ABI). This means, as expected, that richer areas have higher rents. The negative

[9] Note that, as mentioned in paragraph 3.2, a lower value of the indices means a more touristic area.

coefficient on population density seems to confirm that density is a proxy for congestion rather than agglomeration economies (therefore having a negative effect on housing). Another reasonable result is the sign of the coefficients of quality of life variables, such as rain and crime, which have a negative impact on house prices. Being distant from the province (an index of "centrality") affects negatively the house market although the negative coefficients are not very significant (only in Model 2 the coefficients is significant at 10% level). Out of the two structural housing characteristics, only MEDSUPOC is significantly and positively correlated with the rent, while MEDROOM is insignificant in all three models. An unexpected result was the sign on the average consumption variable. The significant and negative sign seems to testify a substitution effect between consumption and housing (crowding out).

5. Conclusions

This paper develops two levels of analysis. The first one is dominated by the believe that the discrimination between tourist and non-tourist location should be scientific and should take into account the complex character of the tourism good. Therefore, two indices have been developed using two different methodologies with the purpose to compare their results regarding the municipalities classification. In general, both indices gives sensible results, though slightly different final rankings, and are significantly correlated.

The second level of investigation tries to find insights on the relationship between tourist activity and house prices. In order to do this, we use an hedonic function implying the dependence among house price and, respectively, the structural attributes of the good, the quality of the place in which the house is located, and the "tourist" characteristic of the place. The findings confirm the expectations, house market is affected by tourism in a positive way, namely, the more touristic is the place, the higher is the competitive pressure on the house market.

The results of the analysis are rather encouraging in continuing to research in this direction. One of the possible future developments of the work will be the introduction of a more complex hedonic equation to allow for a non-linear relationship between houses prices (therefore implicit prices) and the explanatory variables. Furthermore, it

would be important to consider spatial effects arising from the proximity of the municipalities under analysis. Some refinements of the indices could also be devised.

References

Blom, G. (1958), *Statistical estimates and transformed beta variables*, John Wiley & Sons, New York.

Candela, G. (1996), *Manuale di Economia del turismo*, Clueb, Bologna.

Clerides, S.K., Nearchou, P. and Pashardes, P. (2003), 'Price and quality in international tourism', preliminary draft.

Clewer, A., Pack, A. and Sinclair, M.T. (1992), 'Price competitiveness and inclusive tour holidays in European cities', in P. Johnson and B. Thomas (eds), *Choice and Demand in Tourism*, London, Mansell.

Espinet, J.M., Saez, M. Coendus, G. and Fluvià, M. (2003), 'Effect on prices of the attributes of holiday hotels: a hedonic approach', *Tourism Economics*, 9, 2, pp 165-177.

Gilbert, D.C. (1990), "Conceptual Issues in Meaning of Tourism" in Cooper C.P., *Progress in Tourism. Recreation and Hospitality Management*, Belhaven Press, London.

Griliches, Z. (1961), "Hedonic price indexes for automobiles: an econometric analysis of quality change", *The Price Statistics of the Federal Government*, 73.

Griliches, Z. (1971), "Price Indexes and Quality Change: Studies in *New Methods of Measurement*, Harvard University Press, Cambridge, MA.

Mangion, M.L., Durbarry, R., Sinclair, M.T. (2003), 'AIDS and the hedonic pricing models, their relevance to tourism practitioners', preliminary draft.

Papatheodorou, A. (2002), 'Exploring competitiveness in Mediterranean resorts, *Tourism Economics*, 8, 2, pp 133-150.

Rosen, S. (1974), "Hedonic Prices and implicit market: product differentiation in pure competition", *Journal of Political Economy*, 82, pp 34-55.

Sheppard, S. (1999), "Hedonic Analysis of Housing Market", in *Handbook of Regional and Urban Economics*, E. S. Mills and P. Cheshire (eds), Elsevier Science.

Sinclair M.T., Stabler M. (1997), *The Economics of Tourism*, Routledge, London.

Sinclair, M.T. Clewer, A. and Pack, A. (1990), 'Hedonic prices and the mastering of package holidays: the case of tourism resorts in Malaga', in G.J. Ashworth and B. Goodall (eds), *Marketing Tourism Places*, London and New York, Routledge.

