TOURISM SUSTAINABILITY AND ECONOMIC EFFICIENCY - A STATISTICAL ANALYSIS OF ITALIAN PROVINCES

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1. Introduction

In recent years the leisure industry, due to its positive socio-economic effects, has become a prominent economic sector resulting in increasing competition on the tourist market. A tourist in order destination to be competitive has to seek a balance between short-term revenues at the cost of long-term sustainable development and long-term balanced growth strategies by seeking to reconcile local interests with broader tourist objectives. In practice, we observe that different tourist destinations try to exploit their indigenous growth potential comprising various cultural and environmental amenities. This calls for a fine-tuned marketing strategy in order to get the 'right tourist' with the 'right goals' at the 'right place' (Coccossis and Nijkamp, 1995; Giaoutzi and Nijkamp, 1993).

The aim of this paper is to designs a method for assessing tourism sustainability using proper statistical measures of efficiency. At the moment, there is no standard definition of a sustainable tourist destination (STD), but, according to the Associazione Italiana Turismo Responsabile, we may refer here to the generic concept of sustainable tourism (ST): every tourism activity that preserves for a long time the local natural, cultural and social resources, contributing to the well-being of individuals living in those tourist areas. According to this point of view, tourism sustainability, generally, is an aspiration or goal rather than a measurable objective (Middleton and Hawkins, 1998).

A recent study contains an operational concept of ST, by defining two systems – human and ecological – and several dimensions within these (economic and socio-cultural dimensions, environmental impacts, environmental policy measures and so on) and by choosing specific indicators in line with these dimensions to assess sustainability (see Ko, 2005).

Unfortunately, despite many methodological advances, reliable data on several indicators defined and utilized in various conceptual models are generally unavailable, particularly at the local level, so that many models remain unapplied and hence abstract in nature.

In this paper, we develop by using a theoretical background based on the concept of frontier production function, a suitable methodology to explore how efficiently Italian provinces utilize their available tourist resources. We consider here the tourist place, i.e., the destination, as a company whose performance has to be assessed. Thus, we evaluate the sustainability of a tourist destination according to its economic and environmental performance. Specifically, we will introduce the concept of the production frontier of a tourist destination (see also Cracolici and Nijkamp, 2006), and next introduce the concepts of economic efficiency and sustainable tourism efficiency.

We consider sustainable tourism efficiency as a proxy of eco-efficiency; generally, increasing eco-efficiency means a reduction in resource use per unit of product or service. Usually, this concept is used with reference to micro-level units (companies, public organizations etc.), but here we will transfer it to the macro-level, by applying it to Italian provinces. Using a new version of Activity Analysis (AA), we derive – for each province – an eco-efficiency and an economic efficiency indicator (EE), where the eco-efficiency indicator represents the 'sustainable tourism efficiency' (STE). The paper is organized as follows: Section 2 presents a review of sustainability in the tourism field. Next, Section 3 presents the model structure and the data base. In Section 4, the empirical findings are presented and discussed, while Section 5 offers some concluding remarks.

2. Sustainable Tourism: A Review

The notion of sustainable development has a history of almost two decades and has increasingly been translated into operational policy guidelines at a meso (sectoral or regional) level. Examples are agricultural sustainability, urban sustainability, or transport sustainability. The tourist sector is also increasingly faced with sustainability conditions, as tourist mobility and tourist behaviour may be as odds with ecological quality. In other words, tourism tends to use environmental commodities and amenities (such as forests, fossil fuels, water) up to a level that exceed the environmental absorption capacity (or its long-run regeneration capacity). An important question is of course what the socio-economic and ecological value of a tourist area is for the client concerned (i.e., the tourist) and for the population at large (such as residents, businessmen, etc.).

In the (environmental) economic literature on valuation the following typology of use values is commonly made (see Nunes et al., 2003):

(i) use value based on actual (current and future) benefits

(ii) option (risk aversion) value based on the wish to keep an environmental good intact (even if it is not sure that the user will really visit the good concerned)

(iii) quasi-option value based on the wish to avoid irreversible developments of a good in order to keep future visit options open

(iv) moral (existence) value based on the wish to maintain an environmental good, even if no visit is ever planned (now and in the future)

(v) vicarious value based on the assumption that the preservation of the environmental good may be good for others

(vi) bequest value based on the idea that future generations should in principle have the possibility to enjoy an environmental asset.

