# A dichotomous-choice contingent valuation of the *Parc Zoologique de Hann* in Dakar

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**Abstract**

*The challenge of reconciling social, economic and ecological objectives in the pricing of park entry fees in developing countries often translates into the undervaluation of the recreational services and various adverse effects. This paper asks whether a more market-oriented pricing mechanism that reflects visitors' preferences and willingness to pay would better contribute to a more sustainable provision of park amenities than an administered price in the face of government budget constraints. With information collected from 477 visitors, the results – based on a double-bounded contingent valuation – show a mean willingness to pay of more than three times the actual entry fees. An increase in the latter so as to match visitors' willingness to pay, as well as various policies that effectively exploit the heterogeneity in individual valuations, could lead to an even greater increase in the generated revenues and definitely help meet the challenge of adequately pricing the park amenities.*

**Key words**: park amenities; willingness to pay; contingent valuation; double bound

## 1. Introduction

The environment undoubtedly provides much economic value to humans. These values are often categorised as direct, indirect, optional, existence and heritage values (Torras 2000). In the case of parks or zoos, the direct use of these areas for recreation and leisure by visitors is considered as direct value, which can be revealed by a properly designed market-oriented entrance fee. But as is often the case with extra-market environmental goods, an administered price is favoured, with no clear reference, if any, to visitors' willingness to pay (WTP) and preferences. In many instances, this approach can prove ineffective, as it more often than not fails to design a price mechanism that would generate sufficient resources to cover the many costs associated with the management of the park, while at the same time provide affordable services that meet visitors' expectations and more broadly guarantee the sustainability of the provision of park amenities (Point & Desaigues 1993).

In the case of the *Parc Zoologique de Hann* in Dakar, Senegal, the entry fees are set up with the sole objective of providing greater access by the general population. Unfortunately, this social objective clearly conflicts with the economic objective of at least balancing the revenue and the operating costs. In effect, the revenue generated through ticket sales is far lower than the actual cost of administering the park: it represents one fifth of the operating costs (Direction de la Protection des Forêts et Zones Humides 2012). The government mostly makes up the difference. But budget constraints that are typical to this least-developing country are synonymous with adverse repercussions on the provision of recreational services in the form of a significant reduction in the animal population (both in numbers and species), the deteriorating health status and well-being of animals, and the multiple complaints from visitors (quality of services) and from the park personnel (remuneration), etc. In addition, the operating framework is such that the management team lacks both the autonomy and perhaps the motivation to define and implement strategies aimed at reverting these negative trends,

in terms of, for instance, active advertising campaigns that would make the park more visible to the general population, thereby increasing the number of visitors and generating significant revenue.

It can reasonably be assumed that the way the price mechanism is defined is the predominant underlying cause of such an unsustainable supply of recreational services. In fact, although the paramount concern was to ensure affordability and greater access, no direct reference was made to the actual willingness to pay of visitors and their preferences. With the assumption of an administered price that very likely undervalues the supplied services, there may be both foregone revenues and a mismatch between the supply and visitors' preferences and expectations. This paper argues that a pricing mechanism that accounts for visitors' preferences has the potential to guarantee sustainability along these three economic, social and environmental dimensions through increased revenue that would contribute to relaxing the financial constraints on the government budget, improving the well-being of the animals, and not reducing access to the park. It is expected that a good knowledge of visitors' preferences and expectations, as well as how these translate into a willingness to pay, would help counter the challenges faced by this developing country in finding ways to realise the economic potential of the park and secure the preservation of its wildlife (Navrud & Mungatana 1994).

This paper uses the contingent valuation (CV) method to elicit the recreational value of the park through visitors' willingness to pay and its main determinants in a context where such an exercise has never been applied before. The method consists of directly querying individuals' willingness to pay for an improvement in the quality of the recreational services offered. One of the most widely used elicitation methods is the dichotomous choice, close-ended format: individuals are asked whether they are willing to pay a given amount, to which they answer "yes" or "no" (Bishop & Heberlein 1979). A refinement of this single-bounded version consists of introducing a follow-up question, by which respondents are presented with a second bid that is higher if they answered "yes" to the first bid question, and lower otherwise (Hanemann *et al*. 1991). This variant, known as the double-bounded format, can increase the efficiency of the willingness-to-pay estimates, for instance by correcting the poor choice of the initial price offers. As a result, it tends to be very popular (Carson 2011).

