

## **Estimating the Total Economic Value of *La Pointe des Châteaux*, Guadeloupe: A Contingent Valuation Approach**

**Nlandu Mamingi,<sup>1</sup> Alain Maurin and Jean-Gabriel Montauban**

### ABSTRACT

*This study derives the total economic value of La Pointe des Châteaux, the most important tourism site of Guadeloupe. The study uses the contingent valuation approach and has recourse to descriptive statistics, Turnbull estimation and probit models to obtain and assess in the first instance the use and non-use values of the site. The study reveals that the undiscounted total economic value of La Pointe des Châteaux would easily vary from 4,858,000 euros to 6,250,000 euros per year. The study also indicates that the entrance fee to the amenity would be about 6 euros per individual, per visit and the individual's yearly contribution to a fund geared towards the preservation and improvement of the site would amount to 26 euros. These findings mean that the possibility of developing, managing and preserving the site is real. This is indeed the task that the local authority of the site should focus on, particularly in the context of sustainable development.*

**Keywords:** Guadeloupe, *La Pointe des Châteaux*, Contingent Valuation Method, Total Economic Value, Turnbull Estimation, Tourism

Tourism, given its important contribution to the prosperity of many nations and overseas territories of the Caribbean, occupies a special place in the economy of Guadeloupe. There are, on average one

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million tourists to Guadeloupe per year, and in 2014 tourism<sup>2</sup> generated 1,513.5 million euros and contributed 16% of GDP. Tourism activities in particular supported 4,000 direct jobs (3.3% of total employment), and 17,500 induced jobs; that is, tourism generated 21,500 jobs in total (16.5% of total employment). Warm climate, excellent beaches, and beautiful sites (*Les Chutes du Carbet* and *La Pointe des châteaux* to name two) justify, to a certain extent, the tourism trend in Guadeloupe. It can, however, be observed that while the 1990s witnessed a sustained growth of tourism, the decade thereafter, in great part, registered a slowdown in activities. The economic world crisis, the events of 11 September 2001 and the tourism competition of other islands are factors which generally explain the present declining tourism trend in Guadeloupe.<sup>3</sup>

Among the sites which constitute the core of tourism in Guadeloupe, this study concentrates on *La Pointe des Châteaux* and attempts to derive its total economic value (TEV). TEV consists of use and non-use values. Here, use value is assimilated to direct use value and non-use value is associated with existence value.

The study derives the total economic value of *La Pointe des Châteaux* by examining among others whether (1) the users of the resource would like to pay an entrance fee to access the amenity and (2) the users and non-users would like to contribute to a fund geared towards the preservation of the resource. The study uses the contingent valuation method (CVM) to reach its main goal.

CVM is appropriate for the estimation of a variety of non-market goods. It is a stated preference method which uses a questionnaire survey to solicit directly from individuals the value of good (see, among others, Hoyos and Mariel 2010; Hanemann 1994; Mitchell and Carson 1989). Concretely, individuals are requested to express directly their willingness to pay (WTP) for the acquisition of the good, the use of services, the improvement of services, or their willingness to accept compensation (WAC) for a degradation of the quality of the good or the environment. Different question tools have been put in place to conduct a CVM: open ended questions, bidding games, payment cards and closed ended questions (single

2 For statistics, see World Travel and Tourism Council (2015).

3 In fact, the Gadeloupean economy is dominated by services including tourism (68% of GDP; 65% of labour force [LB]), industry (17% of GDP; 20% of LB) and agriculture (15% of GDP; 15% of LB).

bounded dichotomous choice, dichotomous choice with two offers, and so on). The National Oceanic and Atmospheric Administration (NOAA) panel recommends the use of a single-bounded dichotomous choice. The present study adopts the latter approach to derive the use and non-use values (for the two types of value, see, among others, Flachaire and Hollard 2006; Haab and McConnel 2002; Alberini, Kanninen, and Carson 1997). The consideration given to non-use value is an unquestionable advantage of CVM over quite a number of other valuation methods. CVM has been used in various circumstances: estimation of the existence value of monumental trees, estimation of climate change mitigation and adaptation costs, and evaluation of air pollution, water quality, soil and sites (see Ascuito et al. 2015; Markantonis and Bithas 2010; Raboteur and Rodes 2006; Lewis and Mamingi 2003; Dharmaratne, Ye Sang, and Wallig 2000; Dharmaratne and Brathwaithe 1998; Shultz, Pinazzo, and Cifuentes 1998; Choe, Whittington, and Lauria 1996). Ascuito et al. used a CVM to derive the existence value of monumental trees in an Italian park. "The aggregate WTP estimates for the park resident" vary from 10,520.40 euros to 83,479.37 euros. Markantonis and Bithas utilized a CVM to estimate "Greek national mitigation and adaptation climate change costs" (2010, 807). Raboteur and Rodes (2006) resorted to a CVM with payment cards to elicit the total economic value of the Zone of Pigeon (precisely the coral reefs of the Zone) in Guadeloupe. The use value of the site varies between 213,000 euros and 221,000 euros and fully justifies the recommendation, according to which the site needs to be preserved. Lewis and Mamingi (2003) used a CVM with payment cards to assess the total economic value of Barbados Harrison's Cave. According to their calculations, the TEV reaches 6,529,876.83 Barbados dollars.<sup>4</sup> Dharmaratne, Ye Sang, and Wallig (2000) derived, in the context of CVM, the use and non-use values of the oceanic park of Montego Bay in Jamaica and reserve national park in Barbados. Dharmaratne and Brathwaite (1998) combined both CVM and transportation cost method to estimate the value of beaches of the west coast and south-west for the visitors of Barbados.

The present study is important for several reasons. First, an accurate valuation of the resource helps policy makers develop an

4 1 US\$ = 2 BDS\$ with BDS standing for Barbados.

idea about the potential level of financing needed for the preservation of the site and/or its improvement. In fact, the valuation of non-market resources sits well with the sustainable tourism targeted in Guadeloupe. Second, from the results of the study the entrance fee level, allowing for the maximisation of revenue, can be deduced. Basically, the study is an effective way to deal with the question of the ideal entrance fee. To the best of our knowledge, this study is the first which attempts to derive the total economic value of *La Pointe des Châteaux*. Moreover, this is an unusual study which discusses at length the issue of population in the context of a CVM. Finally, to the best of our knowledge, this is the first empirical study which shows that the mean values derived from econometric models are not necessarily the best mean values to use in order to derive total economic value.

This description of the study proceeds as follows: Section one succinctly introduces *La Pointe des Châteaux*. Section two deals with the methodology to elicit the total economic value of *La Pointe des Châteaux*. Section three contains the analysis of survey data. Section four presents the econometric models and the results of estimation. Section five concentrates on the derivation of the total economic value of the site. The last section contains concluding remarks.

