Assessing the Total Economic Value of Barbados Welchman Hall Gully

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Abstract

The objective of this paper is to derive the total economic value of Welchman Hall Gully, a tourist site which contributes in its own right to the economic prosperity of Barbados. The objective is achieved through the derivation of use and non-use values of the amenity. Despite its limitations, contingent valuation method (CVM) is of interest to derive such values. The data for analysis come from a well-crafted CVM survey. Using statistical tools and Tobit modelling, the paper finds that the additional annual use value could reach BDS$45,924.00 or US$22,962.00 and the yearly non-use value could be BDS$72,765.00. Taking the present entrance fees into account, the total undiscounted economic value of the site could reach BDS$289,289.00. Income size, love for the environment, gender and level of education positively affect willingness to pay for an additional entrance fee. Gender, age and membership in a non-governmental organization, sensibly affect willingness to contribute to a fund for the preservation of the site.

The results of the valuation coupled with cost information can motivate the manager of the site in identifying policy or mechanisms by which the site can be maintained and/or improved owing to smart use of funds generated from the utilization of the site.

JEL classification: O5; Q2; C24

Key words: Welchman Hall Gully; private provision of public good; environmental good; tobit model; contingent valuation method (CVM).

1. Introduction

Barbados is an independent island nation in the Caribbean with a land area of 432 km^2 and a population estimated at 285,006 inhabitants (2016). With an income per capita of US$15,557.83 (2015), Barbados ranges among the high income countries. Tourism is the major contributor to the island's economic prosperity. The bulk of tourism can be qualified as mass tourism.

It is, however, important to acknowledge that Barbados faces serious competition from other tourist destinations such as the Bahamas, Cuba, Dominican Republic, Jamaica, St. Lucia and Puerto Rico. An argument can thus be made for the diversification of the Barbadian economy in general and the tourist product in particular. One such area of tourist product diversification is the development of nature-based tourism essentially centered on natural and cultural heritages. Since the 1980's if not the 1970's Barbados has embarked on promoting nature-based tourism. This has been materialized by the development of the well-known and publicized Harrison's Cave and associate Sites (see Axxys Environmental Consulting (B'dos) ltd et *al*. 1999). The Barbados National Trust (BNT) is the main body in charge of managing the heritage sites. Concretely, the BNT manages the following sites: Gun Hill Signal Station, Welchman Hall Gully (WHG), Tyrol Cost Heritage Village, Morgan Lewis Sugar Mill, Port Vale Sugar Museum and Andromeda Botanic Gardens. Recently, some of the sites have been on lease. Andromeda Botanic Gardens and Welchman Hall Gully are cases in point.

The present paper is concerned with the economic valuation of Welchman Hall Gully, a site with sound nature beauty, a rich variety of plants, an ideal spot for hiking and cultural and nature history. Indeed, the paper attempts to assess the total economic value of Welchman Hall Gully[1]. The objective is achieved through the derivation of use (direct use) as well as non-use (existence) values of the amenity. Contingent valuation methodology is of interest to obtain such values. Contingent valuation method (CVM)[2], a popular method of valuation of non-market goods, has gone beyond its boundaries to deal with valuation of other types of goods[3]. The key characteristic of the method is that it is the consumer or the interested party in the amenity who suggests the monetary value of the amenity. To elicit the use as well as non-use values we recourse to payment card. In addition, Tobit modelling is of interest to examine the determinants of willingness to pay.

To the best of our knowledge, apart from Lewis and Mamingi (2003) no serious attempt to look at the economics of heritage site has been conducted for Barbados. This paper fills up this gap by measuring the total economic value of a gully. In addition, it is also among the very few contingent valuation method studies with a Caribbean flavor.

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[1] The paper intended to fully examine the cost side of the amenity too. Due to lack of information, this objective was abandoned. Despite that, we can still, however, speculate on the cost tally.

[2] See among others Carson (2012) and Hanemann (1994) to fix ideas about CVM.

[3] Welchman Hall Gully can be considered a private public good. On the private provision of public goods, read Bergstrom et *al*. (1986), Warr (1983), Buchholz and Peters (2001) and Santagana and Signorello (2002)

That said, the closest papers in the Caribbean context are Mamingi et *al*. (2017), Raboteur and Rhodes (2006), Lewis and Mamingi (2003), Dharmaratne et *al*. 2000 and Dharmaratne and Brathwaite (1998). Using the contingent valuation method with dichotomous choice, Mamingi et *al*. (2017) derived the total economic value of "La Pointe des Châteaux" in Guadeloupe. The study reveals that the undiscounted total economic value of *La Pointe des Châteaux* could easily vary from €4,858,000.00 to €6,250,000.00 per year. Raboteur and Rodes (2006) used payment card in the context of CVM to elicit the total economic value of coral reefs of the zone of Pigeon in Guadeloupe. The use value went from €213,000.00 to €221,000.00 and by and large justifies the recommendation according to which the site needs to be preserved. Using CVM with payment card as vehicle method, Lewis et Mamingi (2003) found that the total economic value of Barbados Harrison's Cave reached BDS$6,529,876.83.[4]

The results of the valuation coupled with cost information can help or motivate managers in identifying policy or mechanisms by which the sites can be maintained and/or improved owing to smart use of funds generated from the utilization of the sites. In other words, a study of the economic value of the amenities will allow to determine whether the value of the sites is low or not realized. Since in many instances most sites are subsidized, this study will reveal whether an extra effort is needed to realize the value of a given site so to reduce for example the level of subsidies. By the same token, it identifies ways that owners of the sites can maximize income generated.