A total of 477 visitors were surveyed. The hypothetical scenario was based on a combination of attributes whose improvement would meet visitors' expectations, the most important being an increased diversity of animals. Once the scenario was carefully described to them, the interviewer asked about their willingness to pay and various individual characteristics.

The remainder of the paper is organised as follows. The next section describes the study context. Section 3 introduces the methodological approach. The data and sample methods are detailed in section 4. Section 5 analyses the willingness-to-pay estimates and the explanatory factors. Finally, section 6 offers a summary and some concluding remarks.

## 2. The study context: The *Parc Zoologique de Hann*

The park, which is more of a conventional zoo, is one the oldest in Senegal, but certainly not the most famous. It celebrated its centenary in 2003. It is the only park located in the capital, Dakar, and is about half an hour's drive from the city centre. At the very beginning of its existence, during the colonial regime, this area of 73 hectares was a public garden, mostly used for the cultivation of fruit and vegetables. It was only in 1935 that an aquarium was developed and the zoo started to operate, next to a forestry park, hence the name of *Parc Forestier et Zoologique de Hann* (Forestry and Zoological Park of Hann).

The park is publicly owned and is run by a management team on behalf of the Ministry of Environment and Sustainable Development. The current pricing scheme offers three levels of entry fees based on visitors' age: FCFA350 (US$0.63) for visitors older than 10 years old, FCFA200 for visitors aged between seven and 10 years, and FCFA75 for visitors younger than seven years of age. Every day, from 10:00 to 12:30, and then again from 15:00 to 18:30, visitors can enjoy the sight of a large variety of species that are held in cages. The species range from lions and tigers to panthers, hyenas, monkeys, snakes, camels, antelopes, turtles and more.

However, one of the things that would strike a returning 1990's visitor is the disappearance of many species. For instance, one of the main attractions of the park used to be a huge gorilla (named *Paco*). It was not replaced when it died about a decade ago. So too were many other species, such as warthogs and cougars. This trend has significantly changed the distribution of species in the park, as well as the quality of the recreational services. Next to many empty cages that used to be occupied, some species seem to be over-represented. This is the case with the lions, of which the population is close to 10, and monkeys, with a population of close to 20. In addition, some other species are represented by only one member, such as hyenas, tigers and buffaloes.

In the past there have been partnerships between the park and other domestic and foreign national parks. For instance, an exchange programme with Bandia Reserve in Senegal provided the park with some species, like impalas. A partnership with a zoo in Rabat, Morocco provided both animals and a reinforcement of management capacity. But a lack of either significant willingness to improve the provision of the recreational services, on the one hand, or insufficient financial and human resources on the other, has significantly impeded the development of such initiatives on a larger scale, which most definitely would have greatly benefitted both sides in the partnership. The cooperation with Rabat Zoo, for instance, was discontinued in 1999, mainly because the Senegalese did not fully reciprocate.

If one were to understand these clearly unsustainable trends, one of the chief directions to look at is the financial situation of the park. The proceeds from the ticket sales to some 50 000 visitors per year (on average 130 per day), which amounted to about FCFA12 million in 2008, is far from covering the operating costs of the park. The latter in fact are about five times the revenue collected from the entry fees (Direction de la Protection des Forêts et Zones Humides 2012). Public resources from both the central government (forestry funds) and the local government (communal budget for investment) barely make up the difference.

It is obvious that significant changes are needed for the provision of recreational services to be spared from discontinuity in the near future. One option to explore is whether the price set by the public authority has to be adjusted in order to reflect actual willingness and capacity to pay by visitors. Another, equally important, change to be considered is the current institutional setting under which the park operates. Any major policy regarding, for instance, price setting or partnerships with other sites, is the sole responsibility of the central government, the managing directorate having only to deal with its implementation. Such a framework provides few incentives for better outcomes in terms of, for instance, the generation of more revenue or greater visitor satisfaction. Some form of autonomy is needed to bring about the necessary correction by allowing the management authority to constantly seek feedback from visitors with whom they directly interact on a daily basis, and consequently to design and implement policies that would better meet their expectations. A formal study of visitors' preferences undoubtedly could offer valuable guidance.