## LA POINTE DES CHATEAUX

*La Pointe des Châteaux* is located in Grande-Terre, forty kilometres from Pointe-à-Pitre and eleven kilometres from Saint-François, Guadeloupe. It is a peninsula with diverse features and spaces covering a total area of 733 hectares with a land area of 175 hectares. With an average of 500,000 visitors per year, *La Pointe des Châteaux* is the most important attraction in Guadeloupe. Figures 1 and 2 give us some hints why this site is a prime site in Guadeloupe and perhaps beyond Guadeloupe.<sup>5</sup> The site consists of a multitude of beautiful inlets, beaches with fine sand, and hiking trails and cliffs, all of which support various leisure and professional activities. The latter include family walks, hikes, sports, school, tourism, swimming, picnics, boutiques, restaurants, street vending and the observation of marine turtles. Incontestably, the photos in Figures 1

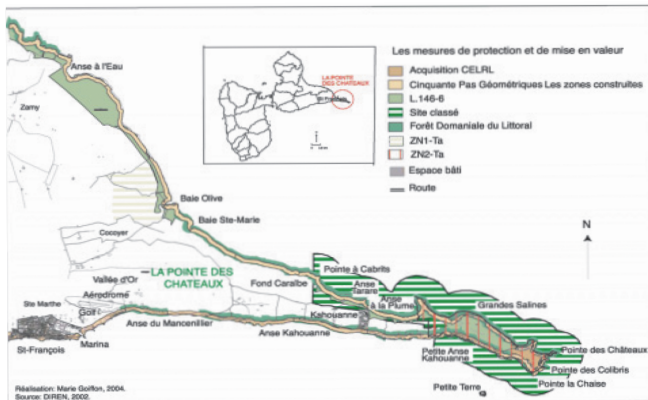
5 Also visit <http://www.pointe-des-chateaux.com/carte.html> and <http://www.pointe-des-chateaux.com/photos.html>.

and 2 convey positive images of the site's natural and landscape qualities. However, these remarkable characteristics, coupled with environmental degradation due to an impressive number of visitors and poor management, have motivated the local authority to mount a project entitled "Operation Great Site", which was approved by the Ministry of the Environment in 2001: "OGS has 4 objectives: to restore the quality of the landscape of a site, to determine a policy of dialogue, to identify a structure in charge of the realisation of programmes of valorisation, and singularly to promote local development" (Luc Legendre, cited by Goiffon and Consales 2005, 30).

Figure 1: *La Pointe des Châteaux*: Poetic Beauty and Location



Source: <https://www.karibbeancars.fr/index.php/2019/03/>



Source: Goiffon and Consales (2005, 35).

**Figure 2: Three Photos of *La Pointe des Châteaux***



Commune of St. François, Guadeloupe. Source: <http://www.pointe-des-chateaux.com/plages.html>



Source: Alain Maurin, 2016



Source: Alain Maurin, 2016

## METHODOLOGY TO DERIVE TOTAL ECONOMIC VALUE

The contingent valuation method is one of the methods to capture the economic value of a non-market good. It is a direct method of valuation of non-market goods for which individuals are requested to express directly their WTP for the utilisation/non utilisation of a non-market good or their WAC for a decrease in the quality of service of the environment. This is done using a questionnaire survey. That is, from the questionnaire information on the WTP for the use of a good or the WAC is derived. According to the literature, WTP is more reliable than WAC. It is worth noting that two types of values are attached to the good: use value and non-use value. Use value consists of direct use value, indirect use value and option value. Non-use value includes existence value, altruistic value and bequest value. In the present study, use value is assimilated to direct use value, and non-use value represents existence value. One of the virtues of CVM is that it helps to capture non-use value. Another advantage is that the interviewee himself or herself suggests the economic value of the good. In reality, an ideal approach to capture the economic value of an amenity in the context of CVM has to fulfil three important characteristics: "(i) incentive compatibility; (ii) statistical efficiency; and (iii) procedural invariance" (Bateman et al. 2009, 806). It seems that, of all the elicitation or question tools pointed out above, only the single bounded dichotomous choice fulfils the criterion of incentive compatibility. The approach has been strongly recommended by NOAA. Nevertheless, it does not fulfil the two other characteristics. The dichotomous choice method with repeated offers has been suggested to alleviate the lack of statistical efficiency of the single bounded dichotomous choice. Indeed, this method distinguishes itself by a certain efficiency although it sacrifices incentive compatibility. Another path has been proposed recently by Cooper, Hanemann, and Signorello (2002) with their one-and-one-half-bound dichotomous choice. Nevertheless, Bateman et al. (2009) have shown that this method does not fulfil the condition of invariance of procedures.

The usual steps of the contingent valuation method are of interest here. First, a hypothetical market for the environmental service in question or the non-market good must be established. This necessitates a clear identification of the object of valuation, a description of characteristics to value and an explanation of the

nature of requested change. *La Pointe des Châteaux* as entity is the object of valuation. The site has essentially three vocations: recreational, scientific and educational. Indeed, the foremost attraction for its many visitors is its natural and singular beauty. The continuous development of the site is a must-do activity in order to boost its value. In other words, without its development, the recreational, scientific and educational characteristics of the site will not be fully realised. In summary, the hypothetical scenario for eliciting use value reads as follows:

*La Pointe des Châteaux* is one of the most interesting sites of Guadeloupe given its recreational, scientific and educational characteristics. The recreational characteristics consist of sport activities, tourism, relaxation, family or individual hobby, and meditation. The site is, however, at the mercy of climatic avatars and its access requires a constant improvement. In fact, to protect the natural and endemic species of the island and to provide a better comfort to its visitors, some layouts must be contemplated and implemented. Particularly, the following are necessary: erection of a welcome site, connection of paths to the main road, installation of benches and tables for picnics, building of public toilets, and installation of garbage dumps. At present, no entrance fee is requested to access the site. Without a substantial and permanent financial intervention, the recreational activities will not be fully realised. There is thus a need to generate revenue through the imposition of an entrance fee to access *La Pointe des Châteaux* as well as the establishment of a fund geared towards securing the perennity of the site. This fund will be managed by an NGO. (Mamingi, Maurin and Montauban 2014, 7,16; translated from French by the authors)

Second, in the context of the questionnaire, the sample size and the sampling procedure, as well as the identification of interviewees must be examined. According to the literature, CVM requires a large sample (1000 is quite standard). Due to budgetary constraints, the sample size was fixed at 627 individuals (458 residents and 169 tourists). The sampling procedure, however, needs to be explained. For the residents, quota methods, based on distribution by commune, sex and age were of interest. For tourists, a random choice is adequate. *La Pointe des Châteaux*, the Port, Epi



beach, and the Marina were selected as the appropriate locations to conduct interviews (see Xavier 2014).

Third, a well elaborated questionnaire was mounted and launched. The latter contained around thirty questions divided in three rubrics: the individual's attitude vis-à-vis the environment, the economic valuation per se and socio-economic information. Naturally, the questionnaire was tested with a pilot study using the sites mentioned above. In light of interviewees' reactions, the questionnaire was revisited before being launched at the locations indicated. As just pointed out, the interviewees were divided into two groups: residents and tourists. It is worth noting that visitors and non-visitors to the amenity belong to the sample of interest. The non-visitors have been included to better justify non-use value. The respondents were aware of the object of valuation through a complete description of *La Pointe des Châteaux* using pamphlets, photos and explanations on an individual basis. As indicated above, recreational (including relaxation), scientific and educational values are the main characteristics for which individuals wanting to visit the site would be willing to pay for.<sup>6</sup>

Only the family head or an adult was requested to fill out the questionnaire which were administered by the students in Masters in Development and the Environment programme of the University of the Antilles, Campus of Fouillole, Guadeloupe.

To derive the use and non-use values, a simple dichotomic choice model is of interest. Concerning use value, the key question was as follows: "If you are asked, to support the improvement of services of the site, to pay  $P_1$  euros per visit, would you be willing to pay the amount? Yes or no?" For this initiative, four groups of individuals (residents and tourists) were formed. Each group has its own bid ( $P_1$ ). Concretely, Group 1 has 4 euros as bid, Group 2 uses 6 euros, Group 3 has 8 euros, and Group 4 settles for 10 euros. These bids or entrance fees were determined following the results of the pilot survey for which the payment card method was of interest.

A similar method is of interest for non-use value. Here, the key question read as follows: "Given the recreational, educational and scientific vocations of *La Pointe des Châteaux*, you are requested to

6 The full questionnaire (see Mamingi, Maurin, and Montauban 2014) is available on request.

contribute to a fund managed by an NGO and geared towards the preservation and improvement of activities practiced in *La Pointe des Châteaux*. Would you be willing to contribute to the fund by the payment of  $P_2$  euros per year? Yes or no?" As above, the same four groups of individuals are of interest. Each group has its own bid ( $P_2$ ). Thus, Group 1 has 20 euros as bid, Group 2 uses 30 euros, Group 3 settles for 50 euros, and Group 4 has 75 euros. As above, the values are the results of the pilot survey.

