CBB Working Paper No. WP/17/6

ESTIMATING THE TOTAL ECONOMIC VALUE OF *LA POINTE DES CHÂTEAUX*, GUADELOUPE: A CONTINGENT VALUATION APPROACH

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CENTRAL BANK OF BARBADOS

December 31, 2017

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Abstract

Tourism dynamism is an important indicator of the economic health of most Caribbean economies. Not surprisingly, the promotion of activities that qualitatively and quantitatively boost tourism is always welcome in those countries. Against this backdrop, this study attempts to derive the total economic value of *La Pointe des Châteaux*, the most important tourism site of Guadeloupe. The study uses the contingent valuation approach to obtain in the first instance the use and non-use values of the site. The study utilizes statistical and econometric methods or models such as descriptive statistics, Turnbull estimation and probit models to obtain the mean values necessary to derive the total economic value of the site. The study reveals that the undiscounted total economic value of *La Pointe des Châteaux* would easily vary from 4,858,000.00 euros to 6,250,000.00 euros per year. The study also indicates that the entrance fee would be about 6.00 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 26.00 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.

JEL Classification : Q26; O54; C25; C13

Keywords: Guadeloupe; *La Pointe des Châteaux*; Contingent Valuation Method; Total Economic Value

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1. Introduction

Like in many nations and overseas territories of the Caribbean, tourism occupies a special place in the economy of Guadeloupe given its important contribution to the prosperity of the island. To pick up a year, in 2014, tourism[1] in Guadeloupe with an annual average of about 1 million of tourists generated 1,513.5 million euros and contributed 16% of GDP. Particularly, tourism activities 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 1990's have witnessed a sustained growth of tourism, the decade thereafter has in great part registered a slowdown in activities. The economic world crisis, the events of September 11, 2001, and the tourism competition of other islands are factors which generally explain the present trend in tourism in Guadeloupe[2].

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). The latter consists of use and non-use values. In this study, use value is assimilated to direct use value and non-use value is associated with existence value.

This 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 to estimate 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 or the use of services or 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 bounded dichotomous choice, dichotomous

[1] For the statistics, see World Travel & Tourism Council (2015).
[2] 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 labour force (LB)).

choice with two offers, etc.). 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 et *al*., 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, evaluation of air pollution, water quality, soil and sites (see Asciuto et *al.*, 2015; Markantonis and Bithas, 2010; Raboteur and Rodes, 2006; Lewis and Mamingi, 2003; Dharmaratne et *al*., 2000; Dharmaratne and Brathwaithe, 1998; Shultz et *al.*, 1998; Choe et *al*., 1996). Asciuto et *al.* used a CVM to derive the existence value of monumental trees of 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 (2010) utilized a CVM to estimate "Greek national mitigation and adaptation climate change costs." Raborteur and Rodes (2006) resorted to a CVM with payment cards to elicit the total economic value of the Zone of Pigeon in Guadeloupe, precisely the coral reefs of the Zone. The use value of the site varies between 213,000.00 euros and 221,000.00 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. The TEV reaches 6,529,876.83 Barbados dollars[3]. Dharmaratne et *al.* (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 at least two reasons. First, an accurate valuation of the resource helps policy makers to have an idea about the potential level of financing needed for the preservation of the site and/or its improvement. This agenda is in agreement with the sustainable tourism targeted in Guadeloupe. Second, from the results of the study it can be deduced the entrance fee level which allows the maximisation of revenue. Basically, the study allows to better deal with the question of the ideal entrance fee.

[3] 1 US$ = 2 BDS$ with BDS standing for Barbados.

To the best of our knowledge, this study is the first one 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 necessary the best mean values to use in order to derive total economic value.