## 3. Empirical methodology

Contingent valuation (CV) is a method devised to elicit information about respondents' preferences or willingness to pay (or to accept) using direct questioning. It was introduced by Davis (1963) in a study of hunters in Maine. Its popularity took off in the 1970s and, since then, it has been the most widely used approach to valuing environmental resources. By 2011 there had been more than 7 500 CV studies and papers from more than 130 countries, with a wide range of environmental applications as well as various declinations or formats (Carson 2011). Bishop and Heberlein (1979) introduced the closed-ended format of CV, known as single-bounded dichotomous choice, in which the respondents are offered a price and asked if they would be willing to pay that amount, the latter being varied across respondents. Hanemann *et al*. (1991) developed a variant that has come to be known as the double-bounded format, in which a follow-up question is introduced: it introduces a second price that is higher if the response to the first price is affirmative, and lower otherwise.

Therefore, let $WTP_j$, the willingness to pay by a given individual $j$, be explained by a set of characteristics $X_j$, and some unobservable factors captured by an error term $\mu_j$:

$$WTP_j(X_j) = X_j\delta + \mu_j \qquad (1)$$

where $\delta$ is a vector of the parameters to be estimated.

The underlying theory is the random utility model, developed by Hanemann (1984), which draws from the theoretical framework developed by McFadden (1974; 1978; 1994). In the face of a potential improvement in the quality of the park amenities, from, say, $q^0$ to $q^1$ (with $q^1 > q^0$), a respondent $j$ answers "yes" to the proposed bid ($P_{1j}$) if the derived indirect utility, net of the payment, is greater than that of the status quo; that is:

$$U_1(y_j - P_{1j}, z_j, q^1, \varepsilon_{1j}) > U_0(y_j, z_j, q^0, \varepsilon_{0j}) \qquad (2)$$

with $y_j$ the income level of individual $j$, $z_j$ a vector of individual characteristics and attributes (other than income), and $\varepsilon_{0,1,j}$ a stochastic component of preferences. $y_j$ and $z_j$ are the subsets of the vector $X_j$ in equation (1).

The random utility model specifies the utility function as additively separable in deterministic and stochastic preferences: $U_i(y_j, z_j, q^i, \varepsilon_{ij}) = V_i(y_j, z_j, q^i) + \varepsilon_{ij}$. The probability of a "yes" answer then is as follows:

$$\Pr(yes_j|y_j, z_j) = Pr[V_1(y_j - P_{1j}, z_j, q^1) + \varepsilon_{1j} > V_0(y_j, z_j, q^0) + \varepsilon_{0j}] \qquad (3)$$

Let $\varepsilon_j$ be the difference in the random components between the two states: $\varepsilon_j = \varepsilon_{1j} - \varepsilon_{0j}$, and $F_\varepsilon$ the density function. The probability statement of visitor $j$ becomes:

$$\Pr(yes_j|y_j, z_j) = 1 - F_\varepsilon[-V_1(y_j - P_{1j}, z_j, q^1) - V_0(y_j, z_j, q^0)] \qquad (4)$$

Assuming a linear form for the deterministic component of the utility function, so that $V_{ij}(y_j, z_j) = \alpha z_j + \beta y_j$, and with the change in deterministic utility expressed as $V_{1j} - V_{0j} = \alpha z_j - \beta P_{1j}$, the conditional probability of responding "yes" becomes:[1]

$$\Pr(yes_j | y_j, z_j) = \Pr(\varepsilon_j < \alpha z_j - \beta P_{1j}) \tag{5}$$

If $\varepsilon_j$ is assumed to be normally distributed, so that $\varepsilon_j \sim N(0, \sigma^2)$, and $\theta_j = \varepsilon_j / \sigma$, then it follows that

$$\Pr(yes_j | y_j, z_j) = \Pr\left(\theta_j < z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right) = \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right) \tag{6}$$

where $\Phi(.)$ is the standard cumulative normal. This is then a probit model.