Fourth, from the questionnaire responses, one derives the mean values of WTP the entrance fee as well as the fund. Moreover, the determinants of WTPs are also derived to better understand the dynamics of WTP.

Fifth, the aggregation of the mean values of WTP is done with special attention to the problem of definition of population. This allows us to derive the total economic value of *La Pointe des Châteaux*.

## DATA ANALYSIS

This section has two objectives: (1) to develop hypotheses that econometric analysis attempts to test, and (2) underline the characteristics of targeted determinants of the WTP an entrance fee and those for the contribution to a fund for the site preservation. At the outset, we point out that the pilot survey covered 100 individuals, of which 70 were residents and 30 tourists. We do not give full account of the results except that we used payment cards as medium for obtaining values. The key questionnaire survey dealt with 627 individuals, residents and tourists together. The results of the survey revealed that 554 files are usable, that is, 88.4% of the sample. The other files were eliminated because they most often contained either incomplete data or protest zeros. The 554 files cover 393 residents and 161 tourists. A great number of residents interviewed were from Saint-François, the commune where *La Pointe des Châteaux* is located. Most tourists come from metropolitan France. Concerning the WTP an entrance fee (WTP1) to access *La Pointe des Châteaux*, 53.4% of individuals interviewed were potentially favourable to pay a certain amount and 46.6% not. 77.6% of interviewees were favourable for the protection of the

environment. Recoding the latter variable<sup>7</sup> leads to a positive relation between WTP an entrance fee and protection of the environment. Indeed, the Pearson coefficient of linear correlation ( $r$ ) is 0.077. Another interesting measure of association between qualitative variables is the  $\phi$  coefficient.  $\phi$ , whose values are between 0 and 1, reaches 0.11. With a value of 6.29 associated with a  $p$ -value of 0.098, the Pearson chi-square<sup>8</sup> test statistic, which tests the independence of two characteristics confirms that the association between WTP and protection of the environment is significant, at least at the 10% level of significance. Note that 54.9% of individuals who had some appreciation of nature are willing to pay an entrance fee to access the site. The mean value of Protenv1 is 2.978. Regarding the variable "amount", four values summarise the bids as entrance fees: 4 euros, 6 euros, 8 euros and 10 euros. The mean is 5.64 euros, and the median is about 4 euros. The third column (percent) of Table 1 indicates clearly a negative association between amount and WTP. This is reinforced by the  $p$ -values of  $r$  and Pearson's chi-square. Revenue should, in theory, be the most important variable of WTP. In our sample, the average revenue is 21,539.71 euros, and the median revenue amounts to 14,500 euros. There is no statistical difference between the average revenue from locals and that from tourists. There is no association between WTP1 and revenue. This is confirmed by the sizes of  $r$  (-0.014),  $\phi$  coefficient (0.113) and Pearson's chi-square (7.132 with a  $p$ -value of 0.713).

Concerning the number of visits to the site before valuation (visitavant), 16.8% of interviewees indicated that they had never visited the site, 27.4% once, 33.8% two times, 12.3% three times and 9.8% four times. The mean number of visits is 1.71 and the median 2 visits. The linear correlation between WTP and visitavant is -0.085. The  $\phi$  coefficient has a value of 0.172 and the Pearson's chi-square

7 That is, Protenv becomes Protenv1, with 1 now capturing insignificant, 2 not highly favourable to the environment, 3 favourable to the environment and 4 very favourable to the environment.

8 Note that the linear correlation coefficient  $r$  is a measure of linear association between two quantitative variables, the  $\phi$  coefficient assesses the degree of association between two binary variables and the Pearson's chi-square test measures the independence between two categorical variables. Whatever the scenario, here we use the three correlations.

has a value of 16.725 with a  $p$ -value of 0.002. Thus, a significant negative association between the two variables is probable.

**Table 1: Relation between Amount and Willingness to Pay (WTP1)**

Amount	WTP1	Percent
4 euros	1	61.3
	0	38.7
6 euros	1	48.7
	0	51.3
8 euros	1	45.3
	0	54.7
10 euros	1	31.1
	0	68.9
Correlation, $r$	-0.202	$p$ -value = 0.000
$\Phi$ coefficient	0.205	
Pearson's $\chi^2$	23.380	$p$ -value = 0.000

Source: Our survey (see Xavier 2014).

Note: Amount: bid or proposed entrance fee. WTP1: willingness to pay the proposed entrance fee to access the amenity: 1 if yes to the bid and 0 otherwise.

The average size of a household is three individuals, and so is the median. According to the statistics of interest, there is no association between household size and WTP1. This is confirmed by the Pearson's chi-square with a value of 13.243 associated with a  $p$ -value of 0.210.

The average age of interviewees was 38.2 years and the median age 35 years. The  $\Phi$  coefficient has a value of 0.144 with the Pearson's chi-square test value of 11.481 associated with a  $p$ -value of 0.176. These results indicate that most likely there is no relation between age and WTP.

There is no relation between sex and WTP1. Indeed, a  $\Phi$  coefficient of the order of 0.007 and a Pearson's chi-square of 0.028 associated to a  $p$ -value of 0.867 corroborate the fact.

Concerning education, while the average level (2.55) basically represents the secondary school level, the median level captures the tertiary level (see Table 4). The relation between education and

WTP1 is not obvious, with a *phi* coefficient of 0.079 and a Pearson's chi-square test value of 3.461 associated with a *p*-value of 0.484.

In summary, there are only three significant relations between the WTP an entrance fee to access the site and the variables alluded to above: a negative relation between WTP1 and amount, a negative relationship between WP1 and visitant, and a positive relation between WTP1 and protection of the environment.

WTP or to contribute to a fund for the preservation of the site (WTP2) was only favoured by about 26% of individuals. As far as the fund or the amount destined to the preservation of the site is concerned, Table 2 provides the distribution of values. We observe that the minimum value is 20 euros and the maximum 75 euros. These values come from the pilot survey using payment cards. The mean value for fund is 32.64 euros and the median 20 euros.

The three different types of correlation used here indicate that, most likely, there is a negative association between willingness to contribute to a fund and the fund requested. Indeed, the correlation coefficient with a value of -0.169 associated to a *p*-value of 0.000, the *phi* coefficient evaluated at 0.217, and the Pearson's chi-square with a value of 28.026 associated with a *p*-value of 0.000 signal that the relation between the two variables is negative and significant.

**Table 2: Statistics for Fund**

Value (euros)	Individuals	Percent	Cumulative Numbers	Cumulative Percent
20	318	57.40	318	57.40
30	80	14.44	398	71.84
50	95	17.15	493	88.99
75	61	11.01	554	100.00
<b>Total</b>	554	100.00	554	100.00

Source: Our survey (see Xavier 2014).

Table 3 summarises further the types of relations between WTP2 and a certain number of variables. We can note the significant relations only hold between WTP2 and protenv1, WTP2 and visitant, as well as WTP2 and visitfutur. An important fact is that

residents and tourists behave differently. This has to be explored further with an econometric model. Furthermore, the peculiar behaviour of revenue is once more confirmed.