The paper is organized as follows. Section 2 introduces Welchman Hall Gully. Section 3 gives details concerning the survey leading to the valuation of the amenity.

[4] 1 US$ = 2 BDS$

Section 4 is concerned with data analysis. Section 5 deals with modelling of willingness to pay. Section 6 derives the total economic value of Welchman Hall Gully. Section 7 centers on discussions and policy implications. Section 8 contains concluding remarks.

2. Welchman Hall Gully[5]

In 1962, Welchman Hall Gully became the Barbados National Trust first asset. Welchman Hall Gully was thus made a tourist attraction. For years it remained the only gully used as a tourism and educational product.

The Gully lies in the parish of St. Thomas on the high central lands of Barbados at an elevation of 800ft and is three-quarter of mile (1.2 km) long. The Gully is rich in natural vegetation. Those areas that have been left entirely natural are often used to illustrate how Barbados must appear to the first settlers in 1627. In other sections of the Gully, flora not native to Barbados and not found in other areas of the island can be seen. Overall some 700 species of plants, bearded fig trees, clove, nutmeg, cocoa, coffee, bananas as well as citrus, avocado, pears, coconuts, bamboo and numerous tropical plants are found in the Gully.

In addition to plant life, visitors to the Gully are exposed to aspects of Barbados's geologic history as a coral island and its connection to the neighbouring Harrison's Cave. Huge stalactites and stalagmites bear testament to the Gully's origins as an enormous cave system.

There are six sections of the Gully each with a distinct attraction including one section known as the "Nutmeg Grove" and one with the "Look-out" and "Grazebo" where the visitor is most likely to see green monkeys.

For recall, the amenity is since 2007 privately managed under a lease contract with BNT. The entrance fee varies according to whether one is local or tourist. As of April

[5] For this section, see mainly http://www.welchmanhallgullybarbados.com as well as http://new.barbadosnationaltrust.org/project/welchmanhallgully

2015, a local adult pays BDS$13.00 to access the Gully while a child pays BDS$6.00. For tourists, an adult pays BDS$24.00 or US$12.00 and a child BDS$12.00 or US$6.00. Children in school uniform or attending summer camp are asked to pay BDS$6.00. In 2001, approximately 10,000 persons visited the Gully. Although, the number of visitors decreased sensibly in 2011 -2013 compared to the early 2000's there has been a recovery in visitations as Table 1 indicates. An interview with the manager of WHG revealed that the majority of visitors taking 1.5 mile trail walk are Americans, British and Germans, with most local traffic coming through church groups and school field trips. Indeed, according to the statistics provided by the manager of WHG, the school program and tours are really alive. In 2008 the number reached 1,381 persons, 2,615 in 2009, 2,434 in 2010, 1,371 in 2011, 2,934 in 2012, 2,200 in 2013 with the majority being students. The peak period for WHG is December to April.

Table 1 : Number of Visitors to Welchman Hall Gully

Year	Number of persons
2011	4800
2012	5575
2013	8289
2014	9198
2015	8500
2016	9300

Source: Debra Branker, Director of WHG, January 2015: interview with N. Mamingi.
Debra Branker, July 3, 2017: email correspondence for 2015 and 2016 statistics.

Although there is no formal link between WHG and Harrison's Cave, a physical link exists. At present, the quality of WHG has improved at least according to the current manager. In fact, an internet review of Trip Advisor Reviews reveals that 36% of visitors think that the amenity is of very good quality and 51% believe WHG is of excellent quality. According to the manager, there is no room for further entrance fee increase. This is a hypothesis that is tested in this paper.

The funding of the Gully has been through various sources: government subsidies, donations, membership subscriptions, entrance fees, and major raising fund event (e.g., open house). Although the Gully is now an income generating entity, up to recently, the cost of running the amenity approximately evaluated at $BDS100,000.00[6] outweighed the benefits. In our view, there is a need to improve the Gully to boost income in order to really break even. The management must be aggressive in seeking new venues to raise funds.

3 Survey

The data used in CVM came from a survey. The ultimate objective of the latter is to help derive the use and non-use values of the good or amenity of interest. Note that although originally CVM only dealt with non-market goods, recently other types of goods in the vicinity of non-market goods have been added to the list. In the present case, it is a public good privately provided.

That said, a survey questionnaire which consisted of 29 questions was conceived and launched in May and June 2015. Two interviewers were recruited to administer in person the questionnaires. Two types of questionnaire were of interest: one addressed to residents and another to tourists. The two are in fact 98% similar. The object and objective of valuation were carefully explained at the outset. In this connection, it was pointed out that Welchman Hall Gully, the object of valuation in its totality, is a site with sound nature beauty, a rich variety of plants, an ideal spot for hiking and cultural and nature history.

The survey dealt with the usual issues of a typical survey: sample, sampling procedure, size of the sample, type of interviewees, location for interviews, among others.

[6] Information provided to one of the co-authors in the early 2000s.