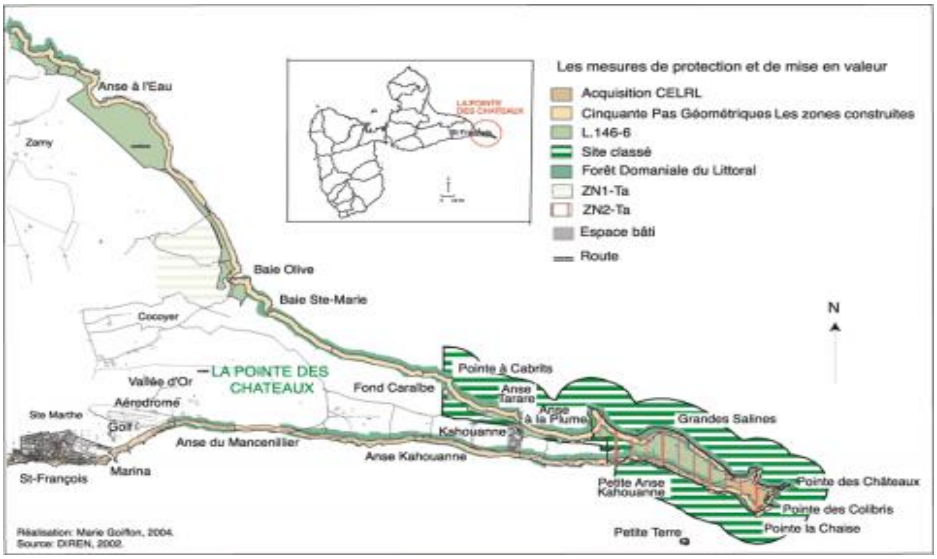
The study proceeds as follows. Section 2 succintly introduces *La Pointe des Châteaux*. Section 3 deals with the methodology to elicit the total economic value of *La Pointe des Châteaux*. Section 4 contains the analysis of survey data. Section 5 presents the econometric models and the results of estimation. Section 6 concentrates on the derivation of the total economic value of the site. The last section contains concluding remarks.

2. La Pointe des Châteaux

La Pointe des Châteaux is located in Grande-Terre 40 km from Pointe-à-Pitre and 11 km from Saint-François, Guadeloupe. It is a peninsula with diverse features and spaces covering a total area of 733 ha with a land area of 175 ha. 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[4]. The site regroups a multitude of beautiful inlets, beaches with fine sand, hiking trails and cliffs, which support various leisure and professional activities. The latter include family walk, hikings, sports, school, tourism, swimming, picnics, boutiques, restaurants, street vending, and observation of marine turtles. Incontestably, the photos in the figures mentioned above convey positive images of the site's natural and landscape qualities. These remarkable characteristics coupled with environmental degradation due to an impressive number of visitors and poor management have, however, motivated the local authority to mount a project named « project of operation great site (OGS) » 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 (2008).

[4] Also visit http://www.pointe-des-chateaux.com/carte.html

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



Sources : Goiffon and Consales (2008, 10).

Figure 2: 3 Photos of *La Pointe des Châteaux*

Source : Commune of St. François, Guadeloupe.

Source : Alain Maurin, 2016

Source: Alain Maurin, 2016

3. Methodology to Derive Total Economic Value

The contingent valuation method is one of the methods to capture the economic value of non-market good. It is a direct method of valuation of non-market goods for which individuals are requested to express directly their willingness to pay (WTP) for the utilisation/non utilisation of a non-market good or their willingness to accept compensation (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 is derived the willingness to pay for the use of a good or the willingness to accept compensation. 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." It seems that 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 Signollo (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 ici. First, an 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. Here, *La Pointe des Châteaux* as entity is the object of valuation. *La Pointe des Châteaux* has essentially three vocations: recreational, scientific and educational. *La Pointe des Châteaux* attracts many visitors with 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 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 subtantial 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. »

Second, in the context of the questionnaire, the sample size, 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 is fixed at 627 individuals with 458 residents and 169 tourists. The sampling procedure needs to be explained somehow. For the residents, quota methods based on the distribution by commune, sex, and age are of interest. For tourists, a random choice is adequate. *La Pointe des Châteaux*, the Port, Epi beach, and the Marina are the appropriate locations to conduct interviews (see Xavier, 2014).