Stabler, M. (1998), "The economic evaluation of the role of conservation and tourism in the regeneration of historic urban destinations", in Laws E. et al. (eds), *Embracing and Managing Change in Tourism*, Routledge, London.

Stabler, M. (1999), "Environmental Aspects of Tourism: Application of Cost-Benefit Analysis" in Baum T. e Mudambi R. (eds) , *Economic and Management Method for Tourism Hospitality Research*, Wiley and Sons, New York.

Tukey, J. W. (1962), The future of data analysis, *The Annals of Mathematical Statistics*, No. 33, pp 1–67

University of Hamburg (2004), Algorithem für SPSS 11.5, http://www.rrz.unihamburg.de/RRZ/Software/SPSS/Algorith.115/

Appendix A

Table A.1: Ranking of municipalities by INDTUR4

Ranking	COMUNE	VdW Score
1	Palau	0.06129
1	Alghero	0.06129
3	Pula	0.06900
4	S.Teresa di Gallura	0.08135
5	La Maddalena	0.08245
6	S.Teodoro	0.08488
7	Bosa	0.09590
8	Olbia	0.09766
9	Arzachena	0.09832
10	Muravera	0.09854
11	Villasimius	0.10428
12	Carloforte	0.10670
13	Budoni	0.10913
14	Golfo Aranci	0.11464
15	Orosei	0.12412
16	Calasetta	0.12698
17	Valledoria	0.12831
18	Stintino	0.13514
19	S.Antioco	0.13558
20	Castelsardo	0.14749
21	Teulada	0.15057
22	Siniscola	0.15675
23	Posada	0.15983
24	S.Anna Arresi	0.16071
25	Quartu S.Elena	0.16116
26	Bari Sardo	0.16182
27	Domus De Maria	0.16204

28	Sorso	0.17504
29	Badesi	0.19092
30	Cabras	0.19356
31	Fluminimaggiore	0.19577
32	Villaputzu	0.19819
33	Dorgali	0.20018
34	Loiri Porto S.Paolo	0.20326
35	Trinita' d'Agultu e Vi	0.20459
36	Buggerru	0.20723
37	Lotzorai	0.21274
38	Cagliari	0.22354
39	Tortoli'	0.22840
40	Castiadas	0.23567
41	Cuglieri	0.24184
42	Oristano	0.24691
43	Tertenia	0.24846
44	Cardedu	0.24912
45	Sinnai	0.25022
46	Baunei	0.25044
47	Maracalagonis	0.25441
48	S.Vero Milis	0.25639
49	Narbolia	0.26213
50	Arbus	0.27050
51	Sarroch	0.27734
52	Portoscuso	0.28086
53	Magomadas	0.28439
54	Aglientu	0.28704
55	Gonnesa	0.29299
56	Selargius	0.29365
57	Terralba	0.29696
58	Porto Torres	0.30049
59	Tresnuraghes	0.30732
60	Torpe'	0.31724
61	Girasole	0.33466
62	Capoterra	0.34854
63	Telti	0.35097
64	Arborea	0.35604
65	Quartucciu	0.35913
66	Masainas	0.36243
67	S.Vito	0.36354
68	Lode'	0.36442
69	S.Maria Coghinas	0.36772
70	Sassari	0.36883
71	Tratalias	0.37059
72	Perfugas	0.37125
73	Villamassargia	0.37456
74	Loceri	0.37654
75	Jerzu	0.37941
76	Assemini	0.38095
77	Berchidda	0.38183
78	Monserrato	0.38228
79	S.Giovanni Suergiu	0.38889
80	Solarussa	0.39220
81	Iglesias	0.39660