With the size of visitations in the vicinity of 10,000 persons per year coupled with the payment card as method to elicit payment, a sample size of about 300 persons is a sizable sample, particularly given budget constraints. Following our conversation with the manager of WHG and the statistics provided, we used a sample of 312 persons with 174 tourists and 138 residents[7]. The sample for tourists was drawn randomly and the sample for locals was drawn in such a way a large number of persons came from the parish of St. Thomas. On the advice of the manager and other considerations, most interviews for tourists took place at the Site and for residents all over the places, including the Site. At another level, visitors and non-visitors to Welchman Hall Gully were interviewed. This is particularly important as non-use value was also sought. The photos of the amenity were part of the interview process.

Each set of survey questionnaire contains 29 questions regrouped in 3 sections: section A essentially dealt with love for the environment and degree of knowledge about Welchman Hall Gully, section B targeted valuation per se, and section C centered on personal information.

Section A had 10 questions for residents and 12 for tourists. Among those questions, two were particularly useful:

(a) What level of importance do you give to efforts to conserve/preserve the environment in the context of development of Barbados?

Very high	High	Just	Insignificant
1. ( )	2. ( )	3. ( )	4. ( )

(b) Do you know Welchman Hall Gully or have you heard about it?

[7] According to the manager, 80% of visitors to WHG are tourists and 20% residents.

( ) 1. Yes ( ) 0. No

Section B was the core of the survey as it dealt with valuation per se. To motivate the valuation the following description of the amenity was provided: "Welchman Hall Gully is one of the important heritage sites of Barbados. The attraction of the Site is essentially due to its environmental, recreational, scientific and educational characteristics. The recreational characteristics consist of sporting activities including hiking, tourism, relaxation, family or individual hobby and meditation. Although recently the quality of the Site has substantially improved at least according to the manager of the Site, further improvement is needed to fully fulfil its mandate. For example, the parking lot is too small if one has to increase the number of visitors. In this connection, an improved welcome site needs to be built. All this requires money, funds. At present, a modest entrance fee is imposed : for locals, BDS$13.00 for adults and BDS$6.00 for children and for tourists, BDS$24.00 for adults and BDS$12.00 for children. Without a substantial and permanent financial intervention, recreational activities would not be fully realized. There is thus the need to generate extra revenue through entrance fees and also the establishment of a fund to guarantee the perpetuity of Welchman Hall Gully. This fund will be managed by an NGO. "

To elicit use value, the following question was asked :

If you were requested, to support the improvement of services of the Site, to pay an additional user fee to access the Site, what would be the maximum amount you would be willing to pay in BDS dollars ?

Circle your response

0.00 1.00 2.00 3.00 5.00 6.00 10.00 Other (specify):…..

To elicit the non-use value the two following questions were of interest:

Given environmental, recreational, educationnal and scientific characteristics of Welchman Hall Gully, you are requested to contribute to a fund managed by an NGO and used for the preservation and the improvement of activities of the Site.Would you contribute to that fund by the payment of a certain amount ?

( ) 1. yes ( ) 0.No

Note : if yes, go to the next question; otherwise go to the second next question

If yes to the previous question, circle the amount in BDS dollars you would be willing to contribute per year.

5.00 25.00 50.00 75.00 100.00 150.00 other (specify)…….

Section C dealt with personal information such as gender, age of the interviewee, highest education level reached, household size , and income.

Following the good practice, a pilot study or pre-survey was considered in the first instance. In this connection, 36 questionnaires (20 for residents and 16 for tourists) were launched. The pilot study allowed to detect sentences not well expressed or totally unclear as well as other errors. It also allowed to identify the plausible values for use and non-use values using payment card method. At the end, the questionnaire was revised in light of remarks made by the interviewees. It is this modified questionnaire which became the foundation of survey per se.

4. Data Analysis

4.1 Demographic Profile of the Interviewees

The survey which contains 29 questions was administered in-person by 2 interviewers. The sample size was 312 individuals, visitors and non-visitors to the Gully, who all favorably responded. However, only 227 surveys were usable[8], that is 72.8% effective response rate. Of 227 valid surveys, 125 (55%) respondents were tourists and 102 (45%) residents. In addition, 56% of respondents were interviewed at the Site.

Concerning age, 57 (25.11%) respondents were in the range of 21-30 years and 53 (23.35%) respondents in the 51-60 years. The mean age of the respondents was 40 years. In terms of gender, there were 104 (46%) males and 123 (54%) females.

Regarding education attainment, 172 (75.77%) respondents had a college or university degree, 51 (22.47%) had a secondary or high school diploma, and 4 (1.76%) respondents had only primary or elementary school diploma. The median education level was 3, that is, college or university. The mean was 2.74. Overall, the respondents had a decent level of education.

The average household size was in the order of 3 persons. The mode was 2 persons with 76 respondents (33.48%). The phenomenon "large family" (4 members or plus) was present. Indeed, 78 (34.36%) respondents lived in a family having at least 4 members.

The average income level was BDS$71,872.25 with a minimum of BDS$5,000 and a maximum of BDS$105,000.00. With a median income of BDS$85,000.00 and a mode of BDS$105,000.00, the distribution of income was skewed. The latter characteristics was largely affected by tourists' income.

[8] Some forms were either incomplete or contained protest bids.

4.2 Attitude towards the environment and knowledge of the site

The typical respondent regarded the environment as highly important to be preserved for Barbados. Precisely, the mean importance was 3.28 (high). In disaggregated form, 53.30% and 30.40% considered the environment very important and important, respectively. Only 8.81% claimed its insignificance. Logically, love for the environment should thus be a positive predictor of willingness to pay.