However, the assessment of such values is fraught with many difficulties, especially since complex micro-based stated preference methods have to be deployed at various geographical scales, for various socio-economic user categories and for various time horizons. For our case study, on Italian regions, a data base on the above mentioned sustainability values is missing, so that we have to resort to aggregate indicators. Therefore, we will make use of a meso-economic scale of analysis for tourism sustainability, viz. the regional (provincial) level. This level is chosen, as the region is normally the vehicle for meso-performance in a competitive market. Thus, we will assess tourism efficiency – while taking to account sustainability requirements – for a set of regions using available statistical information. This will be the subject matter of the next section.

3. Model Structure and Data Base

If a tourist destination area is analyzed as if it were a company in a competitive business environment, we may hypothesize that – in order to survive – a tourist area should manage its inputs efficiently. In general, the territory's physical and human resources constitute the input of a (virtual) tourist '*production process*', while the tourist output may be represented by arrivals, bed-nights, value added, employment, customer satisfaction, etc. As a consequence, tourist destination performance can be evaluated through a measurement of economic efficiency, by the following 'guest-production function':

$$\text{Tourist output} = f\,(\text{material capital, cultural heritage, human capital, labour}) \qquad (1)$$

Clearly, the production of tourist output may cause serious social costs and ecological decay to the tourist area. More specifically, tourism value added cannot be expanded infinitely without some negative external effects on the social and environmental equilibrium of the area at hand (e.g., quality of life of the local community, different kinds of pollution, traffic congestion, use of water resources, increase of garbage, etc.). Thus we have two kinds of outputs: 'goods' (desirable) and 'bads' (undesirable). The situation where desirable and undesirable outputs are jointly produced is called 'null-jointness' (Shephard and Färe, 1974); in other words, it means that no good output can be produced without the production of a bad output. According to this point of view, we have to introduce in the left hand side of (1) some measure of good and bad outputs.

Given the production process function (1), in which the functional form of the 'guest-production function' is not known a priori, an Activity Analysis (AA) model is adopted using the above multiple inputs and outputs. In particular, we will use one of the AA models also referred to as non-parametric or Data Envelopment Analysis models (DEA).

DEA applies mathematical programming techniques to compare the efficiency of a set of decision making units (DMU)[1]. The efficiency score of a DMU is defined as the ratio of the weighted sum of its outputs with respect to the weighted sum of its inputs. The sets of input and output weights and the relative efficiency scores are generated by the DEA model itself. The scores range from 0 (inefficiency) to 1 (full efficiency).

Now in order, to take into account both good and bad outputs, we refer to a model of AA proposed by Färe et al. (1994). They define the output set from the data as an activity analysis or DEA model, as follows:

$$P(x) = \left((y,w) : \sum_k z_k y_{km} \geq y_m ; \sum_k z_k x_{kn} \leq x_n ; \sum_k z_k w_{ki} = w_i \right) \tag{2}$$

where y = 'good' outputs; x = inputs; w = 'bad' outputs; k = 1…K observations (the Italian provinces in our analysis); m = 1…M good outputs; i = 1…I bad outputs; n = 1…N inputs, and $z_k \geq 0$, the intensity variables, which serve to form the frontier technology of the local tourism system.

Model (2) satisfies the following conditions:

(i) weak disposability of outputs – the reduction of bad outputs is feasible if good outputs are also reduced, given fixed input levels;

(ii) null-jointess – bad and good outputs are jointly produced; i.e., if no bad outputs are produced, then there can be no production of good outputs (see Shepard and Färe, 1974);

(iii) constant returns to scale.

According to Färe et al. (1996), the key elements to formulate a sustainable tourist indicator is the input distance function which can be defined as:

$$D_k(y,w,x) = \max\{\lambda : (x/\lambda, y, w) \in S\}, \quad \text{k=1,...,K} \tag{3}$$

where S is the technology set. D_k may be greater than or equal to 1. If D_k=1, no reduction in inputs is possible, while for D_k >1 the same amount of outputs can be produced by decreasing the amount of inputs.

On the basis of the separability property of the input distance function, we have:

$$D_k(y,w,x) = W(w) D_k^*(y,x), \quad \text{k=1,...,K} \tag{4}$$

[1] Charnes et al. (1978) used the term DMU to emphasize the focus on decisions made by non-profit organizations rather than profit maximizing firms.

where the last term (i.e., $D_k^*(y,x)$) represents the 'pure' input productive efficiency (i.e., EE); in other words, it is the efficiency of the *k*-th destination with respect to only good outputs. As mentioned above, the EE scores range from 0 to 1. W(w) (i.e., the eco-efficiency) considers only the effects of bad outputs; it may thus represent a sustainable tourist efficiency indicator (i.e., STE). It can be defined as:

$$W(w) = STE = D_k(y,w,x)/D_k^*(y,x) \quad \text{k=1,...,K} \tag{5}$$

STE has values less than or equal to 1; values of STE less than 1 mean no sustainable efficiency, while values of STE equal to 1 indicate sustainable efficiency. Having now specified the formal model for evaluating the performance, we will next apply it to the Italian provinces for the year 2001[2].