82	Pozzomaggiore	0.39683
83	Palmas Arborea	0.39705
84	Nurachi	0.39969
85	Oschiri	0.40476
86	Villa S.Pietro	0.41027
87	Riola Sardo	0.41270
88	Santadi	0.41601
89	Guspini	0.42284
90	Narcao	0.42284
91	Bortigiadas	0.42328
92	Padria	0.42681
93	Villaurbana	0.43011
94	Galtelli'	0.43011
95	Santu Lussurgiu	0.43034
96	Uras	0.43034
97	Fordongianus	0.43386
98	Monti	0.43519
99	Gonnosfanadiga	0.43651
100	Sennori	0.43849
101	S.Sperate	0.43893
102	S.Giusta	0.43915
103	Baratili S.Pietro	0.44114
104	Pau	0.44136
105	Abbasanta	0.44158
106	S.Nicolo' D'Arcidano	0.44180
107	Bauladu	0.44466
108	Simaxis	0.44489
109	Villanova Monteleone	0.44511
110	Uta	0.44577
111	Sardara	0.44643
112	S.Antonio di Gallura	0.44974
113	Tempio Pausania	0.45018
114	Oliena	0.45040
115	Villanova Truschedu	0.45150
116	Sennariolo	0.45282
117	Irgoli	0.45326
118	Laerru	0.45392
119	Tuili	0.45525
120	Viddalba	0.45547
121	Carbonia	0.45569
122	Olmedo	0.45657
123	Bonarcado	0.45657
124	Bonorva	0.46010
125	Elmas	0.46010
126	S.Gavino Monreale	0.46098
127	Seneghe	0.46208
128	Villasor	0.46384
129	Bulzi	0.46407
130	Allai	0.46539
131	Triei	0.46583
132	Ollastra Simaxis	0.46649
133	Marrubiu	0.47156
134	Montresta	0.47200
135	Siamaggiore	0.47685

136	Arzana	0.47817
137	Villacidro	0.47884
138	Giba	0.47994
139	Lanusei	0.48038
140	Masullas	0.48082
141	Samassi	0.48236
142	Bolotana	0.48369
143	Tramatza	0.48391
144	Gairo	0.48523
145	Villagrande Strisaili	0.48545
146	Seui	0.48765
147	Ballao	0.48787
148	Ales	0.49140
149	Sorgono	0.49449
150	Mores	0.49493
151	Gavoi	0.49537
152	Tonara	0.49537
153	Gonnoscodina	0.49669
154	Ghilarza	0.49691
155	Milis	0.49802
156	Luras	0.49934
157	Villaperuccio	0.50088
158	Nuoro	0.50198
159	Aritzo	0.50265
160	Senorbi'	0.50287
161	Vallermosa	0.50375
162	Sestu	0.50485
163	Luogosanto	0.50529
164	Desulo	0.50573
165	Monastir	0.50794
166	Nulvi	0.50948
167	Villa Verde	0.50948
168	Macomer	0.50970
169	Decimomannu	0.51058
170	Nuraminis	0.51058
171	Osilo	0.51124
172	Ossi	0.51190
173	Ittiri	0.51323
174	Tergu	0.51411
175	Padru	0.51477
176	Siliqua	0.51477
177	Settimo S.Pietro	0.51543
178	Sedini	0.51918
179	Tadasuni	0.52006
180	Perdasdefogu	0.52160
181	Sanluri	0.52293
182	Serramanna	0.52359
183	Uri	0.52535
184	Borore	0.52557
185	Onifai	0.52756
186	Suni	0.52844
187	Ula Tirso	0.53020
188	Perdaxius	0.53153
189	Modolo	0.53175

190	Gonnostramatza	0.53263
191	Soleminis	0.53307
192	Osini	0.53351
193	Domusnovas	0.53373
194	Mamoiada	0.53417
195	Thiesi	0.53483
196	Seulo	0.53616
197	Scano di Montiferro	0.53638
198	Bono	0.53704
199	Banari	0.53726
200	Villanovaforru	0.53902
201	Musei	0.54034
202	Escalaplano	0.54123
203	Piscinas	0.54211
204	Tula	0.54431
205	Barumini	0.54541
206	Bultei	0.54630
207	Fonni	0.54630
208	Ozieri	0.54740
209	Orgosolo	0.54784
210	Senis	0.54850
211	Calangianus	0.54872
212	Decimoputzu	0.54894
213	Onani'	0.54916
214	Pabillonis	0.54938
215	Ploaghe	0.55004
216	Ortacesus	0.55071
217	Sindia	0.55115
218	Paulilatino	0.55159
219	Zeddiani	0.55203
220	Norbello	0.55225
221	Nuxis	0.55644
222	Budduso'	0.55710
223	Albagiara	0.55754
224	Usini	0.55886
225	Serrenti	0.56063
226	Martis	0.56085
227	Dolianova	0.56107
228	Nughedu S.Vittoria	0.56195
	Monteleone Rocca	
229	Doria	0.56217
230	Mogoro	0.56261
231	Ussassai	0.56349
232	Samugheo	0.56504
233	Simala	0.56548
234	Bidoni'	0.56592
235	Ortueri	0.56636
236	Florinas	0.56768
237	Pompu	0.57231
238	Armungia	0.57518
239	Bortigali	0.57628
240	Mara	0.57628
241	Borutta	0.57804
242	Isili	0.57848
243	Zerfaliu	0.57870

