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Investing in biodiversity: The recreational value of a natural coastal area

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This essay focuses on the comparison between the recreational value of a natural beach area and the recreational value of a developed beach area nearby. Within the EU DELOS (2000–2003) framework, a survey by questionnaire was carried out in 2002 in Lido di Dante, a well-developed tourist resort in Italy. It consists of the application of the Contingent Valuation Method (CVM) in the value of enjoyment version (VOE) for assessing the non-marketable recreational use (such as sunbathing, walking, and swimming) of the Lido di Dante beach areas in the status quo and in hypothetical scenarios of erosion and artificial defence. The project of defence from erosion, considered in this exercise, is paid with public funds. Foreigners were interviewed. It is highlighted that the recreational value in the situation of erosion is lower than that of the status quo, and that the individual loss of enjoyment would be considerable, while the implementation of the project would give a mean gain. Among the explanatory variables of the recreational beach use, the beach quality ratings seem to be important, while income is not significant when it is specified. The comparison of the values for the different beach areas highlights that in Lido di Dante, the daily use value in Euros of the natural beach area is higher than that of the developed beach area. This case study shows that, from a recreational point of view, investing in a natural area is successful and that a sustainable coastal development requires defence projects to be selected also in order to preserve biodiversity.

Keywords: Public goods; Biodiversity; Protected area; Sustainable coastal management; Beach-use value; Foreign tourism

1. Introduction

In Europe, traditional 'sun and sea' recreational activities are still the most popular. With the aim of increasing the social welfare and custodianship of the common resources, the preservation of coastal areas is an essential task of the public authorities. From an economic point of view, coastal areas such as beaches, dunes, and pinewoods are public goods, or collective goods, which everyone enjoys in common. In particular, services of open-access beaches are classified as *quasi-public goods*, because a beach is a 'congestible' good; in fact, its carrying capacity can be reached, and beyond this point the more visitors there are on the beach, the poorer each visitor's experience [1].

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The natural and near-natural characteristics of these areas at tourist sites attract numerous visitors and make major contributions to local economies. According to the IUCN [2], 'a protected area is an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means'. Nevertheless, the fact that an investment in protected areas may provide significant sustainable economic benefits has to be proved because public funds are limited. In other terms, investing in natural areas competes with other alternative public investments and other alternative uses of the same area.

The cost–benefit analysis (CBA) is a method for pursuing a sustainable coastal management and has the task of showing whether an investment project will have a net social benefit. It is also designed to show which of the competing projects has the highest net benefit and should be implemented. The CBA requires all the benefits and costs ascribed to a project to be expressed in monetary terms. Nevertheless, not all the benefits and costs of a protected area have a market price. In particular, as regards the benefits, if they are not evaluated, they cannot be considered in the CBA; the economic value of the area is underestimated, and the project may not win the selection.

Which values can be ascribed to a protected coastal area, and which must be considered in the CBA? According to Turner [3], the total value (TV) ascribed to nature has two components and can be written as: TV = PV *and* TEV, where PV is the primary value and TEV is the total economic value. PV means that an intrinsic objective value independent of the individual's preferences is recognized to the natural system considered as a whole. Human preferences cannot establish this value, and because the functioning of an ecosystem is more than the sum of its individual components, this value is recognized by intuition and cannot be measured in economic terms. Therefore, the PV cannot be added to the TEV. The TEV is measurable in monetary terms because it depends on human preferences, which are considered cardinally measurable. The TEV is considered in the CBA and consists of four different economic values: TEV = use value + option value + bequest value + existence value. The use value is the monetary amount ascribed to the use of a resource by whoever makes the valuation; direct uses are beach recreational use and fishing, while indirect uses are storm protection and flood control, for example. When a person states a value in order to have the option to use the resource in the future, they make reference to option value. The bequest value measures the amount a person would pay for the preservation of a resource for future generations. The existence value is the amount the person who makes the valuation would pay only for knowing that a resource exists, because they recognize a subjective intrinsic value to it (the loss of biodiversity may be considered a loss of welfare only because it no longer exists, for example). Economists have established specific methods which permit an estimation of those values that the market does not establish, such as free recreation, beach flood control, bequest, and existence values.

This brief presentation of the different components of the TEV which can be ascribed to a coastal area makes clear that its estimate is a complex task. Here, the focus is on the direct use value given by informal recreational activities on the beach, such as sunbathing, swimming, walking, and relaxing. As regards a free access beach, the market does not establish a price which represents its recreational use value. Therefore, it needs to be evaluated by a specific economic method. In this essay, the beach of Lido di Dante (Italy) is considered as a case study. This beach consists of a developed area and a preserved natural area whose access is free of charge, and which must be defended from erosion by implementing a public project. By 'developed beach area', we mean a sandy beach strip behind which dunes and pinewood are destroyed in order to build tourist facilities (such as sunbathing establishments and bars), while by 'preserved or natural beach area', we mean a beach strip behind which dunes and pinewood are conserved.

This essay highlights that in this site, visitors evaluate the recreational use of the natural beach higher than that of the developed beach. Data obtained from a Contingent Valuation Method (CVM) survey, financed by the EU DELOS (2000–2003) project, were used. Section 2 describes the specific characteristics of the Lido di Dante beach areas, analyses the methodology used in order to estimate the recreational beach use and presents the survey design. Section 3 shows the main descriptive statistics in order to provide data for the decision-making process about the protection of the natural beach, and highlights variables which affect the recreational use value. In section 8, the conclusions are presented.

2. Material and methods

2.1 *Characteristics of the study site*

Lido di Dante is a well-developed tourist resort near Ravenna on the North-West Adriatic coast (Emilia-Romagna region), where the beach of light fine sand is about 2500 m. long. In spring/summer, it is also visited by foreigners, while in autumn/winter, it is visited almost exclusively by Italians. The PV and all the TEV components can be ascribed to this beach. Its PV is justified by its contribution to the natural coastal system (intrinsic value), considered as a whole. As regards the TEV, we particularly highlight that its direct use value is justified by the well-developed local tourist sector, which is based on the recreational activities on the beach mainly in spring/summer.