Unfortunately, with regard to bad outputs, the lack of information about the 'pressure' and the damage caused by tourism activity on the environment makes our analysis problematic. We may partly avoid this obstacle by using an indirect measure, by assuming a positive relationship between volume (or tourist presence) and environmental decay; it is plausible that the more tourists stay in a city or in a tourist area the greater is the exploitation of resources (waste water, deterioration of flora or fauna, high costs of disposal waste, etc.). This obviously entails the problem of the 'carrying capacity' of tourist areas and related policy strategies. Defining differentiated carrying capacities of tourist areas is however, a serious problem and is not the main goal of our paper. Rather we need to measure the 'effort' sustained by the tourist area and its support infrastructures. The most common (and readily available) indicators of this system are (national and international) bed-nights per capita and the average stay of tourists. These variables constitute the indirect proxies of 'bad outputs', whereas tourism value added per capita represents 'good output'.

According to the destination concept (Davinson and Maitland, 1997; Buhalis, 2000) and given the availability of data, the following proxies for material capital, cultural heritage, human capital and labour were chosen: number of beds in hotels over regional (or local) population (NBH); number of beds in complementary accommodations per head (NBC); the regional state-owned artistic-cultural patrimony (number of museums, monuments and archaeological sites) divided by population (ACP); tourist school graduates divided by working age population (TSG); and the labour units (or employment) (ULA) of the tourism sector divided by the total regional ULA.

Data on outputs has been obtained from ISTAT Tourist Statistics, while the data on inputs has been obtained from different sources: number of beds in hotels and complementary

[2] We left out the provinces of Lodi, Isernia, Campobasso and Avellino, as these data showed up as outliers in previous analyses.

accommodations from ISTAT Tourist Statistics; provincial state-owned artistic-cultural heritage from the Ministry of Cultural Heritage; tourist school graduates from the Ministry of Education; and labour units (ULA) of the tourism sector from ISTAT.

4. Empirical Results

4.1 The result of the AA Model

The above data base was used to estimate our AA model. The results obtained by model (2) are synthesized in Figure 1, where the X- and Y-axis represent EE and STE scores, respectively.

All the provinces[3] appear to fall within an EE score ranging from 0.32 (i.e., Agrigento (AG)) to 1 (e.g., Como (CO), Lecco (LC), etc.), and a STE score varying between 0.19 (Venice (VE), for example) and 1 (e.g., Milan (MI), Caltanisetta (CL), etc.); the majority of provinces are concentrated in the second quadrant of Figure 1, with high STE and low EE scores. As Figure 1 shows, only three destinations (Milan (MI), Cremona (CR) and Caltanisetta (CL)) reach full efficiency; i.e., they are able to produce high tourist flows (bed nights in our analysis) with a low effect on the environment in a broader sense.