The estimation procedure of the parameters (up to a scalar multiple) is based on a likelihood function. By denoting the sample size as $N$ and considering an indicator $I_j$ that takes the value 1 if visitor $j$ responds "yes" and 0 otherwise, the log-likelihood function is:

$$\ln(\alpha, \beta, \sigma | y, z, P) = \sum_{j=1}^{N} \left\{ I_j ln\left[\Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right)\right] + (1 - I_j) ln\left[1 - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right)\right] \right\} \tag{7}$$

Maximising this function provides an estimation of the parameters α and β that make up $\delta$ from equation (1). From the parameter estimates, we can derive an estimate of the WTP:

$$E(WTP | \tilde{X}) = \tilde{X} \hat{\delta}$$

where the $\tilde{X}$ vector comprises the values of interest for the explanatory variables. Setting those values to the means will give the mean WTP, and the median values provide the median WTP. A comparison between the mean and median will tell about the general distribution of the WTP.

Hanemann *et al.* (1991) show that, at almost no extra survey cost, the additional information can bring about a follow-up question that increases the efficiency of the dichotomous choice format. In effect, the answers to the initial and then second bid prices provide either clear bounds for the WTP, or further constraints on the part of the distribution of where the WTP may lie (Haab & McConnell 2002). Furthermore, it has also been shown that most of this statistical efficiency gain comes from the first follow-up question (Cooper & Hanemann, 1994), therefore there is no need to increase the complexity of the elicitation exercise with a third follow-up question.

One of the early difficulties associated with the implementation of this technique was the choice of the initial bid prices. It is clear, for instance, that offering respondents with a higher WTP bids that are too low generally will lead, more often than not, to an underestimation of the latter. This is nevertheless more likely to be the case with the single-bounded format than the double-bounded format. Hanemann *et al.* (1991) have again shown that the introduction of the second question corrects any upward or downward bias that comes about because of the often poor selection of the initial prices. In particular, the second question will shift the distribution of the stated preferences toward their true representation.

Therefore, let $P_{2j}$ denote the second offered bid. Combining the responses to both the first and the second bids leads to four possible scenarios: (i) "yes" to both offers, in which case $WTP_j > P_{2j} >$

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[1] The quality indicator $q$ is dropped for ease of presentation, and the index $i$ that remains in the formulations distinguishes the two levels of quality.

$P_{1j}$ (with a possible upper bound of either the disposable income or infinity); (ii) "yes" to the first bid and "no" to the second, and $P_{1j} < WTP_j < P_{2j}$; (iii) "no" to the first bid and "yes" to the second, and $P_{2j} < WTP_j < P_{1j}$; and (iv) "no" to both bids, and $WTP_j < P_{2j} < P_{1j}$ (with a lower bound of zero). Assuming a normal distribution and the linear form in equation (1), the corresponding probability is as follows:

$$\Pr(yes_j, yes_j) = \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right) \tag{8}$$

$$\Pr(yes_j, no_j) = \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right) - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right) \tag{9}$$

$$\Pr(no_j, yes_j) = \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right) - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right) \tag{10}$$

$$\Pr(no_j, no_j) = 1 - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right) \tag{11}$$

It then becomes the following log-likelihood function:

$$\ln(\alpha, \beta, \sigma | y, z, P_1, P_2) = \sum_{j=1}^{N} \left\{ d_j^{1,1} ln \left[ \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right)\right]\right.$$
$$+ d_j^{1,0} ln \left[ \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right) - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right)\right]$$
$$+ d_j^{0,1} ln \left[ \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right) - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{1j} \frac{\beta}{\sigma}\right)\right]$$
$$+ d_j^{0,0} ln \left[ 1 - \Phi\left(z_j \frac{\alpha}{\sigma} - P_{2j} \frac{\beta}{\sigma}\right)\right] \tag{12}$$

with $d_j$ representing a set of indicator variables of which the values pertain to the actual answers to the bids by individual $j$ (1 = "yes" and 0 = "no"). Estimates of the parameters will once again provide estimates of the WTP at desired values of interest for the explanatory variables.