**Table 3: Relation between WTP2 and Determinants**

Relation	Statistics	Corresponding <i>p</i> -values
WTP2 --- revenue	$r = 0.045$ $\Phi = 0.157$	0.290
WTP2 --- protenv1*	$r = 0.155$ $\Phi = 0.215$ $\text{Chi-square} = 14.813$	0.139 0.000
WTP2 --- households	$r = 0.052$ $\Phi = 0.148$ $\text{Chi-square} = 25.604$	0.226 0.280
WTP2 --- age	$r = 0.017$ $\Phi = 0.145$ $\text{Chi-square} = 11.429$	0.691 0.121
WTP2 --- sex	$r = 0.007$ $\Phi = 0.007$ $\text{Chi-square} = 0.030$	0.862 0.862
WTP2 --- csp	$r = 0.0008$ $\Phi = 0.080$ $\text{Chi-square} = 3.571$	0.985 0.981
WTP2 --- education	$r = -0.064$ $\Phi = 0.069$ $\text{Chi-square} = 2.669$	0.133 0.615
WTP2 --- visitavant	$r = 0.169$ $\Phi = 0.187$ $\text{Chi-square} = 19.440$	0.000 0.001
WTP2 --- visitfutur	$r = 0.163$ $\Phi = 0.261$ $\text{Chi-square} = 37.879$	0.000 0.000
WTP2 --- verif	$r = -0.168$ $\Phi = 0.261$ $\text{Chi-square} = 15.576$	0.000 0.000

Notes: X ---Y: relation between X and Y; acronyms/variables meanings are given in the text above as well as in Table 4. Source: Our survey (see Xavier 2014).

## ECONOMETRIC MODEL, ESTIMATION AND ANALYSIS OF RESULTS

This section introduces the econometric model of WTP1 and WTP2 and provides the estimation results and their interpretations.

**Econometric Model: Formulation and Estimation Method**

Two types of parametric models are formulated here. The ultimate objective is: (1) to derive WTP, and (2) incorporate the characteristics of the respondent in the functions of WTP (Haab and McConnell 2002, 23). The two models are binary choice models that belong to the class of models with random utility.

*The Random Linear Utility Model*

A function with random linear utility in revenue (income) and other variables is formulated as follows:<sup>9</sup>

$$v_{ij}(rev_j) = X_{sj}\alpha_{sij} + \beta_i(rev_j) \tag{4.1}$$

where  $v$  is the deterministic part of the indirect utility function,  $i$  is an index which captures two states with 1 being the state or the condition prevailing when WTP is implemented (final state) and 0 being the initial state or the status quo,  $rev$  is the discretionary revenue of the respondent,  $X$  is the matrix of other  $k$  variables related to individual  $j$ , and  $s$  goes from 1 to  $k$ .

Notice that the elicitation questions for the WTP induce the respondents to choose between the current state or status quo ( $i = 0$ ) and the proposed conditions at the required payment  $m$  ( $i = 1$ ). This means that model (4.1) can be rewritten as follows:

$$v_{ij}(rev_j - m_j) = X_{sj}\alpha_{sij} + \beta_i(rev_j - m_j) \tag{4.2}$$

The hypothesis is that the marginal utility of revenue is constant between the two states ( $i = 1$  and  $i = 0$ ). Consequently, the difference of utility between the two states is captured by the following:

$$v_{ij} - v_{0j} = X_{sj}\alpha_{sj} + \beta m_j \tag{4.3}$$

where  $\alpha_s = \alpha_{s1} - \alpha_{s0}$  and  $\beta_1 = \beta_0 = \beta$

Adding the random term to the deterministic model transforms it into a random model. In this connection, the probability to accept an offer for the respondent is given by the following:

$$P(yes_j) = P(X_{sj}\alpha_s - \beta m_j + \varepsilon_j > 0) \tag{4.4}$$

where  $\varepsilon_s = \varepsilon_{j1} - \varepsilon_{j0}$  is normally distributed if we assume that the errors linked to states are each independently and normally

9 This subsection and the following heavily borrow from Haab and McConnell (2002, 26-58).

distributed. We can derive the logistic model similarly. Otherwise, model (4.4) can be rewritten as follows:

$$P(X_{sj}\alpha_s - \beta m_j + \varepsilon_j > 0) = P(-(X_{sj}\alpha_s - \beta m_j) < \varepsilon_j) = P(\varepsilon_j - X_{sj}\alpha_s < X_{sj}\alpha_s - \beta m_j) \quad (4.5)$$

The issue is that in most software programmes the errors of interest are in fact standardised normal errors with mean 0 and variance 1. Thus, model (4.5) becomes

$$P(\varepsilon_j < X_{sj}\alpha_s - \beta m_j) = P(\omega_j < X_{sj}\alpha_s/\sigma - \beta m_j/\sigma) = \Phi(X_{sj}\alpha_s/\sigma - \beta m_j/\sigma) \quad (4.6)$$

where  $\Phi(\cdot)$  is the distribution function of the standard normal,  $\sigma$  is the standard deviation of the regression and  $\omega_j = \frac{\varepsilon_j}{\sigma}$  the new error term.

Model (4.6) is estimated by maximum likelihood method applied to the following expression:

$$L(\alpha_s, \beta | rev, X, m) = \prod_{j=1}^T \left[ \Phi\left(\frac{X_{sj}\alpha_s - \beta m_j}{\sigma}\right) \right]^{I_j} \left[ 1 - \Phi\left(\frac{X_{sj}\alpha_s - \beta m_j}{\sigma}\right) \right]^{1-I_j} \quad (4.7)$$

where *rev* stands for revenue, *T* represents the sample size, *I* is an indicator which takes the value 1 if the respondent says yes to the amount proposed, and the other symbols are defined as above.

Take the logarithm of (4.7) and maximize with respect to the parameters. Note that the coefficients obtained from most software programmes are not generally marginal effects. For a given variable denominated the marginal effect is:

$$\frac{\partial \Phi(X_{sj}\alpha_s - \beta m_j)}{\partial X_{kj}} = \phi(X_{sj}\alpha_s - \beta m_j) \alpha_k \quad (4.8)$$

where  $\phi(\cdot)$  represents the density function under normal distribution. The expression (4.8) is evaluated at the means.

The same procedure can be applied to derive a logit model. Here, however, we are interested in a probit model.

*The Random Utility Model Log Linear in Revenue*

The second type of model resembles the first one with the exception it is non linear or linear in logarithm of revenue.

$$v_j(rev_j, X_{sj}) + \varepsilon_j = X_{sj}\alpha_s + \beta \text{Log}(rev_j) + \varepsilon_j \quad (4.9)$$

Similarly to the case above, the probability of “yes” to the question of WTP is:



$$P(\mathit{yes}_j) = P\left(\beta \text{Log}\left(\frac{\mathit{rev}_j - m_j}{\mathit{rev}_j}\right) + X_{sj}\alpha_s > -\varepsilon_j\right) \quad (4.10)$$

where variables are defined as above.

The expression corresponding to model (4.6) is

$$P(\mathit{yes}_j) = \Phi\left[\left(\beta \text{Log}\left(\frac{\mathit{rev}_j - m_j}{\mathit{rev}_j}\right) + X_{sj}\alpha_s\right)/\sigma\right] \quad (4.11)$$

This probit model is estimated by maximum likelihood method.

### Estimation and Interpretation of Results

To fix ideas, it is useful to repeat the meaning of variables. Table 4 fulfills this goal. We adopt Hendry's methodology; that is, we start with a model which contains all variables of Table 4 and proceed by eliminating variables which do not explain WTP1 or WTP2. That said, the model of linear utility (4.7) retains the following variables: WTP1, amount, protenv1, education, visitavant and CSP. We postulate a negative relationship between the amount proposed and the probability of accepting an entrance fee (a positive relationship with the negative of the amount), a positive relation with the attitude towards the environment (Protenv1, see note to Table 4), a positive relationship with education and an ambiguous relation with visitavant, although a positive relationship is quite convincing. No plausible relationship can be advanced between WTP and professional categories.