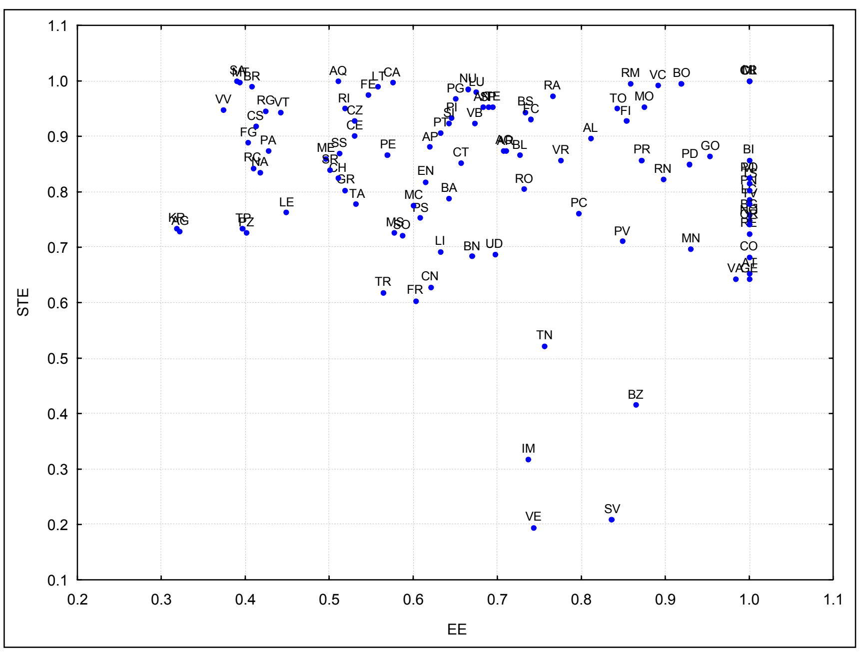

Figure 1. EE and STE scores for all provinces

Moreover, destinations with EE scores equal to 1 (e.g., Trieste (TS), Como (CO), Genova (GE), etc.) show a narrow variability range of their STE scores, in contrast to destinations

[3] The analysis has been performed for only 99 provinces; we left out Lodi, Isernia, Campobasso and Avellino as they showed up as outliers in previous analyses.

with STE scores equal to 1 which present a wider variability range of their EE scores. It is noteworthy that the majority of regions with a high EE score achieve also a good sustainable performance, while regions with a high level of STE not necessary reach full efficiency. High scores of STE and EE may be interpreted as the ability of a region to manage its resources efficiently in order to both attract tourist (positive effect) and to monitor the tourist production process (negative effect).

The scatterplot graph of the STE and EE scores allows us to subdivide the provinces into three clusters: the first at the top-right position, with a high EE and STE; the second on the top-left side, with a very low EE, but high STE; the third on the bottom-right side, with high EE and low STE. In the first group we find the best sustainable tourism practices characterized by many typical tourist destinations (Rome (RM), Florence (FI), Rimini (RN), Ravenna (RA), Verona (VR), etc.); they reached a good economic performance, by preserving simultaneously social and environmental aspects.

The second cluster contains both coastal and historical-cultural destinations (Naples (NA), Salerno (SA), Messina (ME), Lecce (LE), Agrigento (AG), etc.) with a very low economic performance, but a good environmental efficiency.

Finally, the third group is composed of economically efficient provinces with serious problems in controlling the negative effects on the environment. It is not surprising to find among these, provinces like Venice (VE), Bolzano (BZ) or Trento (TN). Venice for example, is one of the most attractive Italian provinces, with a high popularity and a positive image in the national and international mind set, while Bolzano (BZ) and Trento (TN) are famous Italian mountain sites characterized by a large number of tourists not only from Italy but also from Germany and Austria, because two languages (Italian and German) are spoken in these areas.

In order to offer a comparison between Central-Northern and Southern provinces, we grouped the scores into two figures (see Figures 2-3). The analysis of scores with respect to the mean value of EE and STE shows that most Southern provinces have EE scores below the mean (0.70), but quite high STE scores (i.e., over the mean of 0.82); meanwhile, most Central-Northern provinces are economically and environmentally efficient (i.e., with scores over the mean value).