The popularity of the CV method is an indication of its appropriateness when it comes to the valuation of an environmental good, especially when the latter is multi-attribute, as in the case of the package offered to visitors to the park. But the method tends to perform less well when it comes to valuing a single attribute. An additional limitation relates to the direct elicitation format, which tends to lead to an underestimation of the WTP (see Cooper *et al.* (2002), for a discussion of the various limitations of the CV, in particular the double-bound format and, more recently, Haab *et al.*'s (2013) perspective on Hausman's (2012) criticism of the "dubious" and "hopeless" CV method). Nevertheless, a careful implementation of the survey could help to improve the quality of the estimates.

## 4. Data and sample

Face-to-face interviews were conducted *in situ* over six weekends spanning from March to April 2014. Some 477 visitors were interviewed. The standard structure of the CV questionnaire first described the hypothetical scenario: a park that offers high-quality services through more animals (both quantity and species, especially exotic ones), and meets all visitors' expectations. The second part consisted of the elicitation questions. The third part was concerned with the socioeconomic characteristics of the visitors, such as age, gender, education, income, employment status, nationality, number of visits, as well as suggested improvements.

Three initial prices were offered, all greater than the actual entry fee, to be consistent with the prospect of improved amenities described in the hypothetical scenario. They were FCFA500, 1 000 and 1 500.

The second bid was then introduced, and the amount was based on the answer to the first price offer. Table 1 describes the distribution of responses to both bids.

**Table 1: Distribution of discrete responses to bid offers**

| | Responses to first bid | | | Responses to second bid | |
|---|---|---|---|---|---|
| First bid | Yes | No | Second bid | Yes | No |
| 500 | 22 | 139 | 350 | 9 | 12 |
| | | | 750 | 45 | 93 |
| 1000 | 55 | 105 | 750 | 40 | 15 |
| | | | 1 250 | 48 | 55 |
| 1500 | 62 | 92 | 1 250 | 52 | 10 |
| | | | 1 750 | 35 | 55 |
| Total | 139 | 336 | | 229 | 240 |

Note: Prices are in local currency (FCFA). As of April 2014, the exchange rate was about US$1 = FCFA550.

The respondents were almost evenly distributed into three groups, corresponding to the three initial prices. On average, some 70.7% were willing to pay the first prices offered. The proportion of "yes" answers decreased the higher the prices: 86.3% for FCFA500, 65.6% for FCFA1 000, and 59.7% for FCFA1 500. This is consistent with the basic consumer theory that negatively relates price and quantity demanded. These large acceptance rates could make the estimated average WTP close to the upper end of the bid range (FCFA1 500).

In addition, when the second bid was introduced, the proportion of those who answered "yes" decreased, from 70.7% to 51.1%. This is also consistent with the general CV literature, which tends to suggest a decrease in the WTP when the follow-up question is introduced (for the empirical evidence and some proposed explanations, see Carson *et al*. 1992; Alaf & DeShazo 1994; DeShazo 2000; Cooper *et al*. 2002). Again, because of the still high acceptance rates (more than half of the respondents), it is expected that the estimated mean WTP will also be high.

Table 2 summarises the main characteristics of the visitors that were used in the regression analyses.

**Table 2: Summary statistics of some visitors' characteristics**

| Variables | Respondents | Mean/Proportion | Min – Max |
|---|---|---|---|
| Income (million FCFA) | 374 | 0.7 | 0 – 5.0 |
| Education (years completed) | 442 | 13.1 | 0 – 26 |
| Age (years) | 467 | 31.5 | 9 – 75 |
| Gender (1 = female) | 477 | 0.3 | 0 – 1 |
| Nationality (1 = foreign) | 477 | 0.2 | 0 – 1 |
| Number of visits per year | 450 | 9.9 | 0 – 36 |
| Travel time (minutes) | 455 | 28.1 | 0 – 360 |
| Number of accompanists | 462 | 6.7 | 0 – 14 |

Source: Author's calculations, from survey data

Additional information is provided in the Appendix (Table A1). The typical (average) visitor had a relatively high annual income: around FCFA0.7 million, which turned out to be the third quartile. With a median income of FCFA0.3 million, the highly skewed income distribution suggests a larger proportion of relatively low-income visitors than high-income visitors. This may be in line with the administered entry fee, which is supposed to guarantee affordability for the whole population.