Concerning knowledge about the site, 86% of respondents knew about Welchman Hall Gully. In other words, 14% never heard about it. In addition, 28.19% pointed out that they have never visited the site and 71.81% did it at least once. These numbers have to be analysed carefully by the manager.

4.3 Willingness to pay

Regarding willingness to pay for an extra fee to access the amenity, Table 2 gives such an account. It can be noted that 202 (89%) respondents were willing to pay for an extra entrance fee to access WHG. The mean willingness to pay an extra fee was BDS$5.16. The mode was BDS$5.00 with 25.99% of respondents. Other notable characteristics include: 51 (22.47%) respondents preferred to pay BDS$10.00, 26 (11.45%) respondents wanted to settle for BDS$6.00, 32 (14.10%) respondents would pay only BDS$2.00 and 25 respondents (11.01%) were not interested in paying an additional entrance fee.

In terms of justification of payment, 122 (53.74%) respondents believed that the extra payment could be justified on the account that it is “good to contribute to the preservation of Welchman Hall Gully” and 75 (33.04%) thought there is “great interest in the preservation of the environment.” Note that no respondent suggested that the

facility be supported financially. The typical reason for paying an additional entrance fee (see rpay) was the great interest in the preservation of the environment.

Table 2: Willingness to pay an additional entrance fee (WTP) to access Welchman Hall Gully

Amount Proposed	Count (Respondent)	Percent	Cumulative Count	Cumulative Percent
0.0	25	11.01	25	11.01
1.0	13	5.73	38	16.74
1.5	1	0.44	39	17.18
2.0	32	14.10	71	31.28
3.0	14	6.17	85	37.44
5.0	59	25.99	144	63.44
6.0	26	11.45	170	74.89
7.0	2	0.88	172	75.77
10.0	51	22.47	223	98.24
15.0	1	0.44	224	98.68
20.0	3	1.32	227	100.00
Total	227	100.00	227	100.00

Concerning certainty of payment of the declared amount, 92 (42.53%) respondents were certain they were going to pay the amount and 90 (39.65%) respondents were very certain they were going to do so. On the contrary, 11 respondents were uncertain about the payment. This is important when deriving the economic value of the amenity, particularly as it somewhat affects the extent of hypothetical bias.

With 177 (77.97%) respondents, the payment on the site was the preferred method of payment followed by an environment tax with 6.17% of respondents. This gives information about the channel for payment, which can affect the respondents' behavior.

Regarding annual future visits, 24.41% did not think to visit the amenity in the future, 40.38 % planned to visit it once and 9.86% two times. These figures need further considerations for the manager.

Concerning willingness to pay for a fund for the preservation/improvement of Welchman Hull Gully, 49% were willing to contribute to such a fund and 51% had no interest in it. As far the amount was concerned, Table 3 indicates that 18.50% of respondents would like to contribute BDS$25.00 annually, 18.06% would go for BDS$5.00, 6.17% would settle for BDS$50.00. The mean willingnes to contribute to a fund was BDS$14.85 and the median as well as the mode were BDS$0.00. The distribution is really skewed.

For those who were willing to contribute, that is, 111 respondents, 36.04% were very certain to pay the declared amount and 56.76 % were certain to do so while 6.31% were uncertain and 1 person (0.90%) would not likely pay.

Table 3: Willingness to Contribute to a Fund (WTPF)

Amount (BDS$)	Count (Respondents)	Percent	Cumulative Count	Cumulative Percent
0	115	50.66	115	50.66
5	41	18.06	156	68.72
15	1	0.44	157	69.16
25	42	18.50	199	87.67
50	14	6.17	213	93.83
75	4	1.76	217	95.59
100	8	3.52	225	99.12
150	2	0.88	227	100.00
Total	227	100.00	227	100.00

5. Modelling Willingness to Pay

5.1 Determinants of WTP

From the survey we can infer that there are quite a number of factors which are potentially drivers of either willingness to pay for an extra fee to access Welchman Hall Gully (WTP) or to contribute to a fund for the preservation/ improvement of the Site (WTPF). Table 4 in appendix contains the list of variables.

These variables are used in the following formal model. Let WTP* be a latent variable (incompletely observed) which might well be the usefulness or utility attached to Welchman Hall Gully. Suppose that WTP* is only observed if WTP* is greater than zero. In this case, we have a censored model from below or left censoring model which can be written as follows:

$$\begin{aligned} WTP_i^* &= \delta' X_i + e_i \\ WTP_i &= WTP_i^* \quad if \quad WTP_i^* > 0 \\ WTP_i &= 0 \quad\quad if \quad WTP_i^* \le 0 \end{aligned} \tag{1}$$

where *WTP* is either the willingness-to-pay an additional entrance fee to Welchman Hall Gully, *WTP*, or a contribution to a fund destined for the preservation of the amenity ,*WTPF*, X is a matrix of variables defined as in Table 4 including the constant, $i = 1,2,\cdots,n$, is the respondent or household index, and e_i is a well-behaved error term.

Model (1) with errors following a normal distribution is a Tobit model estimated by maximum likelihood method to avoid estimate bias due to zero bids (see, for example, Maddala, 1986; McDonald and Moffitt, 1980).