Third, a well elaborated questionnaire is mounted and launched. The latter contains 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 is tested with a pilot study using the sites mentioned above. In light of interviewees' reactions, the questionnaire is revisited before being launched at the locations indicated. As just pointed out, the interviewees are divided into two groups: residents and tourists. It is worth noting visitors and non-visitors to the amenity belong to the sample of interest. The non-visitors have been included namely 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 individual basis. As indicated above, recreational values (including relaxation), scientic and educational are the main characteristics for which individuals wanting to visit the site would be willing to pay for[5].

Only the family head or an adult is requested to fill up the questionnaire. The latter has been administered by the students in masters in development and the environment 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 goes 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, 4 groups of individuals (residents and tourists) are formed. Each group has its own bid (P_1). Concretely, Group1 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 have been derived from the results of the pilot survey for which the payment card method was of interest.

A similar method is used for non-use value. Here, the key question reads as follows : " Given the recreational, educational and scientific vocations of *La Pointe des Châteaux*, you are requested to 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 4 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 willingness to pay the entrance fee as well as the fund. Moreover, the determinants of WTPs are also derived to better understand the dynamics of willingness to pay.

[5] The full questionnaire is available on request.

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

4. 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 willingness to pay 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 has dealt with 627 individuals, residents and tourists together. The results of the survey have revealed that 554 files are usable, that is, 88.4% of the sample. The other files have been eliminated because most often they contained either incomplete data or protest zeros. The 554 files cover 393 residents and 161 tourists.

A great number of residents interviewed are from Saint-François, the commune where *La Pointe des Châteaux* is located. Most tourists come from metropolitan France.

Concerning the willingness to pay an entrance fee (WTP1) to access *La Pointe des Châteaux*, 53.4% of individuals interviewed are potentially favorable to pay a certain amount and 46.6% are not.

77.6 % of interviewees are favorable for the protection of the environment. Recoding the latter variable[6] leads to a positive relation between willingness to pay 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[7] test statistic which tests the independence of two characteristics confirms that the association between willingness to pay and protection of the environment is significant, at least at

[6] That is, Protenv becomes Protenv1 with 1 now capturing insignificant, 2 not higly favorable to the environment, 3 favorable to the environment and 4 very favorable to the environment.

[77] 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.

the 10% level of significance. Note that 54.9% of individuals who have some appreciation of the 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 (%) of Table 1 indicates clearly a negative association between amount and willingness to pay. This is reinforced by the *p*-values of *r*, and Pearson's *chi-square*.

Revenue should in theory be the most important variable of willingness to pay. In our sample, the average revenue is 21,539.71 euros, and the median revenue amounts to 14,500.00 euros. There is no statistical difference between the average revenue from locals and that from tourists. There is no association between willingness to pay (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).

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

Amount	**WTP1**	**%**
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-square*	23.380	*p*-value=0.000

Source: our survey.
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.

Concerning the number of visits to the site before valuation (visitavant), 16.8% of interviewees have indicated that they have 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 willingness to pay and visitavant is -0.085. The *phi* coefficient has a value of 0.172 and the Pearson's *chi*-square has a value of 16.725 with a *p*-value of 0.002. Thus, a significant negative association between the two variables is probable.

The average number of potential future visits per individual (visitfutur) is about 3, the median 2 as well as the mode. The correlation between willingness to pay and visitfutur is -0.059 with a *p*-

value=0.165, the phi coefficient reaches 0.242 and the Pearson's chi-square test has a value of 32.564 associated with a *p*-value of 0.0001. There is the possibility of a negative relation between WTP1 and visitfutur.

The average size of a household is 3 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 is 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 willingness to pay.