244	Bonnannaro	0.57892
245	Nureci	0.58047
246	Sedilo	0.58047
247	Busachi	0.58422
248	Ulassai	0.58444
249	Urzulei	0.58466
250	Ussana	0.58840
251	Baressa	0.58951
252	Gergei	0.58951
253	Sini	0.59039
254	Gesturi	0.59061
255	Ussaramanna	0.59061
256	Tiana	0.59083
257	Assolo	0.59281
258	Flussio	0.59347
259	Lunamatrona	0.59722
260	Cossoine	0.59810
261	Tinnura	0.59854
262	Giave	0.59899
263	Talana	0.60009
264	Villaspeciosa	0.60229
265	Loculi	0.60384
266	Usellus	0.60406
267	Codrongianos	0.60780
268	Ilbono	0.60957
269	Chiaramonti	0.61067
270	Romana	0.61287
271	Elini	0.61486
272	Illorai	0.61508
273	Villa S.Antonio	0.61684
274	Donori	0.61706
275	Genuri	0.61772
276	Sagama	0.61772
277	Ottana	0.61861
278	Segariu	0.61993
279	Villasalto	0.62037
280	Erula	0.62213
281	Tissi	0.62257
282	Goni	0.62280
283	Bitti	0.62434
284	Nuragus	0.62434
285	Nurallao	0.62566
286	Aggius	0.62765
287	Guasila	0.63117
288	Curcuris	0.63228
289	Boroneddu	0.63338
290	Orune	0.63426
291	Benetutti	0.63646
292	Serdiana	0.63779
293	Ollolai	0.63845
294	Villamar	0.63911
295	Siamanna	0.64308
296	Ardauli	0.64396
297	Torralba	0.64396

298	Anela	0.64418
299	S.Nicolo' Gerrei	0.64418
300	Ardara	0.64484
301	Esterzili	0.64484
302	Morgongiori	0.64616
303	Villanovafranca	0.64638
304	Silanus	0.64660
305	Siligo	0.64660
306	Siris	0.65035
307	Ruinas	0.65123
308	S.Andrea Frius	0.65123
309	Siapiccia	0.65278
310	Gonnosno'	0.65366
311	Laconi	0.65454
312	Silius	0.65564
313	Suelli	0.65829
314	Orroli	0.66005
315	Turri	0.66204
316	Sarule	0.66248
317	Meana Sardo	0.66424
318	Aidomaggiore	0.66468
319	Esporlatu	0.66512
320	Putifigari	0.66601
321	Cargeghe	0.66645
322	Collinas	0.66909
323	Orotelli	0.67086
324	Bottidda	0.67174
325	Pattada	0.67240
326	Sadali	0.67306
327	Las Plassas	0.67394
328	S.Basilio	0.67416
329	Samatzai	0.67416
330	Semestene	0.67416
331	Ala' dei Sardi	0.67681
332	Siddi	0.67747
333	Belvi'	0.68166
334	Barrali	0.68210
335	Baradili	0.68254
336	Bessude	0.68342
337	Selegas	0.68386
338	Lula	0.68673
339	Gadoni	0.68717
340	Cheremule	0.68739
341	Setzu	0.68981
342	Burcei	0.69026
343	Nurri	0.69026
344	Soddi	0.69070
345	Pimentel	0.69158
346	Neoneli	0.69246
347	Siurgus Donigala	0.69687
348	Gesico	0.69731
349	Muros	0.70216
350	Dualchi	0.70282
351	Villanova Tulo	0.70304

352	Sorradile	0.70392
353	Furtei	0.71032
354	Guamaggiore	0.71076
355	Ovodda	0.71186
356	Mandas	0.71605
357	Asuni	0.71715
358	Nughedu S.Nicolo'	0.71892
359	Burgos	0.71914
360	Olzai	0.71980
361	Atzara	0.72134
362	Pauli Arbarei	0.72443
363	Noragugume	0.72619
364	Austis	0.73280
365	Orani	0.73369
366	Mogorella	0.73369
367	Lodine	0.73567
368	Ittireddu	0.73743
369	Birori	0.74228
370	Genoni	0.75000
371	Serri	0.75463
372	Nule	0.75750
373	Lei	0.75992
374	Teti	0.76499
375	Osidda	0.77072
376	Oniferi	0.78219
377	Escolca	0.81680