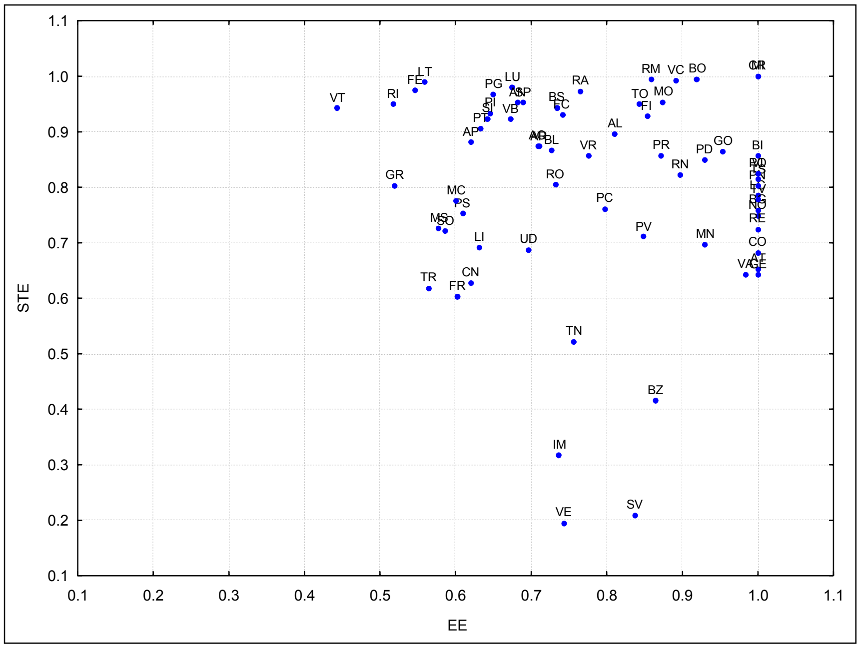

Figure 2. EE and STE scores for Central-Northern provinces

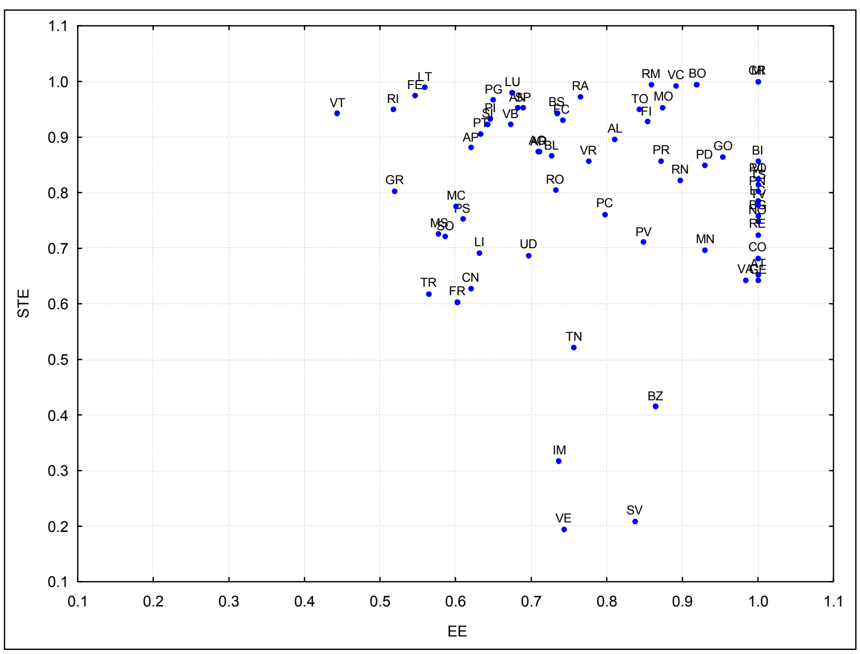

Figure 3. EE and STE scores for Southern provinces

In brief, the empirical findings on Italian provinces show a balance between economic and sustainable efficiency; i.e., the majority of Italian provinces achieve a good economic efficiency and good performance in terms of protection of the environment. In contrast to this general behaviour of Italian provinces, destinations with a prevalent tourist function show performance gaps between STE and EE. This is the case of Venice (VE), Savona (SV), Imperia (IM), Trento (TN) and Bolzano (BZ) which are artistic-cultural, coastal and mountain destinations, respectively. They are characterized by EE scores over the average value (0.70) and STE scores lower than the mean value (0.82).

4.2 A comparison between a simple tourist pressure index (TPI) and the STE index

In addition to the model developed in Section 3, we next used a complementary index that was originally proposed by Jaggi and Freedman (the JF index) (1992) to quantify the impact of environmental performance of firms on their market valuation. This index has thus far never been used to evaluate tourism sustainability. We will calculate it to evaluate the tourist pressure of destinations and to compare it to the STE index.

Following the original formulation of the JF index, we propose to adapt it for the evaluation of tourism sustainability by using specific three indicators. We have for each *k*-th province:

I (national bed-nights)$_k$ = (national bed-nights)$_k$ / population$_k$

I (international bed-nights)$_k$ = (international bed-nights)$_k$ / population$_k$

I (average stay)$_k$ = (bed-nights)$_k$ /arrivals$_k$

Then the tourist pressure index (TPI) may be defined as follows:

$$(\mathrm{TPI})_k = \frac{1}{3}\left[\begin{array}{l} \left(1-\dfrac{I(\text{national bed-nights})_k}{\max\limits_K \left\{I(\text{national bed-nigths})\right\}}\right)+ \\ \left(1-\dfrac{I(\text{international bed-nights})_k}{\max\limits_K \left\{I(\text{international bed-nigths})\right\}}\right) \\ +\left(1-\dfrac{I(\text{average stay})_k}{\max\limits_K \left\{I(\text{average stay})\right\}}\right) \end{array}\right] \quad \text{k=1,...,K} \tag{6}$$

The above standardization permits us to obtain a TPI (tourist pressure index) ranging from 0 (bad performance) to 1 (good performance). The results obtained are presented in Table 1 together with the STE scores.