To explain the derivation of the average WTP from the bid curves, we rewrite Eq. (1) in terms of expected values (see Maddala, 1986, 159):

$$E(WTP_i) = P(WTP_i > 0)\, E(WTP_i \mid WTP_i > 0) + P(WTP_i = 0)\, E(WTP_i \mid WTP_i = 0)$$
$$= \Phi_i \delta' X_i + \sigma \phi_i \qquad (2)$$

where P stands for probability, $E\ (...)$ is expected value, X represents the matrix of independent variables including the constant, δ' is the transpose of the vector of Tobit parameters or estimates, σ is the standard deviation, ϕ_i and Φ_i are the density function and the distribution function of the standard normal distribution evaluated at $\delta' X_i / \sigma$, respectively and $\delta' \Phi$ represents the marginal effects. This equation evaluated at the means of the significant independent variables provides the average WTP.

The interest is on marginal effects (see Cameron and Trivedi, 2005, 529-553). One of the useful marginal effects is of the following type:

$$\frac{\partial E(WTP_i)}{\partial x_{ik}} = \delta_k \Phi(\delta' X_i / \sigma) \qquad (3)$$

where $x_{ik} \subset X_i$ represents the variable of interest for the marginal effect and δ_k its associate parameter to $x_{ik} \subset X_i$.

Expression (3) means the marginal effect with respect to a given variable is equal to the coefficient of that variable multiplied by the probability (proportion) of nonzero censored observations. Note that the marginal effect in expression (3) is for continuous variable. It might, however, be a good approximation for dummy variable marginal effect (see Greene, 2002, E21-9).

A cross section regression always raises the prospect of heteroscedasticity. That means, the possibility of heteroscedastic errors is more than real here. In the context of Tobit MLE regression, heteroscedasticity brings about bias, inefficiency and

inconsistency (see Cameron and Trivedi, 2005, 529-553; Halvorsen and Sœlensminde, 1998). It means that special attention must be paid to the issue of heteroscedasticity.

Let us assume that Model (1) is affected by a multiplicative heteroscedasticity

$$\sigma_i = \sigma\, e^{\gamma' V_i} \tag{4}$$

where the varying variance σ_i depends on the common variance σ (ancillary parameter) and variables in V. Here we suspect that if heteroscedasticity there is, it is mainly due to income behavior. Thus, V consists only of income (INC).

Heteroscedasticity can be tested in model (1) using (4) with an LM test, an LR test or a Wald test. In large samples, they are all equivalent and follow a chi-square distribution.

The derivation of marginal effects in the context of a Tobit model with heteroscedasticity correction is quite challenging, particularly for dummy variable. Greene (2002) contains some of the useful derivations. Let us assume that income the culprit variable enters both Model (1) and Model (4). Then the marginal effect for income for example is given by:

$$\frac{\partial E(WTP \mid X_i, Z_i)}{\partial\, INC_i} = [\Phi_{Ui} - \Phi_{Li}]\delta_{inc} + [\phi_{Li} - \phi_{Ui}]\sigma_i\, \gamma_{inc} \tag{5}$$

where U stands for upper tail censoring (infinity here) and L represents lower tail censoring (here zero) and the rest are defined as above. For a dummy variable, see Greene (2002, E21-45).

5.2. Results

At the outset, we point out calculations were done in Limdep 8.0 and Eviews 9.0 In the first instance, we report the results of willingness to pay for an extra entrance fee.

Table 5: Tobit Estimates for Willingness to pay for extra fee model

Variables	WTP Model		Hetero WTP Model	
	Tobit Estimates	Marginal Effects	Tobit Estimates	Marginal Effects
Constant	-2.624 (-1.109)	-2.344 (-1.112)	-2.798 (-1.086)	-2.502 (-1.084)
Income	0.000018* (1.981)	0.000016* (1.981)	0.000017* (1.989)	0.000016* (1.978)
ENV	0.545* (1.871)	0.487* (1.871)	0.519* (1.631)	0.465* (1.632)
GEND	1.362* (2.458)	1.217* (2.458)	1.422* (2.408)	1.271* (2.394)
SCH	1.183* (1.932)	1.057* (1.932)	1.256* (1.915)	1.123* (1.903)
AGE	-0.026 (-1.386)	-0.023 (-1.386)	-0.022 (-1.278)	-0.020 (-1.280)
WN	-0.333 (-0.401)	-0.298 (-0.401)	-0.422 (-0.466)	-0.378 (-0.466)
HH	0.006 (0.032)	0.006 (0.032)	-0.015 (-0.070)	-0.013 (-0.070)
CERT	1.021* (3.052)	0.912* (3.065)	1.070* (3.603)	0.957* (3.544)
STAT	0.981 (1.436)	0.876 (1.436)	1.066 (1.603)	0.953 (1.595)
Hetero income (1)			0.000002* (1.588)	0.000002* (1.562)
Hetero income (2)				0.000017* (2.250)
Sample Size	227	227	227	227
Left censored obs	25		25	
Mean WTP (BDS$)	5.16	5.11	5.16	5.11

Note: Columns (2) and (3) are results from Model (1): estimates and marginal effects; Columns (4) and (5) are results of Model (1) with heteroscedasticity correction. Row Hetero income (1) tests for heteroscedasticity with income (see Model (4)): Hetero income (2): Marginal effect of income as in Model (5). Variables are defined as in Table (4) in Appendix. (…) means Z-statistics.