Table 5 contains the results of the parsimonious form of model (4.7). The latter passes the full-model test of significance as indicates the  $p$ -value (0.000001) of the likelihood ratio test (LR). The coefficients in Table 5 are not marginal effects. The latter are obtained using the expression (4.8). That said, a 1 euro increase in entrance fee decreases the probability to pay an entrance fee by approximately 0.047. There is a positive relationship between attitude towards the environment and the probability to pay. Indeed, an increase in the positive sentiment towards the environment increases the probability to pay an entrance fee by about 0.055. An increase in education level boosts the probability to

Table 4: Variables and their Meanings

Variable	Meanings	Average
WTP1	Willingness to pay an entrance fee (yes = 1; no = 0)	0.534
WTP2	Willingness to pay or contribute to a fund (yes = 1; no = 0)	0.260
Revenue (rev)	Household Revenue in euros per year (average value of the interval).	21,539.71
Amount or Fund (m)	Amount solicited in euros for WTP1: {4, 6, 8, 10} or WTP2: { 20, 30, 50, 75}	WTP1 = 5.64 euros WTP2 = 32.64 euros
Protenv*	Importance given to the protection of the environment: 1 = very high, 2 = high, 3 = not high, 4 = insignificant.	2.022 38.23 years
Age	Respondent's age (average of the interval)	
Household	Size of the Household	3 individuals
CSP	Professional Category: 1 agriculture, 2 merchant, craftsman, 3 CEO, etc.	5.462
Visitavant	Number of visits to the site in the last 3 years.	1.708
Visitfutur	Number of visits projected in the future	2.960
Sex	Respondent's Sex: 1 male, 0 female	0.473
Modepay	Mode of payment of entrance fee: 0: payment on the site; 1: annual subscription; 2: environmental tax; 3: others.	0.45
Education	Level of education reached: 1 = nothing, 2 = primary, 3 = secondary, 4 = tertiary.	2.545
Verif	Variable indicating whether the respondent is resident (1) or tourist (2)	1.28

Note: (\*) We reorder Protenv by transforming 1 into 4 and 4 into 1, etc. This new variable is called Protenv1. It has a mean value of 2.978

pay an entrance fee by almost 0.049. Surprisingly, those who have already visited the site do not seem to have a good impression of the site since the visit decreases the probability to pay by about 0.039.

Concerning the non-linear model of type (4.10), the same Hendry's methodology has been applied. Essentially, the same variables are used with an add-on of the non-linear variable. Table 6 contains the estimation results of model (4.10) by maximum likelihood method. As can be noticed, the model passes the full-model test of significance as substantiated by the  $p$ -value (0.014) of the LR test at the 10% level of significance. As above, the coefficients

**Table 5: Determinants of Willingness to Pay (WTP1): The Linear Model**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.030	0.359	0.084	0.934
-Amount	0.119	0.026	4.576	0.000
Protenv1	0.139	0.072	1.931	0.053
Education	0.124	0.074	1.676	0.093
Visitavant	-0.099	0.047	-2.106	0.035
CSP	0.030	0.023	1.304	0.186
McFadden R-squared	0.045	Mean dependent var		0.534
Log likelihood	-365.555	S.E. of regression		0.486
LR statistic	34.289	Prob(LR statistic)		0.000
Obs with Dep = 0	258	Total obs		554
Obs with Dep = 1	296			

Note: Variables are defined as in Table 4; Dependent Variable: WTP1; Method: ML-Binary Probit; included observations: 554. For a one-sided test, divide  $p$ -value (Prob.) by two.

**Table 6: Determinants of Willingness to Pay (WTP1): The Non-linear Model**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-0.590	0.328	-1.798	0.072
Lrevenuev	132.213	102.939	1.284	0.199
Protenv1	0.147	0.071	2.070	0.039
Education	0.099	0.074	1.338	0.180
Visitavant	-0.102	0.047	-2.170	0.029
CSP	0.042	0.023	1.826	0.069
McFadden R-sq.	0.019	Mean dependent var		0.534
S.D. dependent var	0.499	S.E. of regression		0.495
LR statistic	14.250	Prob(LR statistic)		0.014
Obs with Dep = 0	258	Total obs		554
Obs with Dep = 1	296			

Note: Dependent Variable: WTP1; Variables are defined as in Table 4; Lrevenuev=Log ((revenue-requested amount)/revenue). Method: ML-Binary Probit; included observations: 554. For a one-sided test, divide  $p$ -value by two.

are not marginal effects. The latter are calculated adapting expression (4.8). All included variables have a significant impact on the probability to pay an entrance fee. A 1% increase in the adjusted revenue variable positively affects the probability to pay an entrance fee by 52.55%. There is a positive relationship between

attitude towards the environment and the probability to pay an entrance fee. Indeed, an increase in the positive sentiment towards the environment increases the probability to pay an entrance fee by 0.058. An increase in schooling level augments the probability to pay an entrance fee by 0.039. Those who have visited the site before have their probability to revisit the site decrease by 0.041. There is a positive relationship between professional categories, CSP, and WTP1. The marginal effect is about 0.017. The latter is quite difficult to interpret given the way the professions have been captured.

Concerning the willingness to contribute to a fund geared towards the preservation of the site, WTP2, as above there are two models (linear and non-linear). In any case, the same methodology applies. In the first instance, we present the results of the linear model. As Table 7 reveals, fund, protection of the environment, and future visits are the key determinants of WTP2. In addition, as seen above, residents and tourists through *verif* behave differently. Table 8 is Table 7 without the indicator of the type of visitor (*verif*). It attempts to underline the importance of the type of visitor. Using the marginal effects derived from expression (4.8), we note that here a 1 euro increase in proposed fund leads to a decrease of the probability to contribute to a fund by 0.005. Protection of the environment positively affects WTP2. Indeed, an increase in the positive sentiment of protection of the environment yields an increase of 0.071 in the probability to contribute to a fund. The variable *visitavant* has a positive impact at the 10% level of significance using a one sided alternative hypothesis. Indeed, a one unit increase in the number of past visits increases the probability to contribute to a fund by 0.103. Similarly, an increase by one unit in the number of future visits raises the probability to contribute to a fund by 0.021.

**Table 7: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Linear Model**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-0.630	0.340	1.853	0.064
-Fund	0.015	0.004	3.750	0.000
Protenv1	0.249	0.082	3.037	0.002
Visitavant	0.087	0.058	1.500	0.133
Visitfutur	0.062	0.035	1.772	0.074
Verif	-0.512	0.151	-3.391	0.001
McFadden R-squared	0.094	Mean dependent var		0.260
LR statistic	59.648	Prob(LR statistic)		0.000
Obs with Dep = 0	410	Total obs		554
Obs with Dep = 1	144			

Note: Variables are defined as in Table 4; Dependent Variable: WTP2; Method: ML- Binary Probit; For a one-sided test, divide *p*-value by two.

**Table 8: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Linear Model without the type of visitor**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.311	0.275	-4.761	0.000
-Fund	0.015	0.004	3.750	0.000
Protenv1	0.226	0.081	2.790	0.005
Visitavant	0.133	0.056	2.375	0.018
Visitfutur	0.067	0.034	1.971	0.050
McFadden R-squared	0.075	Mean dependent var		0.260
S.D. dependent var	0.439	S.E. of regression		0.420
LR statistic	47.578	Prob(LR statistic)		0.000
Obs with Dep=0	410	Total obs		554
Obs with Dep=1	144			

Note: See Table 7.

The comparison of Tables 9 and 10 highlights the fact that only the model for residents is a valid model. In fact, qualitatively, the resident model results match those obtained for tourists and residents combined (see Table 8). The results provided in Table 9 reveal that protection of the environment, past visits and future visits positively affect the willingness to contribute to a fund for the site preservation. There is an inverse relationship between fund and

the willingness to contribute to a fund. Moreover, the results of Table 10 confirm the lack of tourists' enthusiasm for the contribution to a fund for the site preservation. This distinction is extremely important when deriving the passive and total economic values of the site.

**Table 9: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Linear Model for Residents**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.244	0.309	-4.026	0.000
-Fund	0.015	0.004	3.883	0.000
Protenv1	0.271	0.090	3.013	0.003
Visitavant	0.134	0.065	2.058	0.040
Visitfutur	0.044	0.039	1.128	0.260
McFadden R-squared	0.079	Mean dependent var		0.305
S.D. dependent var	0.461	S.E. of regression		0.440
LR statistic	38.233	Prob(LR statistic)		0.000
Obs with Dep = 0	273	Total obs		393
Obs with Dep = 1	120			

Note: see Table 7.