The Northern beach is developed from the recreational point of view, and it can be categorized into two areas: the well-developed beach (North 1), where sunbathing establishments occupy the whole area; and the semi-developed beach (North 2), where one sunbathing establishment occupies part of the area. In these two beach areas, the loss of biodiversity has been quite high, because the natural environment has been to a significant extent sacrified for tourist growth. The Southern beach instead is a protected natural area, with the highest degree of biodiversity in the region. Here, dunes and pinewood (*Pinus pinaster*) are behind the beach. This area belongs to the Parco del Delta del Po, and it is also recognized by the Ramsar Convention (D.M. 13.07.1981) and the European Union (D.M. n.65, 3.03.2000). Young visitors and foreign tourists are numerous, mainly attracted by its natural state. The loss of biodiversity mainly concerns fauna present in fewer numbers than the potentiality of the area, because it is disturbed by visitors. In particular, *Charadrius alexandrinus* and the *Anthus campestris* are present here.

These different beach areas are visited by people with different tastes or preferences. The two Northern areas have the usual traits of beaches in the Emilia-Romagna region, where sunbathing facilities are available on the beach. Access to these areas is easy via an asphalted road. The southern area instead is one of the most beautiful beaches in Italy, and the largest beach for authorized naturism. In this area, there are no sunbathing establishments. The area is well known. There is a website describing its natural characteristics and giving visitors information for easy access. Lido di Dante is a case in which, by visiting one beach area instead of another, visitors clearly reveal their preferences about beach characteristics. Those who visit the Northern areas for 'sun and sea' recreational activities mainly prefer a beach where it is possible to rent sun umbrellas and loungers, to meet new people, and also where there are bar services. Instead, those who visit the Southern beach mainly prefer to sunbathe in a natural environment, where the need for freedom and quiet is also satisfied.

The Lido di Dante beach—particularly the Northern areas—is under erosion (width reduction about 3 m per year) mainly caused by land subsidence and low sediment transport rates

Figure 1. Artifially defended Northern beach: status quo.

from the nearby rivers. The local government is responsible for the coastal management. The Northern beach areas are already artificially defended through nourishment, groynes, and submerged breakwaters. Renourishment is frequently needed to maintain the sand beach. Figure 1 shows a view of the Northern nourished area with groynes, while there are also submerged breakwaters not visible here. In the Southern natural area, instead, erosion is slight, and the beach is not artificially defended, as figure 2 shows.

2.2 *Method for evaluating the recreational beach use*

Different valuation methods exist for estimating the recreational beach use, and the choice of one of them depends on the specific characteristics of the site considered. The practical

Figure 2. Natural Southern beach: status quo.

difficulty lies in obtaining rational and consistent expressions of value from people who use a beach, because the market is unable to establish the recreational value of that beach. In general, as regards beach recreational activities, the Travel Cost Method (TCM) and the Contingent Valuation Method (CVM), based on a survey by questionnaire, can be applied. The aim of these two methods is to estimate the recreational use value of an environmental quality change, such as a loss of biodiversity. However, a valuation survey is time-consuming and very expensive, and therefore the procedure of the Benefit Function Transfer (BFT) is also suggested. For a new site, the BFT uses benefits *transferred* from other studies. For its application, some basic criteria have to be respected, e.g. (1) beach characteristics have to be the same, and (2) population characteristics should be similar for the policy and study sites [4, 5]. As regards the Lido di Dante beach, at the time of the survey, no published or unpublished application of evaluation methods to similar sites in the Northern Mediterranean Sea were found or had a transfer function yet been estimated for beach use. So, it was not possible to infer the value of the beach use in Lido di Dante from the use values of other beaches. The Lido di Dante survey was one out of the first four CVM valuation exercises about beach use contemporarily carried out in Italy (and in the Mediterranean Sea area) in summer 2002 within the EU DELOS project. A BFT about the beach recreational use has now been estimated by Polomé *et al.* [6].

As regards the choice between the TCM and CVM, the TCM was found to be unsuitable for the Lido di Dante case study. The beach is visited by residents, day-visitors, and tourists. Residents take a few minutes to go to the beach (5 or 6 min on average) and spend no or very little money, because many of them go by foot, bicycle, or scooter. In this case, their recreational value would have been underestimated if the TCM had been used. Day-visitors, too (very numerous), do not spend much money because they do not usually travel long distances by scooter or by car, and they take on average just under 45 min to go to the beach. More specifically, the majority of residents and day-visitors take less than 20 min to reach the beach. Moreover, the TCM also requires the cost of the travel time to be added to the journey transportation costs. Nevertheless, how the opportunity cost of time should be considered and measured remains under discussion. The general approach is to assume that visitors' income is the basis for measuring the opportunity cost of time. Some authors assume that the opportunity cost of a holiday hour is a certain (and often arbitrary) percentage of the hourly wage for visitors. In particular, Navrud and Mungatana [7] assume that this opportunity cost is 30% of the hourly wage for all visitors, McConnel and Strand [8] compute this percentage from the sample data, which was found to be about 60% of the hourly wage, while Whitehead *et al.* [9] assume that it is 100%, i.e. the whole hourly wage. In Italy, experience shows that numerous visitors do not state their income, and in Lido di Dante, 47.5% of respondents did not state their income, in particular 57.5% of foreigners. As regards all these respondents, the value of the travel time cannot be computed. In addition, as regards tourists (nationals and foreigners), who travel long distances mainly by car and usually visit the site once per year, beach visits are usually combined with other activities such as visiting the nearby artistic and cultural sites, and recreational activities by night. In the case of multiple destinations, Navrud and Mungatana [7], for example, apply the total TCM and estimate the value of a specific recreational activity by using the criterion of the 'portion of time' spent on the beach. Nevertheless, these authors [7] apply this criterion by assuming 'constant recreational value' for the different activities. This assumption seems to be quite arbitrary if applied to the Lido di Dante case study. In particular, does an hour spent at the disco have the same value as an hour spent on the natural beach? Does a day spent by tourists visiting a town of cultural interest have the same value as a day spent on the beach? Our reply is that the different recreational activities may have different values, which also change from individual to individual. In order to avoid arbitrarily dividing in some way the total travel cost between the different activities, Mendelsohn *et al.* [10] suggest treating a multiple destination trip as a single good with its own

demand function. Nevertheless, this approach does not permit us to know the specific beach use value in a multiple-destination trip. Therefore, for the aforementioned reasons, it seemed to us that the best method for the Lido di Dante case study is to ask respondents directly what this value is, and the CVM was preferred to the TCM.