Table 5 contains the results of Tobit maximum likelihood estimation of model (1) for willingness to pay an extra entrance fee, WTP, under two scenarios: without heteroscedasticity correction and with heteroscedasticity correction. Columns 2 and 4 are estimates results from the model itself and columns 3 and 5 are marginal effects of interest here. For model with heteroscedasticity correction, we hypothesize that heteroscedasticity is due to income.

We start by answering the question of whether heteroscedasticity due to income holds. The row hetero income (1) which exploits Model (4) indicates the associate parameter estimate of income is statistically significant using a one sided Z test. Indeed the p-value is 0.1182/2=0.059, confirms the presence of heteroscedasticity at least at the 10% level of significance.

It is worth noting Model (1) model passes the LM test or LR test with a value of 59.666 (df=10) and 29.64 (df=9), respectively. With the exception of Household variable, overall, the results from models without heteroscedasticity and with heteroscedasticity correction are comparable. Since heteroscedasticity is confirmed, we concentrate on marginal effects of the heteroscedasticity corrected model. Income, environment, gender, schooling, certainty of payment positively affect willingness to pay an extra fee. Indeed, a BDS$1000 increase in income brings about BDS$0.017 increase in payment fee (result read off from Hetero income (2)) derived from Model 5). A one unit increase in love for the environment on average boosts extra fee by BDS$0.47. The mean WTP an extra entrance fee is BDS$1.27 higher for male than for female. Boosting school degree attainment brings about BDS$1.12 increase in extra fee payment. There is almost a one to one correspondence between certainty of payment and intention of payment. It is

important to note that the results of the variable STAT (1 for residents and 0 for tourists) indicate that there is no statistical difference between residents and tourists.

Table 6 contains the results of Tobit maximum likelihood estimation of model for willingness to pay or contribute to a fund for the preservation of Welchman Hall Gully. As for Table 5, columns 2 and 4 are raw results from the model itself and

Table 6: Tobit Estimates for WTP for a fund

Variables	WTPF Model		Hetero WTPF Model	
	Tobit Estimates	Marginal Effects	Tobit Estimates	Marginal Effects
Constant	-78.858* (-4.806)	-26.207* (-5.253)	-77.735* (-3.738)	-24.814* (-3.862)
Income	0.0002* (1.952)	0.00006* (1.922)	0.0002* (1.435)	0.00006* (1.331)
ENV	-1.131 (-0.387)	-0.376 (-0.388)	-1.312 (-0.311)	-0.419 (-0.316)
GEND	12.185* (2.104)	4.050* (2.097)	12.867* (2.103)	4.107* (2.134)
Age	-0.346* (-1.768)	-0.115* (-1.766)	-0.446* (1.997)	-0.142* (-2.073)
NGO	23.551* (2.625)	7.827* (2.543)	19.608* (1.926)	6.259* (2.000)
CONT	80.514* (10.238)	26.757* (10.237)	80.115* (11.155)	25.574* (5.980)
INT	23.252* (2.489)	7.727* (3.115)	24.631 (1.349)	7.863 (1.478)
STAT	8.336 (1.366)	2.770 (1.360)	12.140 (1.454)	3.875 (1.521)
Hetero income (1)			0.000005* (2.577)	0.00006* (2.577)
Hetero income (2)				0.00011* (2.681)
Left censored observations	115	115	115	115
LM test	66.476[9]		177.127[9]	
Mean WTPF	14.845	6.725		6.322

Note: see note to Table (5).LM test to test for overall impact of independent variables.

[…]:degrees of freedom.

columns 3 and 5 report marginal effects. Similarly to Table 5, columns 2 and 3 deal with model without heteroscedasticity correction and columns 4 and 5 concern model with heteroscedasticity correction.

As above income is suspected to bring about heteroscedasticity. Hetero income (1) row indicates heteroscedasticity is indeed an issue with an associated Z-value of 2.577. Heteroscedasticity is corrected in columns 4 and 5. The heteroscedasticity and non heteroscedasticity results are by an large comparable. Here we focus on marginal effects of the heteroscedasticity corrected model. Income, gender, and membership in an NGO are positively linked to willingness to contribute to a fund for the preservation of the amenity. Indeed, a BDS$1000 increase in income brings about an increase of BDS$0.11 in contribution to the fund. The mean WTP to contribute to the fund is BDS$4.11 higher for male than for female. The mean WTPF for members of NGO is BDS$6.26 higher compared to non-members. Age seems to have a negative impact. The interviewer and the residency status does not affect the results of WTPF.

6. Derivation of the Total Economic Value of Welchman Hall Gully

6.1 Which "mean" to use in the calculation?

Several approaches can enable us to derive the mean useful to calculating the total economic value. Here we examine two: the bid mean and the bid curve mean. The bid mean is the simple average of individual willingness to pay (bids). It is indeed derived directly from the survey data. The bid curve mean is the mean obtained from the model per se; that is, the mean derived from WTP equation (i.e., Eq. (2)) evaluated at the means of significant independent variable. It can be conditional or unconditional. For recall, those means have already be derived in the previous sections. For WTP an extra entrance

fee, the bid mean is BDS$5.16. This bid mean does not really change in the Tobit model. Indeed, it is BDS5.16 for raw models and BDS$5.11 for marginal effects models. For willingness to pay for fund, the bid mean is BDS$14.85. For the mean from the model, there is a big discrepancy between unconditional mean and conditional mean. Indeed, while the regular unconditional mean is BDS$14.85, the conditional mean for marginal effects model is BDS$6.322 and BDS$6.725, for model (1) without and with heteroscedasticity correction, respectively. The discrepancy lies in the fact there are many observations which fall under censorship. We retain BDS$14.85.