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, the average level is 2.55, that is, between the secondary and tertiary levels and the median level is the tertiary. 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 two significant relations between the willingness to pay an entrance fee to access the site and the variables alluded to above: a negative relation between WTP1 and amount, and a positive relation between WTP1 and protection of the environment.

Willingness to pay or to contribute to a fund for the preservation of the site (WTP2) is 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 gives the distribution of values. It can be noticed 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
Total	554	100.00	554	100.00

Source: survey

Table 3 summarises the types of relations between WTP2 and a certain number of variables. It can be noticed the significant relations only hold between WTP2 and protenv1, WTP2 and visitavant, 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 behavior of revenue is once more confirmed.

Table 3: Relation between WTP2 and Determinants

Relation	Statistics	Corresponding p-values
WTP2 --- revenue	*r* = 0.045 *Phi* = 0.157 *Chi-square* =14.813	0.290 0.139
WTP2 --- protenv1*	*r* = 0.155 *Phi* = 0.215 *Chi-square* = 25.604	0.000 0.000
WTP2 --- households	*r* = 0.052 *Phi* = 0.148 *Chi-square* =12.074	0.226 0.280
WTP2 --- age	*r* = 0.017 *Phi*=0.145 *Chi-square* = 11.429	0.691 0.121
WTP2 --- sex	*r* = 0.007 *Phi* = 0.007 *Chi-square* = 0.030	0.862 0.862
WTP2 --- csp	*r* = 0.0008 *Phi*=0.080 *Chi-square* = 3.571	0.985 0.981
WTP2 ---- education	*r* = -0.064 *Phi*=0.069 *Chi-square* = 2.669	0.133 0.615
WTP2 --- visitavant	*r* = 0.169 *Phi*=0.187 *Chi-square* =19.440	0.000 0.001
WTP2 --- visitfutur	*r* = 0.163 *Phi*=0.261 *Chi-square* = 37.879	0.000 0.000
WTP2 --- verif	*r* = -0.168 *Phi*=0.261 *Chi-square* = 15.576	0.000 0.000

Note: variables are defined as in the text or Table 4.

5. Econometric Model, Estimation, and Analysis of Results

This section introduces the econometric model of willingness to pay (WTP1 and WTP2), reports and interprets the estimation results.

5.1. Econometric Model: formulation and estimation method.

Two types of parametric models are formulated here. The ultimate objective is: (1) to derive willingness to pay, and (2) incorporate the characteristics of the respondent in the functions of willingness to pay (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[8]:

$$v_{ij}(rev_j) = X_{sj}\alpha_{si} + \beta_1 rev_j \tag{5.1}$$

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 willingness to pay asked to interviewees call for the respondents to choose between the status quo (*i=0*) and the condition proposed with a requested payment *m* (*i=1*). This means that model (5.1) can be rewritten as follows:

$$v_{ij}(rev_j - m_j) = X_{sj}\alpha_{si} + \beta_1 (rev_j - m_j) \tag{5.2}$$

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

$$v_{1j} - v_{0j} = X_{sj}\alpha_s - \beta_1 m_j \tag{5.3}$$

where $\alpha_s = \alpha_{s1} - \alpha_{s0}$.

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

[8] This subsection and that after heavily borrow from Haab and McConnell (2002, 26-58).

$$\Pr(yes_j) = \Pr(X_{sj}\alpha_s - \beta_1 m_j + \varepsilon_j > 0) \tag{5.4}$$

where $\varepsilon_j = \varepsilon_{j1} - \varepsilon_{j0}$ is normally distributed if we assume that the errors linked to states are each independly and normaly distributed. We can derive the logistic model similarly. Otherwise, model (5.4) can be rewritten as follows:

$$\begin{aligned} \Pr(X_{sj}\alpha_s - \beta_1 m_j + \varepsilon_j > 0) &= \Pr(-(X_{sj}\alpha_s - \beta_1 m_j) < \varepsilon_j) \\ &= \Pr(\varepsilon_j < X_{sj}\alpha_s - \beta_1 m_j) \end{aligned} \tag{5.5}$$