2.2.1 Contingent valuation method in the value of enjoyment version. The CVM generally is known in the willingness to pay (WTP)/willingness to accept (WTA) version, whose philosophy is: 'If you want to know what something is worth, go to those who might value it and ask: "what are you willing to pay [to accept] for it?"' (Price, 2000). As regards the coastal use, Penning-Rowsell *et al.* [11] applied the CVM in the value of enjoyment (VOE) version, and the valuation question is: 'What value do you put on your enjoyment of a visit to . . .?'. The WTP/WTA needs the specification of a payment vehicle, such as tax, entry charge, voluntary donation and so on, and in this way the income constraint is expressed. The VOE does not need this specification and makes reference to the cost of similar recreational activities; therefore, it has the advantage of avoiding criticism about the choice of the payment vehicle, which can determine responses biased towards underestimation or overestimation [12]. In addition, certain payment vehicles, such as fees and extra taxes, may be unpopular. More specifically, experience shows that respondents who express zero WTP bids may object to the daily entrance fee because they consider the management of beaches a duty of government [13]. Laarman and Gregersen [14] specify that the charging of a fee raises the question as to whether an environmental resource should be provided as a free good or not. Is access to a natural resource, such as a beach, everyone's right? Should low-income people be excluded from the appreciation of nature? These questions raise a concern for equity, which could determine public resistance to any form of payment. Finally, the VOE method also avoids the problem as to whether an elicitation question in a survey is phrased as WTP or WTA. Considerable evidence exists to show that there is a difference between the WTP and the WTA for changes in quantity of a public good. Respondents tend to state greater WTA values than WTP values for the same good. Transaction costs, loss aversion, uncertainty, and survey-related phenomena seem to be reasons for this behaviour [15, 16].

As regards Lido di Dante, the CVM in the WTP version was found to be unsuitable. At the time of the survey, the local government policy about beach management was: (1) projects are financed through public funds (no new taxes or voluntary private contribution) because beach defence is a primary task of land management, and (2) access to the beach is everyone's right and must be free of charge, thus showing a concern for equity. The EU principle of 'free access to the coast' seems to be interpreted as the recognition that beach access is everyone's right [17]. Local policy-maker interest in the survey findings was justified by the fact that, at that time, estimates about beach use benefits to be compared with the cost of a defence project were not yet available. In addition, in this site, visitors are generally well informed about government beach management (the great majority of them are habitual visitors). Therefore, at that time, not only would any payment vehicle have been unpopular, favouring free-riding responses or protest answers, but a scenario where a defence project is financed through a specific visitors' contribution, and not through public funds, would have been considered totally non-realistic and implausible by respondents.

In order to create a realistic and credible scenario, incentive-compatible [18], a CVM in the VOE version was found to be suitable. This method, founded on the neoclassical economic theory of the consumer, is based on the following individual behaviour rule: each visitor prefers the alternative, or scenario, to which the maximum enjoyment or utility corresponds. The visitor's preference about each different scenario is reflected by the monetary VOE that they state for it. Let us consider, for example, a beach under erosion and two alternative

scenarios: the 'status quo' option and the 'artificial beach defence' option. Each individual prefers the artificial defence option if and only if the enjoyment obtained from the defence option is higher than the enjoyment obtained from the status quo. With this technique, every respondent expresses their own preference by stating a monetary value which is contingent on each scenario considered within the survey. A rational respondent states the highest value for the most preferred option. Given the specific situation about the Lido di Dante beach, the VOE method enabled a scenario to be created where any amount stated by visitors would not be collected by the local government. In this way, respondents had no incentive to behave strategically but were encouraged to say the truth about their preferences.

2.2.2 Aggregate beach value: gain (or loss) of enjoyment for a beach change. The CVM provides the appropriate values for the computation of the aggregate VOEs for the different beach scenarios, and the aggregate gain or loss of enjoyment for each beach change. The aggregate value is generally computed per year as follows:

$$\mathrm{AV} = V_{\mathrm{m}} N q_{\mathrm{m}}, \tag{1}$$

where AV is the aggregate value, V_{m} is the mean value, N is the total arrivals per year, and q_m is the mean number of beach visits per adult and per year (Nq_{m} is the total number of visits per year). The aggregate value must be computed taking into consideration residents, day-visitors, and tourists, and data about their total number of visits per annum are needed. Because some respondents may go to the beach more than once a day (those who live, or are staying, near the beach), it is useful to estimate the beach use value per day (daily visit) instead of per visit, because official data about overnight tourist stays are available. Therefore, we make reference below to a daily beach visit.

When, in equation (1), V_{m} represents the mean use value per daily visit about a specific scenario, AV is the aggregate value of the beach use in that scenario, whereas when V_{m} represents the mean gain (loss) of enjoyment per daily visit for a beach change, AV is the aggregated gain (loss) of enjoyment about that change. Penning-Rowsell *et al.* [11] suggest computing the mean gain (loss) of enjoyment per visit by computing the gain (loss) for each individual and, since individuals may visit other sites after a change in environmental quality (erosion or artificial defence), by distinguishing between people who continue to visit the same beach and people who transfer their visit to an alternative beach. The following two situations can be considered: (1) if people continue to visit the beach area considered, the recreational gain or loss in enjoyment per daily visit is the difference between the VOE of a visit after that change, and the VOE in the status quo; therefore, for each individual, it is:

$$D = V_{\mathrm{c}} - V, \tag{2}$$

where D is the individual gain (loss) in enjoyment, V_{c} is the individual VOE after the beach change, and V is the individual VOE in the status quo; (2) if people transfer their visit to another beach:

$$D_{\mathrm{a}} = (V - V_{\mathrm{a}}) + (C_{\mathrm{a}} - C_{\mathrm{s}}), \tag{3}$$

where D_{a} is the individual net gain (loss), V_{a} is the individual VOE of the alternative beach, C_{a} is the individual cost per daily visit to the alternative beach, and C_{s} is the individual cost per visit to the beach about which the change is considered. The mean gain (loss) for the whole sample is computed from the individual values obtained by equations (2) and (3).