The TPI differs from the STE index as both inputs and ‘good outputs’ are excluded from the definition and only the bad outputs are considered. Moreover, the weights used in the TPI index are arbitrary (the sum of the weights is 1); the STE index is evaluated with respect to the best practice on the frontier, while the TPI index refers to the bad (respectively good) practice, as reflected by the ‘max’ (respectively ‘min’) operators used in the denominators (see model (6)).

The average score of the TPI index is lower than the average score of STE; they are 0.75 and 0.82, respectively. The Spearman rank order correlation coefficient – equal to -0.06 – points at a rather low concordance between the two measures of tourism sustainability. Figure 4 gives an impression of the general lack of correspondence between rankings obtained from the two methods. Only a few provinces are in concordance, i.e., the provinces that lie along the main diagonal (e.g., Venezia (VE), Savona (SV), Trento (TN), Bolzano (BZ), Padova (PD), Bologna (BO), etc.). For the other provinces we find significant discrepancies. The majority of the provinces appear to be located far from the main diagonal showing a non-uniform performance with respect to the two methods. The difference between the two ranks is not surprising, if we consider the different definitions of the indices, but at the same time, it highlights the role of inputs in ranking the provinces. This observation becomes even more clear, when we analyze – for the sake of illustration – the behaviour of a 'symbolic' (emblematic) province: Benevento (BN).

It has a good performance for the TPI index (score equal to 1) and a poor performance for the STE index (equal to 0.68). With regard to its bad outputs, Benevento (BN) has the minimum value of international bed-nights per capita and average stay, and also a low value of national bed-nights per capita. This yields a good ranking for the TPI index (see Table 1).

On the other hand, if we compare two inputs (i.e., NBH and ULA) of Benevento (BN) to the other provinces, we notice that Benevento is located in the first part of the cloud (see Figure 5). Benevento shows a similar amount of inputs (at least for those inputs displayed in Figure 5) compared to the other provinces, but the mix of inputs is likely not proportional to the composition of the bad outputs, if it is compared to the other provinces. In other words, provinces with bad outputs higher than Benevento have a balance between inputs and bad outputs; hence, they perform better than Benevento, which obtains a low STE score with our AA model. This result leads us to state that Benevento can improve its performance both from an inputs and bad outputs perspective. The intensity of the efforts to be made are reflected by the score obtained by the STE index; i.e., 0.68. This discussion can of course be extended to other provinces, in particular to the provinces located above the main diagonal in the Figure 4 (e.g., Varese (VA), Genova (GE) and etc.).

For the provinces below the main diagonal, the high ranking (bad performance) with respect to TPI index is an expression of a high value of one or more bad outputs that is smoothed by a high STE index. In fact, the latter considers, as previous said, the present state of technology that is reflected by the production set.

Moreover, other possible explanations of the different ranks may be ascribed to economies of scale, that were here considered constant. Most likely, if variable economies of scale are considered, other results will be obtained. Finally, an other explanation could be related to the heterogeneity of the provinces with respect to the tourist profile; i.e. different destination areas may have a different production process of efficiency or STE.