The issue is that in most software the errors of interest are in fact standardized normal errors with mean 0 and variance 1. Thus, model (5.5) becomes

$$\begin{aligned} \Pr(\varepsilon_j < X_{sj}\alpha_s - \beta_i m_j) &= \Pr(\omega_j < \frac{X_{sj}\alpha_s}{\sigma} - \frac{\beta_1 m_j}{\sigma}) \\ &= \Phi\left(\frac{X_{sj}\alpha_s}{\sigma} - \frac{\beta_1 m_j}{\sigma}\right) \end{aligned} \tag{5.6}$$

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

Model (5.6) is estimated by maximum likelihood method applied to the following expression:

$$L(\alpha, \beta_1 \mid revenue, X, m) = \prod_{j=1}^{T}\left[\Phi\left(\frac{X_{sj}\alpha_s}{\sigma} - \frac{\beta_1 m_j}{\sigma}\right)\right]^{I_j}\left[1 - \Phi\left(\frac{X_{sj}\alpha_s}{\sigma} - \frac{\beta_1 m_j}{\sigma}\right)\right]^{1-I_j} \tag{5.7}$$

where *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 (5.7) and maximize with respect to the parameters. Note that the coefficients obtained from most software are not generally marginal effects. For a given variable denominated X_k, the marginal effect is:

$$\frac{\partial \Phi(X_{sj}\alpha_s - \beta_1 m_j)}{\partial X_{kj}} = \phi(X_{sj}\alpha_s - \beta_1 m_j)\,\alpha_k \tag{5.8}$$

where $\phi(.)$ represents the density function under normal distribution. The expression (5.8) is evaluated at the means.

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

$$v_{ij}(rev_j, X_{sj}) + \varepsilon_{ij} = X_{sj}\alpha_{si} + \beta_1 Log(rev_j) + \varepsilon_{ij} \tag{5.9}$$

Similarly to the case above, the probability of "yes" to the question of willingness to pay is:

$$\Pr(yes_j) = \Pr(\beta_1 Log\left(\frac{rev_j - m_j}{rev_j}\right) + X_{sj}\alpha_s > -\varepsilon_j) \tag{5.10}$$

where variables are defined as above.

The expression corresponding to model (5.6) is

$$\Pr(yes_j) = \Phi\left(\frac{\beta_1 Log\left(\frac{rev_j - m_j}{rev_j}\right) + X_{sj}\alpha_s}{\sigma}\right) \tag{5.11}$$

This probit model is estimated by maximum likelihood method.

5.2 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 (5.7) retains the following variables: WTP1, amount, protenv1, education, visitavant, and CSP. We postulate a negative relation 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 relation with education, and an ambiguous relation with visitavant although a positive relation is quite convincing. No plausible relationship can be advanced between willingness to pay and professional categories.

Table 5 contains the results of the parsimonious form of model (5.7). The latter passes the full-model test of significance as indicates the *p*-value (0.000001) of the likelihood ratio test (LR). McFadden *R*-square is remarkably small. In fact, the variable "mode of payment" which boosts the above statistic has not been included because it is a dominant variable. In any case the coefficients in Table 5 do not represent marginal effects. The latter are obtained using the expression (5.8). 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 relation 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 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.

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
Age	Respondent's age (average of the interval)	38.23 years
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.

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 by two.

Concerning the non-linear model of type (5.10), 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 (5.10) 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 are not marginal effects. The latter are calculated adapting expression (5.8). 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 relation 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 having their probability to revisit the site decrease by 0.041. There is a positive relation 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.

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
Lrevenuv	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; Lrevenuv=Log ((revenue-requested amount)/revenue). Method: ML-Binary Probit; Included observations: 554. For a one-sided test, divide p-value by two.