Finally, in the CBA, the aggregation level in general is the national economy, and therefore foreigners should not be interviewed [11, 19]. This case is typical of a situation in which

the recreational value for foreigners represents a negligible part of the aggregate recreational value. Nevertheless, in numerous coastal sites, foreigners are a considerable part of the relevant population, and they give high value to 'sun and sea' recreational activities. As Arrow *et al.* [20] claim, in general 'it is sometimes difficult determining the "extent of the market"... . Undersampling and even zero sampling of a subgroup of the relevant population may be appropriate if the subgroup has a predictably low valuation of the resource.' Therefore, if the subgroup consists of foreigners in a well-developed international tourist site, the 'foreign' use value of a beach cannot be neglected, since this would mean neglecting an important part of the aggregate recreational value of that beach. It seems to us that in general, the aggregation level for the Mediterranean beaches of international tourist sites should be at least equal to the European level. Therefore, at Lido di Dante, foreigners were interviewed.

2.3 *VOE function*

If we want to know the explanatory variables of the beach-use value, they must be modelled parametrically. Even though Whitmarsh *et al.* [21] highlight that there is no model to describe all the variables on which a value depends, the following VOE function for each individual about a specific scenario can be written:

$$\mathrm{VOE} = w(q, A, Q, V, H, N, K, T, G, F, W, \mathrm{VOE_s}, L, \mathrm{VOE_a}, B, C, Y, S, I), \qquad (4)$$

where VOE = individual VOE per daily beach visit in a specific scenario; q = individual number of visits (beach days per annum or per season); A = beach attributes, such as the degree of biodiversity; Q = beach-quality ratings; V = beach-visit characteristics, such as time of visit (weekend, other days), number of hours per day, and recreational activities done; H = number of holidays in the same site; N = nationality; K = visitor's category (resident, day-visitor and tourist); T = travel time; G = visiting group, with a child in a visiting group; F = facilities, such as sunbathing buildings and lifeguard; W = different seasons, such as spring/summer and autumn/winter; $\mathrm{VOE_s}$ = the VOEs of alternative beach scenarios; L = alternative beaches; $\mathrm{VOE_a}$ = the VOEs of alternative sites; B = to be in favour or not of the implementation of the project; C = difference between the cost of beach trip about the considered site and the cost of an alternative beach trip; Y = household income; S = other socio-economic attributes, such as sex, age, education, and marital status; and I = survey influences, such as interviewer.

Guidelines for the specifications of model (4) cannot be provided by economic theory. VOE estimates can be obtained by using a random utility model, which is generally indicated as follows:

$$v_i = bx_i + \varepsilon_i, \qquad (5)$$

where v_i is the VOE of the ith visitor in a random sample of beach visitors, b the unknown parameters to be estimated, x_i the observed data, and ε_i the unobserved random term. Through regression analysis, a certain number of attempts are generally made to test determinants of the beach recreational use value.

2.4 *Survey design*

The CVM survey in the VOE version was carried out in August/September 2002 [22, 23]. Its main aim was to assess the use value of the Lido di Dante beach in different conditions—status quo, hypothetical scenario of erosion, hypothetical scenario of artificial defence. The relevant population were residents, same-day visitors, and tourists (foreigners included) aged 18 plus.

As regards the sampling frame, a random sample of 600 interviewees on the beach (on-site survey) was stratified by the place of origin and three beach areas (255 on the well-developed Northern area, 204 on the semi-developed Northern area, and 141 on the Southern preserved area). Interviews (face to face) were done by a market research firm. Anonymity was guaranteed.

The basic structure of the VOE questionnaire used for the Lido di Dante case study is the standard site user questionnaire published in the *Yellow Manual* [11]. The same questionnaire was used for the different beach areas. Visitors were first asked to state the VOE for the status quo, then for the erosion scenario, and finally for the artificial defence scenario relating to their own beach area. As regards seasons, it was possible to organize the survey at only one time; therefore, because the different seasons in Italy have very different weather conditions, specific questions were also included in the questionnaire about autumn/winter.

In its wording, the questionnaire aims to collect information about: (1) respondents' residence (in order to classify them as local resident, day-visitor, or tourist), time spent travelling from home to the Lido di Dante beach, whether respondents visit the beach alone or in groups, whether they usually visit this beach on holiday, and respondents' judgement about suitability of the beach for recreational activities; (2) type of recreational beach use, number of visits per year and daily time spent on the beach in spring/summer and autumn/winter; (3) the beach-quality rating, and the value of enjoyment of a daily visit to the seafront in its status quo in spring/summer and autumn/winter; (4) the change in enjoyment and in the number of visits after the possible erosion of the beach in spring/summer and, if respondents would go to another beach, the VOE and change in the cost of transport for the alternative beach; (5) the change in enjoyment and in the number of visits about spring/summer after the hypothetical defence project, whether they would be in favour of or against the hypothetical beach change, and, if respondents would go to another beach, the VOE and the change in the cost of transport for the alternative beach; (6) visitors' preferences about different kinds of defence structures and materials, and motives of preference; (7) the social characteristics of respondents; and (8) interviewers' judgements of respondents' comprehension of the questionnaire. In particular, as regards point (6), the questions were included in the questionnaire because engineers in the DELOS research programme were interested in designing Low Crested Structures which also meet the preferences of beach visitors.

The VOE valuation question makes reference to the cost paid for similar recreational activities, mainly private. The comparison of the value of goods, such as the beach use, to the cost of similar and familiar goods is also a suggestion of the NOAA panel for estimating the willingness to pay for unfamiliar goods ([11], p. 40). As regards the status quo, the evaluation question is:

> We are trying to find out how much value you, as an individual, put on your enjoyment of this visit to this seafront today; I mean in Euro and cents. Now, this is an unusual question to ask so let me explain it to you in this way: Think of a visit or activity you have done in the past which gave you the same amount of enjoyment as your visit to this seafront today [a list of possibilities, such as swimming pool, theatre, cinema and so on, was shown]. Now, think about how much that visit or activity cost you (such as entrance ticket, bus or train fares, petrol and parking costs). You can use the costs of that visit or activity as a guide to the value of your enjoyment of today's visit to this seafront. So, what value do you put on your individual enjoyment of this visit to this seafront? [11].