**Table 10: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Linear Model for Tourists**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.268	0.652	-1.944	0.052
-Fund	0.018	0.009	2.000	0.046
Protenv1	-0.180	0.203	-0.887	0.375
Visitavant	-0.072	0.138	-0.522	0.599
Visitfutur	0.105	0.079	1.329	0.186
McFadden R-squared	0.054	Mean dependent var		0.149
S.D. dependent var	0.357	S.E. of regression		0.354
LR statistic	7.370	Prob(LR statistic)		0.118
Obs with Dep = 0	137	Total obs	161	
Obs with Dep = 1	24			

Note: see Table 7.

Tables 11 to 14 contain the estimation results for non-linear models dealing with the willingness to contribute to a fund for the site preservation. The results of Table 11 to Table 13 indicate that adjusted revenue, protection of the environment, past visits and future visits positively affect the willingness to contribute to a fund for the site preservation. The results of Table 14 confirm the lack of interest of tourists to contribute to a fund for the site preservation.

**Table 11: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Non-linear Model**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-0.964	0.322	-2.991	0.003
Lrevenu2	38.837	17.418	2.230	0.026
Protenv1	0.243	0.080	3.038	0.002
Visitavant	0.080	0.058	1.379	0.168
Visitfutur	0.062	0.034	1.823	0.071
Verif	-0.511	0.149	-3.430	0.001
McFadden R-squared	0.071	Mean dep. Var.		0.260
S.D. dependent var	0.439	S.E. of regression		0.422
LR statistic	45.023	Prob (LR statistic)		0.000
Obs with Dep = 0	410	Total obs		554
Obs with Dep = 1	144			

Note: Lrevenu2 = Logarithm of (revenue - contribution to a fund)/revenue; Dep. Variable:WTP2; Verif: dummy for type of visitors; For others, see Note to Table 4.

**Table 12: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Non-linear Model without Verif**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.554	0.291	-5.340	0.000
Lrevenu2	34.236	17.287	1.980	0.048
Protenv1	0.219	0.079	2.772	0.006
Visitavant	0.127	0.056	2.268	0.023
Visitfutur	0.067	0.034	1.971	0.048
McFadden R-squared	0.052	Mean dependent var		0.260
S.D. dependent var	0.439	S.E. of regression		0.427
LR statistic	32.786	Prob(LR statistic)		0.000
Obs with Dep = 0	410	Total obs		554
Obs with Dep = 1	144			

Note: see Table 11 without Verif.

**Table 13: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Non-linear Model for Residents**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.554	0.291	-5.340	0.000
Lrevenu2	43.119	19.187	2.247	0.024
Protenv1	0.265	0.088	-3.011	0.002
Visitavnt	0.121	0.065	1.862	0.061
Visitfutur	0.044	0.039	1.128	0.250
McFadden R-squared	0.057	Mean dependent vary		0.305
LR statistic	27.437	Prob(LR statistic)		0.000
Obs with Dep=0	273	Total obs		393
Obs with Dep=1	120			

Note: Lrevenu2 = Logarithm of ((revenue - contribution to a fund)/revenue). Dep. Variable: WTP2. For others, see Table 4.

**Table 14: Determinants of Willingness to Contribute to a Fund (WTP2):  
The Non-linear Model for Tourists**

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.715	0.600	-2.858	0.004
Lrevenu2	15.673	43.223	0.363	0.717
Protenv1	-0.161	0.196	-0.821	0.410
Visitavnt	-0.051	0.134	-0.381	0.704
Visitfutur	0.108	0.078	1.385	0.166
McFadden R-squared	0.024	Mean dependent var		0.149
LR statistic	3.228	Prob(LR statistic)		0.520
Obs with Dep = 0	137	Total obs		161
Obs with Dep = 1	24			

Note: See Table 13

The results of this section allow us to conclude the following:

- (i) WTP an entrance fee or contribute to a fund is negatively affected by the amount of the bid; that is, the larger the amount, the less the WTP an entrance fee or contribute to a fund for the site preservation.
- (ii) Attitude towards the environment is the most stable variable in all models used here. It is positively linked to WTP1 and WTP2. The more positive is the attitude towards the environment, the more the respondent is



- willing to contribute to the prosperity of the site by the payment of an entrance fee or the contribution to a fund for the preservation of the site.
- (iii) Past visits affect the probability to pay an entrance fee or contribute to a fund. The direction of the impact is, however, ambiguous.
  - (iv) Future visits are an important positive determinant of WTP1 and WTP2.
  - (v) Willingness to contribute to a fund for the site preservation is dominated by residents. Most tourists do not seem to be concerned.

#### TOTAL ECONOMIC VALUE OF LA POINTE DES CHATEAUX

To derive the total economic value of *La Pointe des Châteaux*, we proceed in two steps. First, we estimate the mean value(s) of WTP an entrance fee and/or contribute to a fund for the site preservation. Second, we consider the population to use to transform mean value into aggregated value.

#### Mean Value (MV) of Willingness to Pay (WTP)

We can estimate the MV of WTP an entrance fee or contribute to a fund directly from survey data without worrying about the determinants of WTP1 or WTP2. MV can also originate from a model such as developed in the previous section. Each approach has advantages and limitations.

##### *Bid Mean Value*

This MV comes directly from survey data. Table 4 contains information sought. Thus, the mean value of WTP an entrance fee is 5.64 euros in the bracket (4.00 euros, 10.00 euros). By the same token, the mean value of willingness to contribute to a fund for the site preservation is 32.64 euros in the bracket (20.00 euros, 75.00 euros).

##### *Mean Value from a Non-Parametric Approach: Turnbull Estimator*

The present text is largely based on Haab and McConnell (2002, 60-83). Consider a random sample of size  $T$ . The respondent has to accept or reject the price or the amount ( $m_j$ ) that is proposed to

them. Indeed, the individual answers favourably to the offer if his/her WTP is greater than the proposed amount,  $WTPM_j \geq m_j$ ; otherwise, negatively if  $WTPM_j < m_j$ . As  $WTPM$  is unobservable, we can consider it a random variable with a distribution function  $F_C(m_j)$ . In other words, the respondent's probability of saying no or having a WTP less than the proposed amount can be represented by

$$P(WTPM_j < m_j) = F_C(m_j) \tag{5.1}$$

Maximum likelihood method yields:

$$F_C(m_j) = \frac{N_j}{T_j} \tag{5.2}$$

where  $N_j$  is the number of individuals who respond no to the bid price is  $m_j$ ,  $O_j$  the total number of individuals who respond yes to the price above,  $T_j = N_j + O_j$  is the total number of individuals to whom one offers  $m_j$  and  $F_C(m_j)$  is the proportion of individuals who respond no to the offer  $m_j$ . In addition,  $M$  is the number of bids, and  $f_j = F_j - F_{j-1}$ .

The Turnbull estimator is calculated as follows

(i) For bids  $j=1, 2, 3, \dots, M$ , calculate  $F_j = \frac{N_j}{N_j + O_j} = \frac{N_j}{N_j + O_j}$   
with  $F_0 = 0$  and  $F_{M+1} = 1$

(ii) Starting with  $j=1$ , compare  $F_j$  and  $F_{j+1}$ .

(iii) If  $F_{j+1} > F_j$  then continue.

(iv) If  $F_{j+1} \leq F_j$  then "pool" cells  $j$  and  $j+1$  in one cell with boundaries  $(m_j, m_{j+2})$ , and

$$\text{calculate } F_j^* = \frac{N_j + N_{j+1}}{T_j + T_{j+1}} = \frac{N_j}{T_j^*}.$$

That is, eliminate bid  $m_{j+1}$  and pool responses to bid  $m_{j+1}$  with responses to bid  $m_j$ .

(v) Continue until monotonicity is reestablished.