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. As above, residents and tourists behave differently. Table 7' is Table 7 without the indicator of the type of the visitor (verif). Using the marginal effects derived from expression (5.8), 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.

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

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.

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.

The comparison of Tables 8 and 9 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 7'). The results of table 8 reveal 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. Moreover, the results of Table 9 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 8: Determinants of Willingness to Contribute to a Fund (WTP2): The Linear Model for Residents

	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.

Tables 10 to 13 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 10 to Table 12 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 13 confirm the lack of interest of tourists to contribute to a fund for the site preservation.

Table 9: 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			

Table 10: 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
Lrevenuv2	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: Lrevenuv2= 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 11: Determinants of Willingness to Contribute to a Fund (WTP2): The Non-linear Model

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.554	0.291	-5.340	0.000
Lrevenuv2	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: Table 10 without Verif.

Table 12: Determinants of Willingness to Contribute to a Fund (WTP2): The Non-linear Model for Residents

	Coefficient	Std. Error	Z-Statistic	Prob.
C	-1.554	0.291	-5.340	0.000
Lrevenuv2	43.119	19.187	2.247	0.024
Protenv1	0.265	0.088	-3.011	0.002
Visitavant	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: Lrevenuv2= Logarithm of ((revenue - contribution to a fund)/revenue). Dep. Variable: WTP2. For others, see Table 4.

Table 13: 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
Lrevenuv2	15.673	43.223	0.363	0.717
Protenv1	-0.161	0.196	-0.821	0.410
Visitavant	-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 12.

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

(i) Willingness to pay 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 willingness to pay 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.

6. Total Economic Value of *La Pointe des Châteaux*

We derive the total economic value of *La Pointe des Châteaux*. We proceed in two steps. First, we estimate the mean value(s) of willingness to pay 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.

6.1. Mean Value (MV) of Willingness to Pay

We can estimate the MV of willingness to pay 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.

6.1.1 "Raw" Mean Value

This MV comes directly from survey data. Table 4 contains information sought. Thus, the mean value of willingness to pay 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).

6.1.2 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 respondents have to accept or reject the price or the amount (m_j) that is proposed to them. Indeed, the individual answers favorably to the offer if his/her willingness to pay 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 to say no or having a willingness to pay less than the proposed amount can be represented by

$$P(WTPM_j < m_j) = F_C(m_j) \tag{6.1}$$

Maximum likelihood method yields:

$$F_C(m_j) = \frac{N_j}{T_j} \tag{6.2}$$

where N_j is the number of individuals who respond no to the bid price m_j, O_j is 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 $F_C(m_j) = F_j$ 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,…, m*, calculate $F_j = \frac{N_j}{N_j + O_j} = \frac{N_j}{T_j}$ 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 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:

$$E_{LB}(WTPM) = \sum_{j=0}^{M^*} m_j (F^*_{j+1} - F^*_j) = \sum_{j=0}^{M^*} m_j f^*_{j+1} \quad (6.3)$$

The variance of the lower limit of the mean is

$$Var(E_{LB}(WTPM)) = \sum_{j=0}^{M^*} \frac{F^*_j (1 - F^*_j)}{T^*_j} (m_j - m_{j-1})^2 \quad (6.4)$$

We can thus derive the mean for Turnbull Estimator for *La Pointe des Châteaux*. We start by the willingness to pay 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 14 provides the evolution of no's responses to proposed entrance fees. The last column indicates that monotonicity alluded to above is fulfilled.

Table 14: 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's answers.

From Table 14, we can derive the mean as follows:

$$E(WTPM) = \sum_{j=0}^{M} m_j f_{j+1} = 0x0.384 + 4x0.129 + 6x0.034 + 8x0.142 + 10x0.311 = 4.97 \text{ euros} \quad (6.5)$$

It is appropriate to obtain the confidence interval of the mean. Using formula (6.4) to obtain the variance and subsequently the standard deviation, we find the following 95% confidence interval: (4.53 euros, 5.41 euros). Likewise, the 90% confidence interval is (4.60 euros, 5.33 euros). It is the case that the mean is about 5.00 euros.