As regards the hypothetical scenario of erosion, after explaining that because of the erosion the size of the beach will reduce, figure 3 was shown and described to respondents who were on the Northern beach area (North 1 and North 2), while figure 4 was shown and described to those who were on the Southern area. These figures represent the hypothetical changes due to erosion in the two areas, respectively. As regards the hypothetical scenario of artificial defence from erosion, it was explained that the exact design of the works to defend the beach had not

Figure 3. Northern beach: erosion.

yet been decided; nevertheless, at the end of the works, the beach area where respondents were would very likely have been as shown in figure 5 (Northern areas) or figure 6 (Southern area), where the width of the beach increased by nourishment and defended by building submerged breakwaters. Figure 1 was used for creating figures 3 and 5, and figure 2 for creating figures 4 and 6. The hypothetical erosion and protection scenarios are not specifically described in the questionnaire in terms of metres, because at the time of the survey, the possible erosion and the best project for obtaining a beach similar to that shown in figure 5 or figure 6 were still under study. For the same reason, no mention was made of the cost of the project (on this topic, see Zanuttigh *et al.* [24]); in addition, there was no need to make respondents aware of the minimum level of voluntary funding because the project is financed by public funds [25, 26]. The evaluation question, used for the beach change in the hypothetical situation of erosion and also in that of hypothetical defence, is: 'How much enjoyment would you get from your visit to the beach as shown in the figure . . . in money terms?'

The questionnaire is quite complex. In particular, respondents had to state six use values: four for the Lido di Dante beach (three for the different scenarios in spring/summer, and one for the status quo in autumn/winter) and two for the alternative beach in spring/summer if respondents for each beach change would visit another beach. Given the available funds, questions about autumn/winter visits were asked only for the status quo of the beach, in order to prevent the Lido di Dante questionnaire being too long. As regards household income, in order to reduce the number of non-responses if the exact amount of income was asked, and to facilitate respondents

Figure 4. Southern beach: erosion.

Figure 5. Northern beach: defence.

who do not know the exact current income of their family, a list of 10 income categories was established and shown to interviewees: 1 = €1–9999; 2 = €10 000–14 999; 3 = €15 000–19 999; 4 = €20 000–24 999; 5 = €25 000–29 999; 6 = €30 000–34 999; 7 = €5 000–39 999; 8 = €40 000–44 999; 9 = €45 000–49 999; 10 = €50 000 and above.

Because most of the biases that may occur in a CVM survey are related to the questionnaire structure, a pilot survey was carried out to test the questionnaire wording before conducting the main survey. In particular, attention was paid to reducing and possibly avoiding: strategic behaviour (free-riding), by presenting the realistic scenario where the value stated will not be asked by local authorities; compliance behaviour, by informing respondents that the research has exclusively scientific aims and that impartiality is guaranteed, and by training interviewers in this sense; starting-point bias, by considering open-ended evaluation questions; methodological misspecification bias, by specifically training interviewers in order to prevent respondents unfamiliar with the valuation question actually answering a different question. In addition, as regards the information bias, respondents have use experience of the beach; furthermore, to limit the risk of respondents giving an incorrect interpretation of the two hypothetical beach changes, these changes were described through figures 3–6.

Figure 6. Southern beach: defence.

3. Results and discussion

3.1 *Beach recreational use value: Descriptive statistics and aggregate values*

In all the different beach areas, on a scale of 1–10, the great majority of respondents rated the beach as a place to visit at 5–10 (about 90% in the Northern areas, and 88% in the Southern area); in particular, in all the areas, about 50% gave a rate of 6–9. Nourishment and submerged breakwaters were the most preferred combination of defence techniques for Lido di Dante [23, 24]. The main comparable recreational activities, whose cost is taken by respondents as guide in order to state the monetary value of the enjoyment of a day spent on the beach, are: a visit to a nature park (14% of respondents), going to the swimming pool (13%), the favourite sport (12%), and going to the cinema (11%). The majority of respondents who declared their household income have an income lower or equal to €30 000; in particular, 20.94% of these respondents declared an income in the €10 000–14 999 category and 18.66% in the €15 000–19 999 category, while 8.51% declared an income higher than €40 000.

3.2 *Mean value according to scenarios and population groups*

Very few respondents declared that they were unable to state a monetary value, and these were excluded from the mean value computation. Respondents who stated zero value for the beach use were considered in the mean value computation. A certain number of extreme values were found and excluded from the mean computation. In particular, as regards the status quo in spring/summer, 19.8% of the sample gave values higher than €100, whereas for the erosion scenario, this percentage was 2.7%, and for the artificial defence scenario, 10.8%. For the status quo in autumn/winter, 0.8% gave values higher than €100. A justification of these differences may be that a certain number of people who did not properly understand the first valuation question for the status quo understood better with the subsequent valuation questions and therefore stated lower values for the other scenarios.

As regards the different scenarios, considering the whole sample, table 1 shows the following mean values computed by excluding from the sample all individual values >€100: €27.67 and €4.10 for the status quo in spring/summer and autumn/winter, respectively, €13.26 for the eroded beach (spring/summer), and €28.37 for the artificial defence (spring/summer). The lower value for the autumn/winter season is also justified by the fact that in the mean

Table 1. Mean VOE according to scenarios and population groups (€).

Mean value (median)	Status quo	Erosion	Artificial defence
Spring/summer			
Whole sample	27.67 (20)	13.26 (5)	28.37 (20)
Visitor category			
Residents	10.25	9.33	23.14
Day-visitors	23.21	10.76	24.91
Tourists	32.28	15.51	31.53
Nationality			
Italy	26.45	12.49	27.16
Germany	30.93	16.45	28.65
France	30.00	14.04	33.36
Switzerland	53.33	28.70	36.38
Holland	22.50	5.50	25.00
Other countries	39.33	14.08	31.73
Autumn/winter			
Whole sample	4.10 (0)		

computation, respondents who do not visit the beach in autumn/winter (75.5%) are included as zero values.

As regards population groups, table 1 shows that at Lido di Dante for spring/summer, the highest mean use value for all the scenarios considered was stated by tourists, and the lowest by residents. This may be due to the fact that beach tourists spend more money in travel costs for visiting the Lido di Dante than residents and day-visitors. The beach-use value also changes according to visitors' nationality. 17.7% of interviewees were foreign visitors, with many stating higher values than Italians (nationals). As regards the status quo in spring/summer, the mean use value for Italians is about €26.5, while for foreigners, it is about €33. In particular, table 1 shows that Swiss and Dutch interviewees give on average the highest and the lowest mean values, respectively, for all the scenarios evaluated, and that the French, the Dutch, and the Italians evaluate the artificial defence higher than the status quo, while the Germans, Swiss, and other nationalities evaluate the artificial defence lower than the status quo.