Table A.2: Ranking of municipalities by INDTUR5

Ranking	COMUNE	INDTUR5
1	Alghero	0
2	Olbia	22.460183
3	Muravera	36.055777
4	Pula	39.344614
5	Budoni	45.359459
6	Orosei	46.592827
7	Quartu S.Elena	46.723608
8	La Maddalena	47.721338
9	S.Teodoro	47.757764
10	Palau	47.948213
11	S.Teresa di Gallura	48.3206
12	Tortoli'	49.096676
13	Villasimius	51.140141
14	Oristano	51.261185
15	Bosa	51.710135
16	Stintino	52.106178
17	S.Antioco	54.635131
18	Valledoria	54.722018
19	Arborea	56.828689
20	Carloforte	58.26556
21	Golfo Aranci	58.323474
22	Porto Torres	58.426072
23	Assemini	59.123864
24	Calasetta	59.748488

25	Lotzorai	60.075373
26	Monserrato	60.647473
27	Cabras	60.763697
28	Selargius	60.792851
29	Villaputzu	61.316444
30	Portoscuso	61.914202
31	Posada	62.657377
32	Terralba	63.429879
33	S.Vero Milis	63.691429
34	Siniscola	63.726678
35	Quartucciu	63.831641
36	S.Giusta	64.676197
37	Girasole	64.844061
38	Elmas	64.900443
39	Uta	65.045372
40	S.Giovanni Suergiu	65.272798
41	S.Maria Coghinas	65.468174
42	Marrubiu	65.631503
43	Nurachi	65.978585
44	Riola Sardo	66.100769
45	Palmas Arborea	66.117132
46	Decimomannu	66.210639
47	Baratili S.Pietro	66.411432
48	Siamaggiore	66.451223
49	Zeddiani	66.603153
50	Solarussa	66.796377
51	S.Nicolo' D'Arcidano	66.824518
52	Padru	67.047663
53	Simaxis	67.476386
54	Torpe'	67.704861
55	Irgoli	67.750159
56	Villaspeciosa	67.958688
57	Zerfaliu	68.006905
58	Tramatza	68.125572
59	Decimoputzu	68.69359
60	Gonnesa	68.813154
61	Viddalba	68.827705
62	Uras	68.964892
63	Loculi	69.402827
64	Tratalias	69.632591
65	Onifai	69.685613
66	Ollastra Simaxis	69.773701
67	Villasor	69.906269
68	Villa S.Pietro	70.437084
69	Galtelli'	70.73599
70	Bari Sardo	71.842513
71	Cardedu	71.848491
72	Teulada	72.718483
73	Sarroch	73.220026
74	S.Sperate	73.420767
75	Serramanna	73.516638
76	Fluminimaggiore	73.994034
77	Sestu	74.154344
78	Bauladu	74.520133

79	Capoterra	75.266734
80	Fordongianus	75.792327
81	Pabillonis	76.019699
82	Buggerru	77.497136
83	Siamanna	80.142515
84	Arzachena	80.671957
85	Masainas	81.267801
86	Narbolia	81.314123
87	S.Gavino Monreale	83.145309
88	Giba	83.80234
89	Domus De Maria	84.21314
90	Villanova Truschedu	84.672133
91	Samassi	86.580113
92	Piscinas	88.749351
93	Olmedo	88.893314
94	Allai	89.056148
95	Siapiccia	89.081827
96	Villaperuccio	90.341279
97	Settimo S.Pietro	90.597123
98	Siliqua	90.962562
99	S.Anna Arresi	91.949051
100	Milis	93.153389
101	Vallermosa	94.712148
102	Maracalagonis	100.00413
103	Monastir	101.15596
104	Villaurbana	102.74259
105	Perfugas	107.31292
106	Ballao	108.35157
107	Badesi	109.07582
108	Nuraminis	110.44817
109	Loiri Porto S.Paolo	110.8593
110	Perdaxius	112.88668
111	Ussana	112.88851
112	Furtei	113.21647
113	Gonnostramatza	113.81585
114	Castelsardo	118.22839
115	Carbonia	120.99588
116	Villamar	126.60678
117	Gonnoscodina	126.67282
118	Serrenti	128.62711
119	Tertenia	130.98659
120	Musei	131.22464
121	Villamassargia	131.90855
122	Segariu	134.02636
123	Narcao	135.35645
124	Guspini	138.8918
125	S.Vito	139.86914
126	Masullas	140.31842
127	Sorso	140.34984
128	Sinnai	140.92317
129	Curcuris	141.68675
130	Mogoro	142.58816
131	Modolo	143.11968
132	Cagliari	144.18982