Table 15 contains the disaggregate results for the contribution to a fund for the site. They indicate that contrary to the case above Turnbull estimator must be applied since the proportion of "no's" does not increase monotonically.

Similar to (6.5), the mean willingness to contribute to a fund is 15.47 euros. Using formula (6.4) 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% confidence interval for the lower bound of WTPM is (11.30 euros, 19.64 euros). Similarly, the 90% 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 15: 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.

6.1.3. Mean Value from 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 willingness to pay an entrance fee is given by

$$E(WTP1 \mid \alpha, \beta_1, X_{sj}) = [\alpha / \beta_1] X_{sj} \tag{6.6}$$

evaluated at the means of variables. Variables and parameters have been defined above. Expression (6.6) is also valid for WTP2 (willingness to contribute to a fund for the site preservation).

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

$$E(WTP1 \mid \alpha, \beta_1, X_{sj}, revenue_j) = revenue_j - revenue_j \exp\left(-\frac{\alpha}{\beta_1} X_{sj} + \frac{1}{2} \frac{\sigma^2}{\beta_1^2} \right) \tag{6.7}$$

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

Table 16 contains the results of mean values derived from formulas (6.6) and (6.7). 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 willingness to pay 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 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 that for residents

Table 16: 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.

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 Turnbull method are 32.60 euros and 15.47 euros, respectively.

Although the econometric models of interest here are good in deriving the determinants of willingness to pay 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 willingness to pay an entrance fee or contribute to a fund is the mean of raw values from survey data, Turbull estimator and the econometric value[9]. Thus, the mean willingness to pay an entrance fee amounts to about 6.00 euros per visit. For the fund, it is about 26.00 euros per year.

[9] If the value makes sense.

6.2 Total Economic Value of *La Pointe des Châteaux*

As pointed above, 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 necessary 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, 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.

That is, the use value would amount to 500,000 x 6.00 euros= 3,000,000.00 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 x 500,000 x 6.00=1,602,070.20 euros. Concerning non-use value, the latter would amount to 125,000 x 26.00 = 3,250,000.00 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 6,250,000.00 euros[10]. The amount range is somewhat comparable to that obtained by Lewis and Mamingi (2003) for Harrison's Cave.

[10] A refinement can be made by charging different entrance fees for adults and children.

7. Conclusion

The main objective of this study is to derive the total economic value of *La Pointe des Châteaux*, an important touristic site of Guadeloupe. The study uses the contingent valuation method to obtain the use and non-use values of the site. The study resorts 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 6,250,000.00 euros. Naturally, the question of realisation of these values needs to be posed. In any case, this study would justify the iniative undertaken by the Guadeloupean authority to develop and preserve the site, particularly in the context of sustainable development.

Total economic value in this context is 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 education level, the attitude towards the environment, and the knowledge about the amenity.

This study could be improved in several directions. There is a need to revisit the chosen econometric models which in many situations are unable to generate acceptable mean values for willingness to pay entrance fee or to contribute to a fund for the site preservation. It is also 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.

Acknowledgements

The research leading to the present paper has been undertaken under the auspices of CREDDI (Centre of Research in Economics and Law of Island Development) of the University of the Antilles, Campus of Fouillole, Guadeloupe. We thank Monier Xavier who, in the context of his master's internship report (2014), conducted the survey used here. We acknowledge Prosper Bangwayo-Skeete for useful comments. We also benefited from helpful comments from conference participants at St. François, Guadeloupe, SALISES 18th Annual Conference 2017 and the Central Bank of Barbados' 37th Annual Review Seminar. Editing from Winston Moore and Roxanne Hinds is appreciated. All remaining errors are, however, our own.

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