3.3 *Mean gain and loss of enjoyment*

The Lido di Dante beach has alternative beaches in the vicinity. In the hypothetical situation of erosion, 16.4% of respondents would never visit the Lido di Dante beach, 29.1% would visit less or much less often, and the majority of respondents in these two groups would go to another beach. Nevertheless, the majority of respondents would continue to visit the eroded beach (54.5%), and in particular 2% would visit the beach more or much more often. In the hypothetical situation of artificial defence, the great majority of respondents would visit the beach (93%) and are in favour of the implementation of the defence project (82.17%); while only 4.7% would reduce the number of visits, and the majority of these respondents would go to another beach. The greatest percentage of unfavourable respondents were among foreigners (7.5%), while only 1.6% of Italians were unfavourable.

The individual gain or loss of enjoyment for a beach change is computed by distinguishing visitors according to their reaction to each hypothetical scenario. Equation (2) is applied for those respondents who would not go to an alternative beach after the change, while equation (3) is used for those who would visit an alternative beach. Table 2 shows the mean individual gain or mean loss (spring/summer) computed for each of these two sub-samples of respondents, for the whole sample, and for foreigners. If the beach change is the situation of erosion, respondents who would visit another beach would report a smaller mean loss (€3.5) than those who would remain on the Lido di Dante beach (€14.92); while, when the beach change is the situation of artificial defence, respondents who would go to another beach would have a higher mean gain (€11.17) than those who would not visit an alternative beach (€0.92). The mean gain and loss for the whole sample depends on the reaction of all respondents—the great majority of them in both hypothetical scenarios would remain on the Lido di Dante beach. For the whole sample, the mean loss of enjoyment due to erosion is €12.29, while the mean gain is €1.29 for the situation of artificial defence. Finally, as regards the sub-sample of foreigners,

Table 2. Visitor reactions: daily loss and gain in spring/summer (€).

Mean values	Alternative beach*	Same beach†	Whole sample	Foreigners
Loss from erosion	3.50	14.92	12.29	12.25
Gain from artificial defence	11.17	0.92	1.29	2.58

* 'Alternative beach' means that visitors go to another beach after the Lido di Dante beach change.
† 'Same beach' means that visitors do not visit another beach after the change.

their loss of enjoyment from erosion is not very different from that of the whole sample, while the gain from the defence is higher. These data suggest that visitors are generally very sensitive to loss of enjoyment due to erosion.

3.4 *Aggregate values*

To calculate the aggregate value, the total number of beach visits (Nq_m) are needed. As regards 2002, official data are only available about the number of tourists, about 12 100 arrivals and 129 000 night-stays (for foreigners, 5230 and 51 400, respectively). Nevertheless, data about day-visitors and residents' beach visits are provided by the CVM survey, which shows that about 53% of respondents are tourists, while 45% are same-day visitors and 2% residents. They visit the beach on average 12 (foreigners 10), 23, and 47 days per year, respectively. In particular, in order to show the importance of measuring the foreign beach use value, we highlight that—according to equation (1)—in spring/summer the aggregate recreational value of the status quo is estimated to be of the order of €10 million, of which €1.7 million can be ascribed to foreigners. As regards the beach changes due to erosion and protection, the aggregate loss and gain in enjoyment must be respectively computed according to equation (1) by considering not only the values shown in table 2 but also the respective changes in the beach visits per year.

3.5 *Recreational value of biodiversity*

The stratification of the sample according to the different beach areas permits us to highlight that the beach use value changes according to the different beach areas. Visitors in the natural Southern beach stated higher mean daily VOEs than that stated by the visitors in the Northern beach areas for all scenarios and seasons. More specifically, as regards the status quo, table 3 compares the mean values about the different beach areas according to the different seasons. In particular, as regards autumn/winter, in order to show the mean values of those who visit the beach (24.5% of the whole sample), the computation is made by considering only the sub-samples of those respondents who visit the different beach areas (named 'visitors only').

In both seasons, the mean use value of the natural Southern beach is higher than the mean values of both the Northern beach areas. The greatest difference is about the well-developed area (Nord 1), which in spring/summer is €7.03 higher and in autumn/winter €3.24 higher, while as regards the semi-developed beach (Nord 2) in spring/summer, this difference is €5.23 higher and in autumn/winter €2.02 higher. These differences between the mean value of the natural Southern beach and those of the developed Northern areas show that the lower the degree of biodiversity in a beach area, the lower its recreational value.

This result is also confirmed by considering the hypothetical scenarios of erosion and artificial defence in spring/summer. The difference is that, in the two hypothetical scenarios,

Table 3. Status quo: mean daily use value according to beach areas and seasons (€).

Mean values (median)	Spring/summer	Autumn/winter: 'visitors only'*
Southern preserved beach	32.44 (20)	19.62 (10)
Northern semi-developed beach	27.21 (20)	17.60 (10)
Northern well-developed beach	25.41 (20)	16.38 (10)

*'Visitors only' means visitors to the Lido di Dante beach in autumn/winter.

Table 4. Hypothetical scenarios: mean daily use value according to beach areas in spring/summer (€).

Mean values (S.D.)	Erosion	Artificial defence
Southern preserved beach	21.49 (26.20)	33.39 (30.16)
Northern semi-developed beach	9.94 (17.17)	26.35 (25.16)
Northern well-developed beach	11.47 (16.27)	27.43 (23.60)

the mean values for the semi-developed area are lower than those for the well-developed area, as shown in table 4. In particular, in the situation of erosion described in figure 4, the Southern beach would retain more value than the Northern areas. The mean values presented here can be considered measures of the daily recreational values of biodiversity in Lido di Dante in different conditions.