(vi) Set  $F_{M+1}^* = 1$

The lower limit of the mean is given by:

$$E_{LB}(WTP) = \sum_{j=0}^{M^*} m_j (F_{j+1}^* - F_j^*) = \sum_{j=0}^{M^*} m_j f_j^* \quad (5.3)$$

The variance of the lower limit of the mean is

$$Var(E_{LB}(WTP)) = \sum_{j=0}^{M^*} \frac{F_j^*(1-F_j^*)}{T_j^*} (m_j - m_{j-1})^2 \quad (5.4)$$

We can thus derive the mean for Turnbull Estimator for *La Pointe des Châteaux*. We start with the WTP an entrance fee.

In principle,  $F_j$  must increase as  $m_j$  increases, that is,  $F_j \leq F_{j+1}$ . In reality, this monotonicity is not often satisfied. A correction is thus needed. The Turnbull estimation is an important estimation alternative.

Table 15 provides us with the evolution of no responses to proposed entrance fees. The last column indicates that monotonicity alluded to above is fulfilled.

**Table 15: Responses to Bids as Entrance Fees**

Bids (in euros)	N(no)	O (yes)	F
4	123	195	0.384
6	41	39	0.513
8	52	43	0.547
10	42	19	0.689
10+			1

Note: F: proportion of no answers.

From Table 15, we can derive the mean as follows:

$$E(WTPM) = \sum_{j=0}^M m_j f_{j+1} = 0x0.384 + 4x0.129 + 6x0.034 + 8x0.142 + 10x0.311 = 4.97 \quad (5.5)$$

It is appropriate to obtain the confidence interval of the mean. Using formula (5.4) to obtain the variance and subsequently the standard deviation, we find the following 95 percent confidence interval: (4.53 euros, 5.41 euros). Likewise, the 90 percent confidence interval is (4.60 euros, 5.33 euros).

Table 16 contains the disaggregate results for the contribution to a fund for the site. They indicate that, contrary to the case above,

the Turnbull estimator must be applied since the proportion of “nos” does not increase monotonically.

Using formula (5.3), the mean willingness to contribute to a fund is 15.47 euros. Using formula (5.4) we find that the variance of willingness to contribute to a fund is equal to 4.52; that is, the standard deviation is 2.13 euros. Using asymptotic normality, the 95 percent confidence interval for the lower bound of WTPM is (11.30 euros, 19.64 euros). Similarly, the 90 percent confidence interval is (11.98 euros, 18.96 euros). Overall, we can assimilate the mean willingness to contribute to a fund to 20 euros, the lower limit of the bracket of bids (20.00, 75.00).

**Table 16: Responses to Proposed Bids: Contribution to a Fund**

Bids (euros)	N (no)	O (yes)	$F_j$	$F_j^*$	$f_j^*$
20	209	109	0.657	0.657	0.657
30	69	11	0.863	0.851	0.192
50	80	15	0.842	Pool	Pool
75	52	9	0.853	0.853	0.002
75+			1	1	0.147

Note: symbols defined in the text.

### *Bid Curve Mean Value: The Econometric Approach*

In the first instance, it is necessary to derive the mathematical expectations of interest for the linear and non linear models developed in the previous section.

For the linear model, the mean value of WTP an entrance fee is given by

$$E(WTP1|\alpha_s, \beta, X_{js}) = [\alpha_s/\beta] X_{sj} \quad (5.6)$$

evaluated at the means of variables. Variables and parameters have been defined above. Expression (5.6) is also valid for WTP2.

For the non-linear model, the mean value of WTP an entrance fee is given by

$$E(WTP1|\alpha_s, \beta, X_{js}, rev_j) = rev_j - rev_j \exp\left(\frac{\alpha_s}{\beta} X_{sj} + \frac{1}{2} \frac{\sigma^2}{\beta^2}\right) \quad (5.7)$$

where  $\sigma$  is the standard deviation of the regression of interest and  $\exp$  represents exponential function. The same mathematical expectation applies to WTP2.

Table 17 contains the results of mean values derived from formulas (5.6) and (5.7). The mean values for the non-linear models are not reliable because, in a number of cases, they are outside the limits of the proposed bids, even sometimes negative. The mean value for the linear model for WTP an entrance fee amounts to 6.36 euros which is comparable to the values of 5.64 euros and 4.97 euros obtained directly from survey data and the Turnbull method, respectively. For the contribution to a fund for the site preservation, it is worth recalling here only residents are part of the story. In fact, the mean value is -14.05 euros for the full sample (residents and tourists) and for residents it is 70.20 euros. Of course, the negative value does not make sense and the value for residents, although in the bid bracket (20.00, 75.00 euros), is rather suspicious. For comparison, the mean values from survey data and the Turnbull method are 32.60 euros and 15.47 euros, respectively.

**Table 17: Bid Curve Mean Values from Econometric Models**

Sample	Type	Mean values	Bracket (euros)
All with WTP1	Linear	6.36 euros	4.00 – 10.00
All with WTP1	Non-linear	216.43 euros	4.00 – 10.00
All with WTP2	Linear	-14.05 euros	20.00 –75.00
Residents with WTP2	Linear	70.20 euros	20.00–75.00
All with WTP2	Non-linear	-364.34 euros	20.00 – 75.00
Residents with WTP2	Non-linear	-187.11 euros	20.00 –75.00

Note: All: full sample.

Although the econometric models of interest here are good in deriving the determinants of WTP an entrance fee or contribute to a fund for the site preservation, in general they do not seem appropriate for deriving the mean values with the present data. In summary, in the context of the present study, the mean value of WTP an entrance fee or contribute to a fund is the mean of raw values from survey data, Turbull estimator and the econometric value.<sup>10</sup> Thus, the mean WTP an entrance fee amounts to about 6 euros per visit. For the fund, it is about 26 euros per year.

10 If the bid curve mean value makes sense. In reality, overall, in this exercise the bid mean values dominate other mean values.

### Total Economic Value of *La Pointe des Châteaux*

As already pointed out, the total economic value of the site is the sum of use and non-use values. Here the use value comes from WTP1 models and non-use value from WTP2 models. But any economic value is necessarily the product of quantity and price. Here, quantity is captured by population.

The question of finding the adequate population in the context of contingent valuation has always been a difficult question. As seen above, the unit analysis is household. That is, the concerned population is in the first instance that of households. On another note, the population is dominated by residents. It can then be inferred that our population concerns the number of households in Guadeloupe at least for use value. In fact, one approach would suggest using the number of annual visitors to the site; that is, 500,000. There is a gap between the annual number of visitors and the number of households, which is 167,655. The gap can, however, possibly vanish if we factor in the size of a typical household. Concerning non-use value, it is the case that only 1/4 of individuals would like to contribute to a fund. Using the assumption that the economic and social parameters have remained stable in Guadeloupe, we propose to use 500,000 as population of interest for use value and 125,000 for non-use value. This means that the use value would amount to  $500,000 \times 6$  euros = 3,000,000 euros per year. This amount would be the upper limit of the bracket. For recall, 53.4% of individuals would accept to pay an entrance fee. It means that the lower limit of use value would be  $0.534 \times 500,000 \times 6 = 1,602,070.20$  euros. Concerning non-use value, the latter would amount to  $125,000 \times 26 = 3,250,000$  euros, an amount greater than the use value. That said, the undiscounted economic value of *La Pointe des Châteaux* would vary from 4,852,070.20 euros to 6,250,000 euros.<sup>11</sup> The amount range is somewhat comparable to that obtained by Lewis and Mamingi (2003) for Harrison's Cave.

### CONCLUSION

The main objective of this study was to derive the total economic value of *La Pointe des Châteaux*, an important touristic site in Guadeloupe. The study used the contingent valuation method to obtain the use and non-use values of the site. The study also

11 A refinement can be made by charging different entrance fees for adults and children.

resorted to statistical and econometric methods to derive the mean values necessary to obtain the total economic value. The latter would vary from 4,852,070.20 euros to 6,250,000 euros. Naturally, the question of realisation of these values needs to be posed. In any case, this study would justify the initiative undertaken by the Guadeloupean authority to develop and preserve the site, particularly in the context of sustainable development.