In addition, visitors tended to be fairly well educated, with an average school attainment of more than 13 years, which corresponds to early college/university levels. The distribution of schooling seems less skewed, even symmetrical, with a median of 14 years. One implication would a better understanding of the described hypothetical scenario and the issues associated with the preservation

of the park and the services it renders. As a consequence, one may expect a higher value imputed to the park.

The mean age of 31 years is statistically identical to the median age. However, this seemingly symmetric distribution may not reflect the actual distribution of the visitors along this characteristic. In effect, most visitors came in groups (88%), which likely may comprise children. In addition, the latter were not interviewed (the minimum age of respondents being nine years). This could suggest an under-representation of this important portion of the visitors, which in many cases may be the reason why adults (e.g. parents) come to the park. But we make the assumption that their preferences correlate largely with their parents' preferences, given that adults may visit the park in response to their children's desire, which would make our sample fairly representative of all visitors' preferences.

Furthermore, most of the visitors were male. They represented more than two-thirds of the respondents. In addition, the average number of visits per person over a given year was more than 10, or once every five weeks, which signals some popularity of the park among the general population. A significant proportion of the visitors were foreigners, representing one fifth of the respondents. To the extent that these foreigners were tourists, there may be an incentive to align the quality of the services to that of foreign parks in order to attract more foreigners. As far as travel time was concerned, it took on average less than half an hour to reach the park. This is consistent with the location of the park in the heart of the city. Whether these various characteristics help shape how visitors value the recreational services is investigated empirically in the next section.

## 5. Estimates and determinants of willingness to pay

Table 3 shows the estimates of the mean and median WTP under various regression scenarios.

**Table 3: Estimates of willingness to pay**

| Model specification | Single-bounded CV | | Double-bounded CV | |
|---|---|---|---|---|
| | No control | With controls | No control | With controls |
| Mean WTP | 1 660.3*** (35.8) | 1 670.0*** (75.4) | 1 226.4*** (36.2) | 1 307.6*** (31.5) |
| Median WTP | | 1 528.6*** (93.9) | | 1 219.1*** (46.6) |

Notes: The single-bounded contingent valuation exploits the responses to the first bid amounts, whereas the double-bounded adds the follow-up responses to the second bids. The control variables are the characteristics summarised in Table 2. The values between parentheses are standard errors, and the 1% level of significance is indicated by ***.

The single-bounded model, which only exploits responses to the first bids, reveals a mean WTP of FCFA1 660.3 with no control added to the regression model, except the bid amount, and FCFA1 670.0 when controls are added. Both estimates fall outside the range of the first proposed bid amounts, of which the upper bound was FCFA1 500. This is in line with the relatively high "yes" responses to the first bid amounts (more than 70%). When the follow-up responses are factored in, the mean WTP from the double-bounded model decreases to FCFA1 307.6. This reflects some accuracy of the estimates, which need to fall within the range of the offered bid amounts, as single-bound estimates may likely have suffered from a relatively poor choice of bid prices. Furthermore, this decrease in the mean WTP when the second bids are introduced is also in line with a general finding in the literature, as discussed previously.

In each case, the median WTP is lower than the mean WTP, which is consistent with the literature. For instance, Chen and Jim (2012) estimated the median WTP as 16% smaller than the mean WTP in the case of three parks in Hong Kong. This is higher than our 7% to 9% gap, which turns out to be insignificant. So, statistically, the distribution of the WTP seems to be fairly even, with a relatively equal number of visitors on either side of the valuation spectrum.

These estimates of the mean WTP are also larger than the current entry fee of FCFA350 per adult. This is suggestive of a large undervaluation of the recreational services, which is generally the case when the price is set with little or no reference to the actual preferences of consumers. As hypothesised before, the discrepancy between the mean WTP and the actual price shows that it may be possible to reconcile the social motive of greater access to the park and the economic motive that would dictate a reference to consumers' preferences and willingness to pay.

The prospect of an increase in revenue is also important, as suggested by a combination of an increase in the entrance fee by a factor of at least three on the one hand, and the possibility to increase the number of visits on the other. As suggested by Table A2 in the Appendix, the visitors indicated that, on average, their visits would be more frequent, going from 9.9 to 31.0 (more than three times), provided that the park services were tailored to their needs. To the extent that the park capacity would be able to accommodate all the corresponding daily inflow, this would translate into an increase in revenue from entrance fees by a factor of more than nine, which could reasonably be hypothesised to match the operating cost as well the needed investments.