133	Santadi	144.25163
134	Sanluri	146.85645
135	Triei	148.40486
136	Pauli Arbarei	148.96768
137	Barrali	151.12341
138	Donori	151.8353
139	Pompu	156.3126
140	Uri	157.9564
141	Domusnovas	159.85148
142	Las Plassas	160.48124
143	Sardara	162.86183
144	Pimentel	163.7469
145	Simala	163.89363
146	Ussaramanna	167.87181
147	Siris	168.82334
148	Samatzai	170.88722
149	Castiadas	171.60869
150	Ortacesus	171.7198
151	Turri	173.356
152	Baressa	173.57154
153	Baradili	173.92088
154	Serdiana	177.33674
155	Laerru	182.60758
156	Gonnosfanadiga	185.19101
157	Tadasuni	187.99325
158	Lunamatrona	188.01505
159	Siddi	191.45493
160	Loceri	194.58634
161	Ottana	195.08694
162	Nuxis	195.27242
163	Ales	199.43192
164	Gonnosno'	201.07533
165	Iglesias	201.50942
166	Soleminis	203.96327
167	Usini	204.42911
168	Bulzi	205.02132
169	Senorbi'	205.851
170	Guamaggiore	206.62779
171	Oschiri	207.79098
172	Villa Verde	208.95454
173	Barumini	209.02149
174	Setzu	212.38381
175	Tuili	213.66201
176	Dolianova	215.59099
177	Guasila	217.5521
178	Albagiara	219.73929
179	Boroneddu	221.4341
180	Tissi	228.20647
181	Sassari	231.39334
182	Genuri	234.75213
183	Asuni	237.69013
184	Selegas	239.33199
185	Villa S.Antonio	250.79725
186	Collinas	252.48186

187	Aidomaggiore	253.72198
188	Soddi	253.89551
189	Bidoni'	254.50412
190	Tresnuraghes	258.00635
191	Suelli	258.30876
192	Sini	258.39074
193	Assolo	258.40694
194	Mara	259.09751
195	Senis	259.56943
196	Magomadas	263.65987
197	Villacidro	266.25564
198	Mogorella	267.47396
199	Putifigari	268.38544
200	Romana	268.69314
201	Sennariolo	275.09903
202	Tula	277.13431
203	Sennori	277.6173
204	Tergu	280.85056
205	Paulilatino	281.60054
206	Bonarcado	283.77237
207	Sedilo	286.03379
208	Usellus	290.63038
209	Noragugume	290.96765
210	Ghilarza	291.58452
211	Ardara	297.87978
212	Monti	300.3682
213	Martis	300.6695
214	Berchidda	301.32349
215	S.Andrea Frius	301.48023
216	Villanovafranca	303.16273
217	Gesico	303.4068
218	Padria	304.4146
219	Flussio	305.21613
220	Seneghe	305.23166
221	Sedini	306.20285
222	Muros	308.5773
223	Arbus	309.4076
224	Villanovaforru	311.51554
225	Gesturi	312.65122
226	Pau	315.46893
227	Ittireddu	315.76679
228	Abbasanta	316.02483
229	Norbello	316.24533
230	Codrongianos	317.56966
231	Luogosanto	320.98636
232	Dualchi	322.72054
233	Tinnura	327.7308
234	Telti	331.57774
235	Sagama	332.68184
236	Cargeghe	333.05678
237	Ossi	334.60116
238	Nureci	336.40745
239	Escalaplano	338.31795
240	Sorradile	338.52417