Table 1. Score and rank of STE and TPI indices for Italian provinces

Province	STE Score	STE Rank	TPI Score	TPI Rank	Province	STE Score	STE Rank	TPI Score	TPI Rank
TO	0.9490	22	0.7950	42	LI	0.6916	85	0.4765	96
VC	0.9915	10	0.7457	61	PI	0.9330	28	0.7608	55
BI	0.8566	49	0.8061	35	AR	0.8723	42	0.8401	21
VB	0.9222	33	0.6343	81	SI	0.9232	32	0.6857	76
NO	0.7486	74	0.7957	40	GR	0.8029	63	0.5516	93
CN	0.6274	92	0.7970	38	PG	0.9666	17	0.7367	62
AT	0.6525	89	0.8724	7	TR	0.6185	93	0.7772	50
AL	0.8956	37	0.8500	15	PS	0.7517	73	0.7217	66
AO	0.8740	40	0.5891	91	AN	0.9511	21	0.8163	30
VA	0.6425	90	0.8640	10	MC	0.7750	69	0.7058	72
CO	0.6826	88	0.8074	33	AP	0.8801	39	0.6601	78
LC	0.7846	66	0.7764	52	VT	0.9416	27	0.7362	63
SO	0.7205	82	0.6227	84	RI	0.9488	23	0.7968	39
MI	1.0000	1	0.8243	28	RM	0.9943	9	0.7604	56
BG	0.7584	72	0.8173	29	LT	0.9882	12	0.6182	85
BS	0.9436	26	0.6286	83	FR	0.6037	94	0.7677	54
PV	0.7098	83	0.8418	20	AQ	0.9982	5	0.8362	23
CR	1.0000	3	0.8506	14	TE	0.9527	19	0.6023	90
MN	0.6966	84	0.8310	25	PE	0.8664	44	0.8457	18
BZ	0.4144	96	0.3269	98	CH	0.8238	58	0.8069	34
TN	0.5219	95	0.5861	92	CE	0.9006	36	0.7989	37
VR	0.8560	50	0.6848	77	BN	0.6829	87	0.9025	1
VI	0.8240	57	0.8279	27	NA	0.8341	55	0.7955	41
BL	0.8654	45	0.5104	95	SA	0.9999	4	0.6865	75
TV	0.7777	67	0.8897	2	FG	0.8872	38	0.7508	60
VE	0.1948	99	0.4717	97	BA	0.7882	65	0.8801	5
PD	0.8488	52	0.7769	51	TA	0.7763	68	0.8336	24
RO	0.8038	62	0.6179	87	BR	0.9885	11	0.7683	53
PN	0.8016	64	0.8548	13	LE	0.7617	70	0.7058	71
UD	0.6874	86	0.6909	74	PZ	0.7257	79	0.8486	17
GO	0.8636	46	0.6311	82	MT	0.9956	7	0.7051	73
TS	0.8133	61	0.8600	11	CS	0.9174	34	0.7875	46
IM	0.3170	97	0.6350	80	KR	0.7330	76	0.7536	59
SV	0.2088	98	0.5391	94	CZ	0.9271	30	0.7851	49
GE	0.6421	91	0.8392	22	VV	0.9474	24	0.6566	79
SP	0.9516	20	0.8080	32	RC	0.8427	53	0.8710	9
PC	0.7611	71	0.8891	3	TP	0.7327	77	0.7935	43
PR	0.8570	48	0.8307	26	PA	0.8736	41	0.8013	36
RE	0.7244	81	0.8419	19	ME	0.8594	47	0.7166	68
MO	0.9532	18	0.8802	4	AG	0.7283	78	0.7873	47
BO	0.9945	8	0.8713	8	CL	1.0000	2	0.7895	45
FE	0.9742	15	0.7173	67	EN	0.8180	60	0.8785	6
RA	0.9727	16	0.6166	88	CT	0.8523	51	0.8130	31
FC	0.9299	29	0.6099	89	RG	0.9452	25	0.7326	64
RN	0.8216	59	0.2990	99	SR	0.8392	54	0.7921	44
MS	0.7256	80	0.6181	86	SS	0.8685	43	0.7107	70
LU	0.9792	14	0.7250	65	NU	0.9852	13	0.7158	69
PT	0.9059	35	0.7557	58	OR	0.7403	75	0.8554	12
FI	0.9266	31	0.7586	57	CA	0.9962	6	0.7872	48
PO	0.8249	56	0.8495	16					