Table 4 shows the results of the model estimates, including controls.

**Table 4: Determinants of visitors' willingness to pay**

|  | Single-bounded | Double-bounded |
|---|---|---|
| First bids | -0.0009*** | --- |
|  | (0.00) | --- |
| Income | 0.0001* | 0.0001** |
|  | (0.00) | (0.00) |
| Education | 0.0222 | 5.0652 |
|  | (0.02) | (10.03) |
| Age | -0.0009 | -2.1663 |
|  | (0.01) | (3.94) |
| Female | 0.1178 | 6.3703 |
|  | (0.17) | (8.70) |
| Foreign | -0.3588* | -3.0436 |
|  | (0.21) | (5.61) |
| Travel time | 0.0042 | 1.9044* |
|  | (0.00) | (1.14) |
| Companions | -0.0071* | -4.7838** |
|  | (0.00) | (2.25) |
| Visits | 0.0078 | 4.4026* |
|  | (0.01) | (2.27) |
| Intercept | 1.1331*** | 1094.613*** |
|  | (0.41) | (177.18) |
| N | 340 | 340 |
| Log likelihood | -184.6 | -445.3 |
| LR/Wald | 41.0*** | 15.3*** |
| Pseudo-$R^2$ | 0.09 | 0.05 |

Notes: the dependent variable is the dichotomous responses to the first bid amount in the single-bounded model and responses to both the first and the follow-up bids in the double-bounded model. Values between parentheses are standard errors, and significance levels at 1, 5, and 10 percent are indicated by ***, **, and *.

Income is a significant determinant of willingness to pay, as visitors with higher income are more likely to accept bid offers. This result tends to be straightforward, as it follows from the standard demand theory that positively associates income and the quantity consumed. It also aligns with the empirical literature, such as the findings of Chacha *et al*. (2013) for Lake Nakuru National Park in Kenya, and Molaei *et al*. (2009) for Iranian parks. The result is either an indication of higher purchasing power or actually a greater valuation of the environmental services, or both.

In addition, nationality appears to matter significantly, but surprisingly in the sense that foreign visitors are less likely than their local counterparts than their local counterparts than their local counterparts to accept paying higher prices. This result is somewhat opposite to a general finding in the literature that suggests that (international) tourists value the services more than local visitors do. For instance, Chacha *et al*. (2013) have suggested such a result in the case of Lake Nakuru National Park in Kenya. Our result could be suggestive that foreigners are not always tourists in the traditional sense (people with higher purchasing power who may travel a long distance to enjoy, among others, the park amenities). The result could rather be suggestive of the greater attachment of local visitors to the park, which they may consider as collective property, in contrast to foreigners, who may be less accustomed to the park and its offerings. An additional explanation could be that foreigners, who may be more accustomed to foreign parks with much better recreational services, would consider those offered in the *Parc Zoologique de Hann* of a lower quality, hence the corresponding lower willingness to pay.

Furthermore, visitors who are willing to travel a long distance to spend time at the park are more willing to pay higher entry fees. This willingness to incur additional cost (travel cost) is certainly indicative of a higher valuation of the recreational aspect of the park, otherwise visiting the park would not be worth the travel. To the extent that an individual is willing to pay this extra cost, the revealed preferences are synonymous with a high valuation of the park amenities. This conclusion is further supported by an alternative valuation method, known as the travel cost method. With reference to three parks in Hong Kong, Chen and Jim (2012) have suggested that differences in individual valuation across the parks have to do with their accessibility. In the case of the implementation of an urban park project in Greece, Latinopoulos *et al*. (2016) indicated that people living within 20 minutes from the reference site were willing to contribute a significant amount of money.

In addition, visitors who come in groups tend to be less likely to respond positively to the bid offer. This could be an indication that they are already paying higher total amounts, especially in the case of parents visiting with children. They could also view the unit price reduction for group visits as a favour from the park managers and may refuse to give it up. An alternative view could argue that their refusal to pay higher prices is simply an indication of their lower valuation of the park amenities. This again could be the case for adults whose visits may be solely or in large part motivated by having to accompanying their children.