3.6 *Main variables affecting the recreational VOE*

In order to find out explanatory variables of the beach use value, model (5) is estimated. The elicited values about respondents' recreation use do not cover the entire range of possible values, because some observations are concentrated at the lower limit zero. In addition, the presence of extreme values requires the establishment of an upper limit. Therefore, the Tobit regression technique is applied [27, 28]. The software STATA is used. Tables 5–7 show the independent variables (whose coefficients are significant) of seven Tobit models (I–VII). Models I–IV consider household income in categories; while models V–VII only concern visitors who declared income. $P = 0.10$, the cutoff value, in brackets.

As regards models I and II, presented in table 5, the whole sample is considered. Household income (after taxes and deductions) categories are considered as dummy variables. In model I, the dependent variable is the VOE about the *hypothetical* defence project (spring/summer), and in model II, the dependent variable is the VOE about the *real* scenario of the status quo (spring/summer). For both models, the VOEs of the alternative scenarios and also the VOE of the alternative beach (if the Lido di Dante beach becomes eroded) are positively and significantly related to the VOE of the scenario considered as a dependent variable. As regards model I (dependent variable=artificial defence VOE), for example, the status quo VOE and the eroded beach VOE coefficients are positive and significant; this suggests that an increase of €1 in the status quo VOE (or in the erosion scenario VOE) increases the defence scenario VOE by €0.017 (or by €0.267). Certain beach-quality ratings (on a scale from 1 to 10) are significantly related to the VOE of the scenario considered as dependent variable. Quality rating coefficients are mainly negative, but as a trend, they increase as the rating increases, suggesting that (*ceteris paribus*) respondents giving a high rating stated higher use values than respondents giving a low rating. A significant relation also exists between the VOE and some income categories. This relation is positive for only one category out of 10 when the dependent variable is the artificial defence VOE (model I), while it is negative for five middle-low, middle, and middle-high income categories when the dependent variable is the status quo VOE. Table 5 (model II) shows that, as a trend, the absolute values of income coefficients increase as the categories represent higher income classes. Considering the negative sign of these coefficients, this suggests that (*ceteris paribus)* a certain number of respondents with higher incomes gave lower status quo values than respondents with lower incomes. This seems justified by the fact that a certain number of respondents with higher incomes expressed lower beach-quality ratings than people with lower incomes [22].

Table 5. Spring/summer: Tobit coefficients: income in categories (whole sample).

Independent variable	Dependent variable	
	VOE: artificial defence* (model I)	VOE: status quo† (model II)
VOE: status quo	0.017 (0.025)‡	
VOE: erosion	0.267 (0.000)	0.438 (0.000)
VOE: artificial defence		0.505 (0.000)
Alternative beach VOE: erosion	0.058 (0.004)	0.104 (0.000)
Being in favour of the project	3.215 (0.000)	
ASE§: football match	8.756 (0.085)	
ASE§: art exhibition	18.982 (0.041)	
Tourist	7.607 (0.053)	
Tourist nights	−1.663 (0.094)	
Quality rating 1	−24.846 (0.002)	−14.695 (0.06)
Quality rating 2	−17.903 (0.024)	
Quality rating 3		−10.709 (0.066)
Quality rating 4		−13.184 (0.004)
Quality rating 5	−5.466 (0.073)	−7.211 (0.018)
Quality rating 6		−9.346 (0.001)
Quality rating 7		−5.717 (0.038)
Quality rating 10	10.820 (0.006)	
Income category 2	6.092 (0.045)	
Income category 3		−7.562 (0.012)
Income category 4		−5.964 (0.084)
Income category 5		−8.988 (0.016)
Income category 6		−7.453 (0.079)
Income category 7		−9.661 (0.030)
Income category 8	12.862 (0.056)	
Age	0.213 (0.07)	
Single	6.046 (0.016)	
Separated	8.039 (0.041)	
Primary school	6.931 (0.097)	
University degree		6.313 (0.033)
Pensioner	−7.641 (0.072)	
Constant		18.316 (0.011)

*Number of observations = 564; pseudo-R2 = 0.0604; log likelihood = −1856.2808.
†Number of observations = 564; pseudo-R2 = 0.1335; log likelihood = −1615.0296.
‡$P = 0.10$ cut-off value for all coefficients, in parentheses.
§ASE: activity that gives a similar enjoyment to daily beach recreation.

Model I also shows that being in favour of the implementation of the project is highly significant. The coefficients of being a tourist and the number of tourist nights in Lido di Dante are significant; being a tourist increases the use value of the defended beach, while the VOE for the defended beach decreases as the number of tourist nights increases. In addition, two recreational activities where fees are charged (football match and art exhibition) given by respondents as terms of comparison for establishing the monetary VOE for the defence project are significant and positive. Finally, as regards model I, the coefficients of age, having only attended primary school, and being single, or separated are significant and positive, while being a pensioner is significant and negative. As regards model II, the university degree coefficient is significant and positive.

The Tobit model is more explanatory (a higher pseudo-R^2, indicated at the bottom of table 5, notes * and †) when the dependent variable is the status quo VOE, than when the dependent variable is the artificial defence VOE. Therefore, it seemed more profitable to exert time and effort in further investigating the relationship between the status quo VOE and its explanatory variables. Models III and IV, presented in table 6, focus on the status quo VOE as a dependent variable, about which respondents have complete information because they are on the beach. They were estimated by considering visitors in the Northern areas and the Southern area,

Table 6. Tobit coefficients: beach areas, income in categories (dependent variable = status quo VOE (spring/summer)).

Independent variable	Northern beach* (model III)	Southern beach† (model IV)
VOE: erosion	0.557 (0.000)‡	
VOE: artificial defence	0.445 (0.000)	0.821 (0.000)
Alternative beach VOE: erosion	0.124 (0.001)	
Daily hours	0.013 (0.089)	
Quality rating 1	−27.127 (0.016)	
Quality rating 3	−10.792 (0.092)	
Quality rating 4	−13.882 (0.007)	
Quality rating 5	−7.494 (0.028)	
Quality rating 6	−12.621 (0.000)	
Quality rating 7	−5.459 (0.073)	
Income category 2	−6.643 (0.056)	
Income category 3	−7.900 (0.015)	
Income category 5	−12.686 (0.004)	−15.167 (0.042)
Income category 6	−8.716 (0.062)	
Income category 7	−9.655 (0.053)	
Entrepreneur		−11.388 (0.066)
Housewife		−20.074 (0.053)
Constant	19.392 (0.008)	25.171 (0.079)

*Number of observations = 429; pseudo-R^2 = 0.1177; log likelihood = −1278.486.
†Number of observations = 135; pseudo-R^2 = 0.2246; log likelihood = −318.7728.
‡P = 0.10 cut-off value for all coefficients, in parentheses.

respectively. Income is considered in categories. As regards model III, a certain number of beach-quality ratings and income categories explain the use value of the Northern beach, confirming the results obtained with model II. In addition, in this area, the use value also depends on the number of daily hours spent on the beach since the coefficient about the daily

Table 7. Tobit coefficients: Sub-sample of visitors who declared their income (dependent variable = status quo VOE (spring/summer).