6.2. From Sample to Population

In this type of exercise the annual number of visitors can serve as proxy to the population size, at least concerning use value. That said, looking at the visitors trend to WHG we can forecast 10,000 visitors as the annual stable population for WHG. This means the raw use value would be BDS$5.16 x 10,000=BDS$51,600.00. However, according to the survey only 89% were willing to pay for an extra fee. Accounting for this fact, the revised use value yields BDS$51,600.00 x 0.89=BDS$45,924.00.

Finding population to derive non-use value is challenging. Here, we are conservative and choose 10,000 persons as population size[9]. It is worth recalling only 49% were willing to contribute to a fund. Using the average annual contribution of BDS$14.85, the non-use value would be BDS$14.85 x 10,000 x 0.49= BDS$72,765.00. This is certainly an underestimation of true non-use value. Not taking into account non-use value turns out to be a serious omission. That said, the provisional total economic value would be BDS$45,924.00+ BDS$72,765.00= BDS$118,689.00

[9] It might be the case that the whole Barbados (total number of households) is the population size.

It is worth recalling that the values derived above are hypothetical values. Since at present there are actual fees charged to visitors, we have to derive the tangible use value. Taking into account that children represent approximately 24% to 30% of visitors to WHG, the use value of children is BDS$6.00 x 10,000 x 0.30 = BDS$18,000. In addition, for tourists, the value is BDS$24 x 7,000 x 0.80= BDS$134,400.00. Likewise, for locals it is BDS$13 x 7,000 x 0.20=BDS$18,200.00. Adding these different components yields a total economic value (in fact use value) of BDS$170,600.00.

In final analysis, the overall total economic value reaches BDS$289,289.00 as the sum of BDS$170,600.00 and BDS$118,689.00.00. Tentatively, the new entrance fee would be for tourists 24+5.16 = BDS$29.50 for adults and 12+5.16 =BDS$17.50 for children; for locals, 13+5.16=BDS$18.50 for adults, 6+5.16=BDS$11.50 for children and BDS$11.50 for school children in uniform.

Note that the additional entrance fee, that is, BDS$5.16 compares favourably to that found for Harrison's Cave, BDS$5.40 (see, Lewis and Mamingi, 2003). The passive average value, BDS$14.85, is almost the double of Harrison's Cave, BDS$7.53 (see Lewis and Mamingi, 2003).

7. Discussions and Policy Implications

It is well known that the quality of results obtained from a CVM study largely depends on a certain number of conditions. In the first instance, a CVM exercise has to circumvent or attenuate a number of biases (hypothetical bias, starting point bias, vehicle payment bias and strategic bias). Given the quality of the survey, it is believed that most of these biases are minimized. In terms of approaches to elicit values for the amenity, although it is advised to use a dichotomous choice scenario (Hanemann, 1994) it is found

here that the method of payment card is not that bad as one may think. Indeed, at the very least it does not suffer from the "yea-saying" (Blamey et *al.* 1999) of dichotomous choice. The question of which population (size) to use will remain a serious issue, particularly as far as non-use value is concerned. We believe that using the number of households in Barbados will largely overestimate non-use value of the amenity. We acknowledge that the short time period of sampling process, May-June 2015, may be an impediment to an accurate characterization of visitors to WHG behavior.

That said, as seen above the research hypothesis that the amenity has extra use and non-use values is confirmed. In final analysis, the overall total economic value reaches BDS$289,289.00.

Although the cost of running the amenity is not fully known to the outsider, if we allow ourselves to double at the very least the running cost pointed out to one of the co-authors, BDS$100,000, in the early 2000s, then to break even the present manager needs to make happen the extra values advocated in this study. In this connection, three remarks are in order. First, it is important that the manager convince herself that the amenity can still be improved to justify higher entrance fees. It can be noted the new entrance fees will still be bellow the current fees for Harrison's Cave, a competitor. Second, the manager has to realize that ignoring passive value is depriving the amenity from an important source of value. This is particularly true as the passive value is more important than the use value. Third, creativity and sustained publicity must be part of the equation to help realize the objective of benefits outweighing cost.

8. Conclusion

The objective of this study is to derive the total economic value of Barbados Welchman Hall Gully, which can be broken down in use and non-use values. Using CVM with payment card as instrument to elicit values, the study enables us to derive indeed use and non-use values. In terms of use value, the mean WTP an additional entrance fee was estimated at BDS$5.16. This means the new entrance fee would be for tourists, BDS$29.50 for adults and BDS$17.50 for children; for locals, BDS$18.50 for adults, and BDS$11.50 for children. With respect to the non-use value, the study indicated that few persons were willing to contribute to the fund. The mean WTP for the "fund" was evaluated at BDS$14.85. Put differently, this is a potential source of revenue that has yet to be taken into account by Welchman Hall Gully management.

Overall, tentatively the total undiscounted economic value of Welchman Hall Gully is estimated at BDS$289,289.00. This represents at the very least a 41.03% increase with respect to the proceeds based on present fees alone. Using Tobit modelling, we are able to link willingness to pay to a number of significant predictors: income, love for the environment, gender, education level as well as membership in an NGO.