The frequency of visits is an additional determinant of willingness to pay, as more regular visitors are willing to pay a higher entry fee. Individuals who value the recreational services the most are more likely to "consume" more of them in the form of more frequent visits. In contrast, less frequent visitors, or individuals who do not visit at all, are more likely to attach lower values to the services, all else being equal.

The remaining regressors did not significantly influence the visitors' responses, although the sign of the relationships tends to be in line with what one would expect. Highly educated individuals, who tend to be more aware of the many benefits associated with parks besides the recreational services, are more likely than less educated individuals to value the services more highly. The same is true for younger people, who may cherish the recreational services more so than older people do, as well as female visitors in contrast to their male counterparts.

These statistically insignificant results with respect to the latter characteristics would not make any of these characteristics a target for effective public policies. The latter should rather aim at the significant determinants of individual willingness to pay.

## 6. Conclusion

This paper was concerned with determining a more market-oriented pricing mechanism that accounts for visitors' preferences and willingness to pay in the general context of the publicly managed and deteriorating *Parc Zoologique de Hann*. The dichotomous choice CV method, based on data from 477 visitors, revealed a mean willingness to pay that was more than three times higher than the actual entry fee.

A general implication of the results is that an entrance fee that would effectively reflects visitors' preferences and their willingness to pay has the potential to reconcile the social objective of greater access to the park, the economic or financial objective of increased income generation in the context of government budget constraints, and the environmental objective of more protection of the biodiversity in the park. In addition to considering an increase in the entry fees to match visitors' WTP, park managers could implement various policies that successfully exploit the heterogeneity across visitors' valuation schemes with respect to income, nationality or group visiting. They could also take full account of the suggestions made by visitors (see a summary in Table A2) in order to adequately tailor the supply of services to fit the demand.

All of these policies could occur within an institutional framework that grants greater autonomy to the managing authorities of the park. It is expected that this approach could be broadened to other parks in Senegal, where research could show the extent of the undervaluation of the recreational services and how policies should be designed in order to bring more sustainability to the provision of these services.

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**Appendix: Additional and detailed information from the survey data**

**Table A1: General summary statistics**

| Variables | Mean/percentage | Min – Max |
|---|---|---|
| Effective entrance fees (FCFA) | 320.6 | 0 – 350 |
| Age (years) | 31.5 | 9 – 75 |
| Education (years) | 13.1 | 0 – 26 |
| Income (FCFA) | 737 304.9 | 0 – 5 000 000 |
| Travel cost (FCFA) | 1 170.4 | 0 – 3 500 |
| Travel time (minutes) | 28.1 | 0 – 360 |
| Number of accompanists | 6.7 | 0 – 14 |
| Visit time (minutes) | 83.8 | 30 – 180 |
| Number of visits per year | 9.9 | 2 – 36 |
| Potential number of visits if improved | 31.0 | 5 – 365 |
| Gender (1=female) | 31.4 | 0 – 100 |
| Occupation (1=student/worker) | 91.2 | 0 – 100 |
| Nationality (1=foreign) | 18.6 | 0 – 100 |
| Transportation modes | | |
|    Motorcycle | 5.82 | 0 – 100 |
|    Own car | 27.8 | 0 – 100 |
|    On foot | 22.6 | 0 – 100 |
|    Taxi | 23.4 | 0 – 100 |
|    Public transportation | 20.3 | 0 – 100 |

Source: Author's calculations, from survey data.

**Table A2: Visitors' suggestions**

| Categories | Description | Percentage |
|---|---|---|
| Animal varieties | Additional species (giraffes, hippos, zebras, rabbits, elephants), less of some species (monkeys), no domestic animals (e.g. sheep). | 39.5 |
| Animal well-being | Larger and more comfortable cages, more food, animals in pairs, regular cleaning of cages and animals, improved health, more freedom. | 20.5 |
| Safety | Security guards inside the park, more control over young visitors. | 3.3 |
| General | Increased visiting time, guides, more information on animals, map of the park, more advertising, souvenir boutiques and restaurants, playground for children, no fees for children, more green spots, rationalised spatial distribution of animals, daily cleaning of the park, more garbage bins. | 36.8 |

Source: Author's calculations, from survey data.