Total economic value in this context was mainly affected by the proposed entrance fee to access the amenity, the size of the contribution to a fund for the preservation of the site, the attitude towards the environment and the knowledge about the amenity. The study could be improved in several directions. Among others, it is useful to continue the debate on the size of population to use for the derivation of total economic value. More importantly, for the study to be more interesting, if not more complete, there is a need to examine the cost dimension of the site. That is, a cost-benefit analysis of the site is really warranted.

## REFERENCES

- Alberini, A., B. Kanninen and R. T. Carson. 1997. "Modeling Response Incentive Effects in Dichotomous Choice Contingent Valuation Data." *Land Economics* 73 (3): 309-24.
- Asciuto, A., V. Borsellino, M. D'acquisto, C. P. Di Franco, M. Di Cesaro, and E. Schimmenti. 2015. "Monumental Trees and Their Existence Value: Case Study of an Italian National Park." *Journal of Forest Science* 61 (2): 50-61.
- Bateman, I. J., B. H. Day, D. P. Dupont, and S. Georgiou. 2009. "Procedure Invariance Testing of the One-and-one-Half-Bound Dichotomous Choice Elicitation Method." *Review of Economics and Statistics* 91 (4): 806-20.
- Choe, K., D. Whittington, and D. T. Lauria. 1996. "The Economic Benefit of Surface Water Quality Improvements in Developing Countries: A Case Study of Davao, Philippines." *Land Economics* 72 (4): 519-37.
- Cooper, J. C., M. Hanemann, and G. Signorello. 2002. "One-and-one-Half-Bound Dichotomous Choice Contingent Valuation." *Review of Economics and Statistics* 84 (4): 742-50.
- Dharmaratne, G.S., F. Ye Sang, and L. J. Wallig. 2000. "Tourism Potentials for Financing Protected Areas." *Annals of Tourism Research* 27 (3): 590-610.

- Dharmaratne, G.S., and A. E. Brathwaithe. 1998. "Economic Valuation of the Coastline of Tourism in Barbados." *Journal of Travel Research* 37: 138-44.
- Goiffon, M., and J. N. Consales. 2005. "Le Massif des Calanques (Marseille-Cassis) et la Pointe des Châteaux (Saint-Francois, Guadeloupe)." *Méditerranée* 105: 29-35.
- Flachaire, E., and G. Hollard. 2006. "Controlling Starting-Point Bias in Double-Bounded Contingent Valuation Surveys." *Land Economics* 82: 103-11.
- Haab, T.C., and K.E. McConnell. 2002. *Valuing Environmental and Natural Resource: The Econometrics of Non-Market Valuation*. Northampton: Edward Elgar.
- Hanemann, M. W. 1994. "Valuing the Environment through Contingent Valuation." *Journal of Economic Perspectives* 8 (4): 19-44.
- Hoyos, D., and P. Mariel. 2010. "Contingent Valuation: Past, Present, and Future." *Prague Economic Papers* 4 (3): 329-43.
- Lewis, D.A., and N. Mamingi. 2003. "Valuing Harrison's Cave of Barbados: A Contingent Valuation Approach." *Journal of Eastern Caribbean Studies* 28 (2): 30-56.
- Mamingi, N., A. Maurin and J. G. Montauban. 2014. *La Valeur Economique Totale de la Pointe des Châteaux: Une Application de la Méthode Contingente, Le Questionnaire*, Unpublished, 1-22.
- Markantonis, V., and K. Bithas. 2010. "The Application of the Contingent Valuation Method in Estimating the Climate Change Mitigation and Adaptation Policies in Greece. An Expert-based Approach." *Environment, Development and Sustainability* 12 (5): 807-24.
- Maurin, A. 2016. *Photos Personnelles de La Pointe des Châteaux*, unpublished.
- Mitchell, R., and R. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Washington, DC: Resources for the Future.
- Raboteur, J., and M.F., Rodes. 2006. "Application de la Méthode d'Évaluation Contingente aux Récifs Coralliens dans la Caraïbe: Étude Appliquée à la Zone de Pigeon de la Guadeloupe." *La Revue Electronique en Sciences de l'Environnement* 7 (1): 33.
- Shultz, S., J. Pinazzo, and M. Cifuentes. 1998. "Opportunities and Limitations of Contingent Valuation Survey to Determine National Park Entrance Fees: Evidence from Costa Rica." *Environment and Development Economics* 3 (Part I): 131-49.



Xavier, M. 2014. Etude sur l'Opération Grand Site de la Pointe des Châteaux: Vers Une Estimation de la Valeur Economique Totale du Site, Rapport de Stage, Université des Antilles et de la Guyane.

World Travel and Tourism Council. 2015. "Travel and Tourism: Economic Impact 2015 Guadeloupe." [http://www.caribbeanhotelandtourism.com/wp-content/uploads/data\\_center/global/WTTC-WorldEconomicReport2015.pdf](http://www.caribbeanhotelandtourism.com/wp-content/uploads/data_center/global/WTTC-WorldEconomicReport2015.pdf).

**Palabras clave:** *W Arthur Lewis, Historia de la economía, Enseñanza de la economía, La Universidad de las Indias Occidentales; El Colegio Universitario de las Indias Occidentales.*

### **Estimation de la valeur économique totale de La Pointe des Châteaux, Guadeloupe: Une approche d'évaluation contingente**

Nlandu Mamingi, Alain Maurin et Jean-Gabriel Montauban

Cette étude tire la valeur économique totale de La Pointe des Châteaux, le site touristique le plus important de la Guadeloupe. L'étude utilise l'approche de l'évaluation contingente et recourt à des statistiques descriptives, à une estimation de Turnbull et à des modèles probit pour obtenir et évaluer en premier lieu les valeurs d'utilisation et de non-utilisation du site. L'étude révèle que la valeur économique totale non actualisée de La Pointe des Châteaux varierait facilement de 4 858 000 euros à 6 250 000 euros par an. L'étude indique également que le coût d'accès à l'agrément serait d'environ 6 euros par personne et par visite, et que sa contribution annuelle à un fonds destiné à la préservation et à l'amélioration du site s'élèverait à 26 euros. Ces résultats signifient que la possibilité de développer, de gérer et de préserver le site est réelle. C'est en effet la tâche à laquelle les autorités locales du site devraient s'attacher, en particulier dans le contexte du développement durable.

**Mots-clés:** *Guadeloupe, La Pointe des Châteaux, méthode d'évaluation contingente, valeur économique totale, estimation du Turnbull, tourisme.*

### **Calculando el Valor Económico total de La Pointe des Châteaux en Guadalupe: Un enfoque de Valoración Contingente**

Este estudio enfoca el valor económico total de La Pointe des Châteaux, el sitio turístico más importante de Guadalupe. Utiliza el enfoque de valoración contingente y recurre a estadísticas descriptivas, al método de estimación de Turnbull y modelos probit para obtener y evaluar en primera instancia los valores de utilización y no utilización del sitio. El estudio revela que el valor económico total no descontado de La Pointe des Châteaux fácilmente varía de 4,858,000 euros a 6,250,000 euros por año. También indica que la tarifa de entrada al sitio es aproximadamente 6 euros por persona por visita, indicando una contribución anual de hasta 26 euros por persona al fondo para la preservación y mejora del sitio. Estos datos significan que hay una posibilidad real de desarrollar, administrar y preservar el sitio. De hecho, esto debe ser la tarea central de la autoridad local del sitio, particularmente en el contexto del desarrollo sostenible.

**Palabras clave:** *Guadalupe, La Pointe des Châteaux, Método de valoración contingente, Valor económico total, Estimación Turnbull, Turismo.*

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