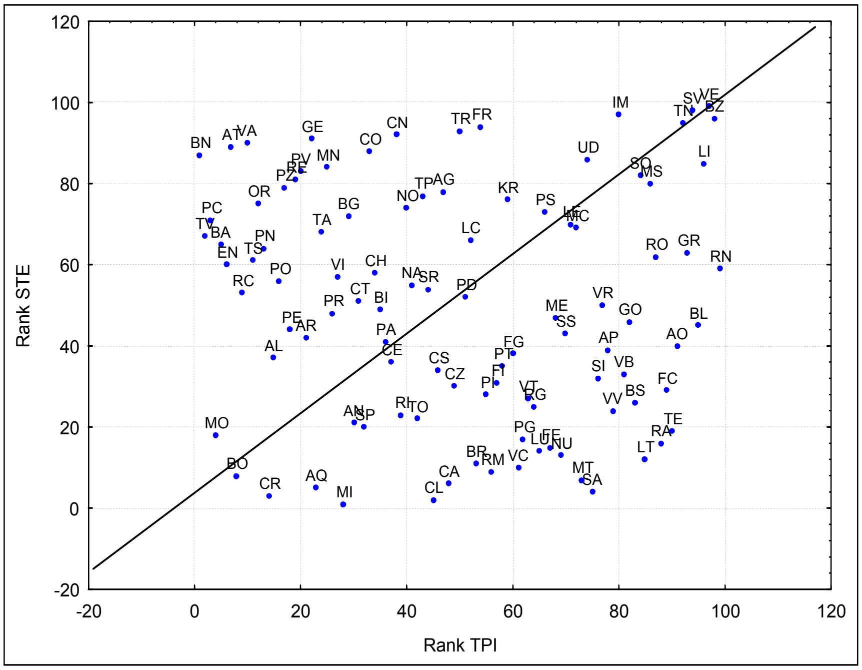

Figure 4. Comparison of ranks obtained by STE and TPI indices

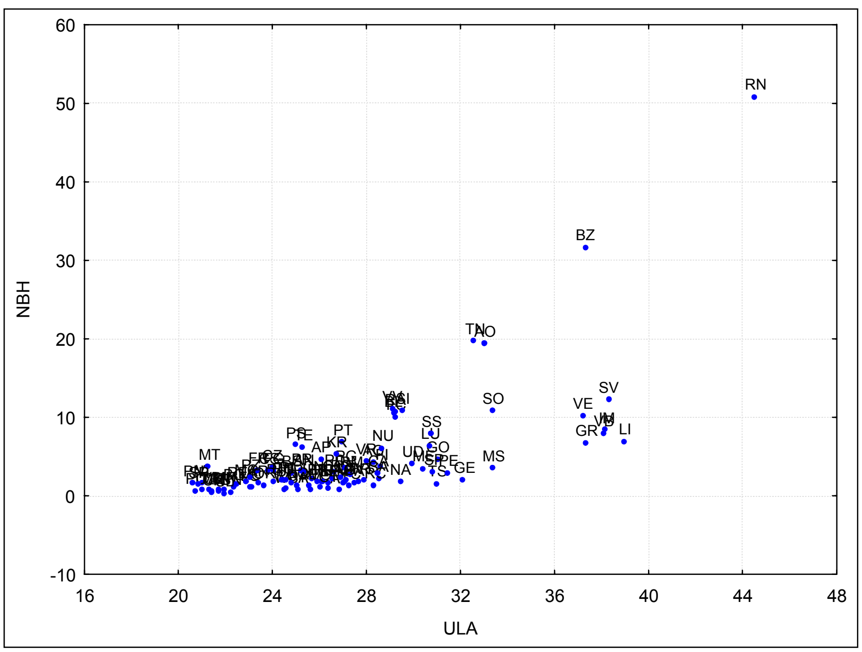

Figure 5. Comparison of NBH and ULA inputs

5. Conclusions

The aim of the paper has been to evaluate the tourist sustainability of 99 Italian provinces using the tools of Activity Analysis. The novel aspect of this paper is the application of the above methodology – usually applied to micro units (i.e., manufacturing or service firms) – to meso units (regions, cities, etc.).

We proposed a measure of sustainable tourism in terms of efficiency considering the economic and environmental dimensions of the 'production process' of tourist destinations (i.e., Italian provinces in our application). Viewing a tourist site as a company, we assessed its sustainability by a tourist 'production function'. In particular, Activity Analysis allowed us to obtain two indicators: eco-efficiency (i.e., STE index) and economic efficiency (i.e., EE). Clearly, the former is more interesting because it may represent a tourist sustainability indicator.

The results obtained may be helpful for policy-making purposes. In fact, the results highlight that the majority of provinces are characterized by high STE and low EE scores. Obviously, from a policy-makers' view it would be desirable that tourist destinations achieve a good economic performance (high EE score). In fact, provinces with high STE and EE scores are an expression of a 'good quality' of tourism; i.e., a development of tourism that has an increasing positive economic effect on the territory (increasing employment, high value added, etc.), but not in conflict with the preservation of the environment in a broader sense (well-being of residents, waste water, etc.).

This observation imposes on destination management organizations the hard task of managing tourist resources by cutting down the negative social and environmental effects. Although many factors influence the 'production' of sustainable tourism, we have stressed some relevant dimensions of sustainable tourism. The analysis could be further improved if better and more accurate data were available.

Finally, although our main goal in this paper was to develop a measure of sustainable tourism linked to an economic index, we undertook a comparison between the STE index and a simple tourist pressure index (TPI) based only on bad outputs. The results stress both the importance of inputs and the positive economic impact (i.e., good outputs) in evaluating the tourism sustainability of relevant territorial units. Therefore, the analysis of sustainability must be performed by following a broad approach that includes both economic and environmental aspects, rather than using a simple index that measures only one specific tourist characteristic.

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