Independent variable	Whole beach* (V)	Northern beach† (VI)	Southern beach‡ (VII)
VOE: erosion	0.372 (0.00)§	0.415 (0.00)	0.422 (0.03)
VOE: defence	0.476 (0.00)	0.420 (0.00)	0.471 (0.002)
Alternative beach VOE: erosion			0.206 (0.038)
Travel cost to other beach: erosion			0.448 (0.051)
Incombe	−0.0001 (0.207)¶	−0.0014 (0.15)¶	−0.0002 (0.57)¶
Daily hours		0.014 (0.08)	
Quality rating 1		−22.374 (0.05)	
Quality rating 4		−10.297 (0.04)	
Quality rating 5		−6.903 (0.05)	
Quality rating 6	−7.085 (0.025)	−9.388 (0.003)	
Quality rating 7		−6.861 (0.03)	
Being divorced		11.710 (0.005)	
Being widowed	−29.098 (0.005)	−27.445 (0.01)	
Entrepreneur			−15.475 (0.095)
Teacher			22.927 (0.09)
Labourer			23.832 (0.09)
Constant	18.881 (0.007)	15.031 (0.05)	

*Number of observations = 304; pseudo-R^2 = 0.1457; log likelihood = −889.041.
†Number of observations = 224; pseudo-R^2 = 0.1356; log likelihood = −700.22288.
‡Number of observations = 80; pseudo-R^2 = 0.2428; log likelihood = −160.80478.
§P = 0.10 cut-off value for all coefficients, in parentheses.
¶Non-significant.

hours is positive and significant, suggesting that the daily VOE increases by €0.013 if the time spent on the beach increases by 1 h. Model IV, instead, does not provide much information about the explanatory variables of the use value of the natural Southern beach. In particular, no coefficients of beach-quality ratings are significant, while those of only one income category, being an entrepreneur or housewife, are significant and negative.

In order to further investigate beach use in the different beach areas, some models were estimated by considering only those respondents who declared their income (52.5% of respondents). Income is specified by attributing to all respondents of each income category the midpoint of that category, and the income values established for the lowest and highest categories are 5000 and 50 000, respectively. Table 7 presents three models (V–VII) which concern the sub-samples of visitors to the whole beach, the Northern areas, and the natural Southern area, respectively. The non-significant coefficients presented are only those about income.

In models V–VII, the VOE coefficients in conditions of erosion and protection are significant and positive, while income is not significant. As regards the Northern beach, model VI substantially confirms the results of model III, while as regards the natural Southern area, model VII adds information, if compared with model IV. In particular, the coefficient of the 'alternative beach VOE' if the beach becomes eroded and the coefficient of the 'travel cost' to visit this beach are positive and significant; this suggests that, for respondents (who declared their income) in the Southern area, an increase of €1 in the alternative beach VOE, or in the travel cost, increases the status quo VOE by €0.206, or by €0.448. In addition, the coefficients of being a teacher or labourer are significant and positive.

4. Conclusion

This essay shows that the Lido di Dante beach is evaluated quite highly for 'sun and sea' recreational activities. This seems mainly due to the presence of tourists and to the natural characteristics of the Southern area. As regards the status quo in spring/summer, the mean value of a recreational visit to beaches in the UK and the US is about €20 (with reference to 2001 [6]), which is lower than the mean use value about the Lido di Dante beach with reference to 2001 (about €27, considering an inflation rate in Italy of 2.4% in 2002). More specifically, as regards the different categories of visitors, in Lido di Dante residents stated a much lower mean value than that of the UK and US (€10), day-visitors slightly higher (about €22.5), and tourists much higher (about €31.5, in particular, foreign tourists about €32). The Lido di Dante VOE is also higher than the mean use values elicited for the other Italian beaches considered as case studies in the DELOS research (mainly visited by residents and day-visitors), the values of which range from about €5 to €18 [6].

The great majority of respondents are in favour of the artificial defence of the beach from erosion, and the implementation of the coastal defence project in Lido di Dante would increase the mean status quo VOE. Nevertheless, this gain in enjoyment cannot be identified with the willingness to pay for the project, since there are different reasons why visitors may be willing to pay nothing or less than the VOE gain stated. More specifically, visitors may think that the beach use is everyone's right and that the defence of the beach is the task of the local policy-maker; in particular, nationals may justify their unwillingness to pay by saying that they already pay taxes, and tourists that they already pay travel costs and that local tourist managers should pay instead.

The beach-quality ratings seem to be important determinants of the VOE for the developed beach. Their coefficients increase as the rating increases, and this trend seems to highlight that (*ceteris paribus*) respondents giving a high rating state higher use values than those giving a

low rating. In the models presented here, the income coefficient is not significant when it is specified, whereas when income categories are considered as dummies, as regards the status quo VOE, a certain number of their coefficients are significant but negative. As a trend, the absolute values of these coefficients increase as the categories represent higher income classes. Given their negative sign, this suggests that (*ceteris paribus*) a certain number of respondents with higher incomes state lower values than respondents with lower incomes.

The explanatory variables of the use value of the natural beach appear not to have emerged completely, thus suggesting that further survey information is needed. New work seems justified in order to create a specific questionnaire to discover the main variables affecting the use value of the natural beach, in particular by including attitudinal questions, and to obtain new observations. Nevertheless, the Lido di Dante survey shows that, from the recreational point of view, investing in biodiversity is successful. The natural Southern area is evaluated more highly than the Northern beach areas—where biodiversity is sacrificed for tourism growth—in all the different scenarios and seasons. Therefore, coastal planning here requires defence projects to be selected also in order to preserve biodiversity.

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