241	Suni	339.44627
242	Lode'	344.33643
243	Ula Tirso	349.00257
244	Morgongiori	350.76119
245	S.Antonio di Gallura	354.2959
246	Ruinas	359.26286
247	Nuragus	360.45228
248	Trinita' d'Agultu e Vi	362.3587
249	S.Nicolo' Gerrei	364.86644
250	Armungia	365.59167
251	Mores	366.70896
	Monteleone Rocca	
252	Doria	367.22866
253	Samugheo	370.32574
254	Gergei	375.56409
255	Oliena	377.34673
256	Scano di Montiferro	378.82378
257	Busachi	379.19886
258	Goni	382.75413
259	Dorgali	385.6422
260	Ozieri	390.0828
261	Nurallao	391.13424
262	Borore	393.27502
263	Bottidda	397.13375
264	Ittiri	398.34927
265	Ilbono	398.56401
266	Semestene	404.10092
267	Bonnannaro	404.37828
268	Siligo	405.53249
269	Benetutti	406.37255
270	Orotelli	406.63917
271	Montresta	408.23051
272	Florinas	415.75889
273	Escolca	416.67394
274	Aglientu	417.26208
275	Banari	417.87341
276	S.Basilio	419.55151
277	Ardauli	420.64107
278	Ploaghe	423.66499
279	Jerzu	424.94305
280	Chiaramonti	428.44656
281	Torralba	429.08308
282	Silanus	431.33836
283	Pozzomaggiore	436.16404
284	Bessude	445.92499
285	Genoni	446.54422
286	Anela	446.83863
287	Siurgus Donigala	451.47292
288	Erula	455.17221
289	Lei	455.27535
290	Mandas	456.80517
291	Thiesi	459.16014
292	Birori	462.55091
293	Borutta	469.63358
294	Elini	469.79713

295	Bolotana	471.00338
296	Esporlatu	472.68564
297	Olzai	473.33556
298	Nulvi	475.54513
299	Bortigiadas	476.75719
300	Baunei	477.08981
301	Oniferi	477.09104
302	Cuglieri	479.85129
303	Onani'	480.10142
304	Nughedu S.Vittoria	494.9293
305	Calangianus	497.82492
306	Villasalto	499.74228
307	Santu Lussurgiu	500.12181
308	Bortigali	503.14735
309	Luras	505.59981
310	Bonorva	505.82579
311	Sindia	507.43872
312	Urzulei	508.30525
313	Bultei	508.79287
314	Aggius	511.47183
315	Lula	513.66633
316	Illorai	514.11564
317	Orani	519.46089
318	Isili	521.73482
319	Cossoine	526.6741
320	Orroli	528.04042
321	Cheremule	537.68572
322	Bono	538.98708
323	Atzara	539.02499
324	Nuoro	545.17369
325	Bitti	545.59363
326	Laconi	548.53325
327	Neoneli	552.26173
328	Burgos	559.64087
329	Macomer	559.74601
330	Tiana	562.49505
331	Tempio Pausania	562.51804
332	Silius	562.57485
333	Villanova Monteleone	563.63608
334	Villanova Tulo	569.09929
335	Nughedu S.Nicolo'	575.48793
336	Ortueri	583.04425
337	Meana Sardo	586.40221
338	Nurri	587.75993
339	Lanusei	591.35593
340	Giave	592.33173
341	Perdasdefogu	595.76365
342	Osilo	611.60131
343	Serri	615.02967
344	Orgosolo	616.66018
345	Sarule	623.54518
346	Mamoiada	640.88466
347	Osini	641.53473
348	Burcei	644.48809

349	Nule	647.71428
350	Osidda	647.84128
351	Belvi'	657.56126
352	Ala' dei Sardi	660.02212
353	Ussassai	666.65525
354	Arzana	668.14583
355	Talana	678.2212
356	Gairo	681.2233
357	Sorgono	685.63428
358	Gadoni	693.3927
359	Villagrande Strisaili	696.03957
360	Budduso'	697.1422
361	Sadali	701.88939
362	Ovodda	707.22174
363	Teti	711.41807
364	Esterzili	727.6961
365	Austis	734.39344
366	Orune	746.31891
367	Ulassai	770.84821
368	Pattada	775.03123
369	Gavoi	786.33511
370	Aritzo	792.49727
371	Seulo	795.52829
372	Seui	816.10394
373	Lodine	880.1687
374	Desulo	884.00033
375	Tonara	896.07165
376	Ollolai	916.12401
377	Fonni	995.47069