With an hypothetical yearly cost of BDS$200,000.00 it is easy to understand that benefits will outweigh cost only if the new values just alluded to are realized. The lesson is that mechanisms have to be put in place to see realized those values.

To check the robustness of our results, as in Lewis and Mamingi (2003) in further research it will be important to: "(1) increase the sample size; (2) use the dichotomous choice; and (3) revisit the population size."

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Table 4: Variables for Welchman Hall Gully

Abbrv.	Description	Numerical Representation	Statistical Representation
INT	INT – INT denotes Interviewer.	1 - Alesia Skeete 0 -Chadeene Roett.	Dummy Variable
STAT	STAT- Status denotes where an individual is either a Resident or Tourist.	1 – Resident 0 – Tourist	Dummy Variable
LOC	LOC denotes the location where the respondent answered the questionnaires.	Welchman Hall Gully – 1 All others – 0	Dummy Variable
ENV	ENV- Environmental importance; this denotes the level of importance given by the respondent for the preservation of the environment of Barbados.	Very high – 4 High – 3 Just – 2 Insignificant – 1	Ordinal
WN	WN- Welchman Knowledge represents if the respondent knew of Welchman Hall Gully or heard about it.	Heard of Welchman – 1 Not heard of Welchman – 0	Dummy Variable
VISIT	VISIT- Visit represents if the respondent has visited Welchman Hall Gully or not.	(Yes)Visited Welchman – 1 (No)Not visited Welchman – 0	Dummy Variable
nVISIT1	nVISIT1 represents the number of times that the respondent has visited Welchman Hall Gully.	1 - once, 2 - 2 to 5 times 3 - 6 to 10 times 4 - more than 10 times	Ordinal
nVISIT2	nVISIT2 represents the number of times the respondent has visited Welchman Hall Gully, to capture this the midpoints were taken.	1 - Once, 3 as midpoint of 2 to 5 times, 8 as midpoint of 6 to 10 times and for more than 10 times, 12 was the representation.	Ordinal (Midpoints)

WTP	WTP means Willingness to pay. This represents the additional maximum willingness to pay of respondents in accessing the site.	Maximum amount of money respondents are willing to contribute to access Welchman Hall Gully.	Ordinal
Rpay	Rpay - This represents the respondent's reason for paying an additional entrance fee.	1 (Good to contribute to the preservation of Welchman Hall gully.) 2 (Great interest in the preservation of the environment.) 3 (The Facility deserves to be supported financially) 4 (The security aspect needs to be improved) 5 (Other)	Categorical
Mpay	The respondents preferred method of payment.	1(payment on the site) 2 (Annual Subscription) 3 (Environmental Tax) 4 (Other (specify)	Categorical
CERT	CERT – The respondent's certainty of paying an additional entrance fee	1(Very Certain) 2(Certain) 3(Uncertain) 4 (Null)	Ordinal
FVISIT	FVISIT – Represents the respondent's planned visits per year.	0 (0 times) 1 (1 times) 2(times) 3 (3 times) 4 (4 times) 5 (5times) 10 (10 times) 11 Other (specify) and – 1 represents not sure	Ordinal
NGO	NGO – Represents whether the respondent is a member of a NGO or not.	1 -Yes 0 – No	Dummy variable
CONT	CONT – This represents the respondent's willingness to contribute to a NGO to help improve the activities of Welchman Hall Gully.	1 -Yes 0 – No	Dummy variable
WTPF	WTPF – This represents the respondent's willingness to pay for fund or their willingness to contribute per year.	Maximum amount of money respondents are willing to contribute per year.	Ordinal or ratio

CEPF	CEPF - This represents the respondent's certainty to pay his/her declared amount.	1(Very Certain) 2(Certain) 3 (Uncertain) 4 (Null)	Ordinal
GEND	GEND - This represents whether an individual is male or female.	1 - (Male) 0 - (Female)	Dummy variable
AGE	AGE – This represents the age of the individual. Midpoints were taken to represent the respondents' age category.	1 13 years or younger - 13 2 (13 – 20) years – 15 3 (21 – 30) years – 25 4 (31 – 39) years – 35 5 (40 – 49) years – 45 6 (50 – 60) years – 55 7 Over (60) years – 65	Interval (Midpoints were taken to represent the respondents' age category).
SCH	SCH – This represents the respondents' highest level of education.	0 – represents none 1 – Primary/ Elementary 2 – High School/ Secondary 3 – College/ University	Ordinal
HH	HH -This represents the number of members in the household.	1 (1) 2 (2) 3(3) 4(4) 5(5) 6(6) 7(7) 8(8) 9(9) 10(10)	Ordinal
INC	INC – This represents the respondent's total household income in BDS$. The midpoints were taken from the income intervals	1 Under 10,000 – 5,000 2 (10,000 – 19,000) – 15,000 3 (20,000 – 29,000) – 25,000 4 (30,000 – 39,000) – 35,000 5 (40,000 – 49,000) – 45,000 6(50,000 – 59,000) – 55,000 7(60,000 – 69,000) – 65,000 8(70,000 – 79,000) – 75,000 9(80,000 – 89,000) – 85,000 10(90,000 – 99,000) – 95,000 11(100,000 and over) – 105,000	Interval (Midpoints were taken to represent the income data.)