

# Application of the contingent valuation method to agricultural landscapes in the Central West of Tunisia

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**Abstract**— Testing effects of protection of agricultural land is not always statistically significant in the results of the contingent valuation. As the economic analysis of the value of the agricultural landscape is rarely achieved in Tunisia, a developing country, this study attempts to analyze the effects of conservation of the agricultural landscape in centralwest of Tunisia. To achieve our objective, we applied the contingent valuation method based on an investigation of a representative sample of 320 citizens in the region of Sbiba placed in the Governorate of Kasserine known by its agricultural timbre. The results of this study show that the respondents agreed to pay an amount of high value (117 DT) on average per household per year. This amount varies according to individual characteristics and social concerns. The study illustrates the importance of the agricultural landscape and the interest that the population have allocated to protect agricultural area especially that farming is ranked first economic speculation in the Governorate of Kasserine.

**Index Terms**— Agricultural landscape, contingent valuation, central-West of Tunisia, socio-economic value, willingness to Pay.

## 1 INTRODUCTION

THE landscape is one of the key public goods produced by agriculture. Farmers, by being involved in the production of traditional commodities, confer benefits on society by maintaining and creating rural landscapes through a combination of activities covering land use decisions, crop composition, and farming practices (Ciaian and Paloma, 2011). In the few last decades, there have been many researches attempting to value agricultural landscape (Hanley and Ruffell, 1993; Campbell, Hutchinson and Scarpa 2005; Johns et al. 2008).

As the landscape is a non-traded good, its monetary value cannot be observed and thus is not available from traditional statistical sources. The literature, therefore, most often applies a stated preference (SP) approach by using survey-based methods to uncover consumers' willingness to pay (WTP) for landscape (Ciaian and Paloma, 2011).

Agricultural activity in the governorate of Kasserine; Centre-west Tunisia occupies 789,000 hectares or about 95% of the entire territory. This governorate imposes itself as the largest area of apple in Tunisia (6923 ha), and the most-productive region of the apples with 45% of the national production (Khedhri and al., 2012). Apple orchards are an

important potential and a great opportunity for the development of truly sustainable development for the region, consideration of the landscape dimension of this agricultural activity is of considerable importance in public decisions (Ilahi., 2014).

The main objective of the present study is to contribute to the economic evaluation of the landscaped externalities of the agrarian area in the central west of Tunisia, this space that is threatened by several natural and anthropological constraints.

The study research of contingent valuation realized in Sbiba in the governorate of Kasserine have shown the social importance of agricultural landscape. These results have encouraged us to develop research in a study to develop this culture and its extension in the region of Feriana and to preserve agricultural local identity through the application of the method of contingent valuation to evaluate the monetary value of this landscape.

The paper is organized as follows. First there is a presentation of the site of study. The next section documents the methodology of the survey. A final section is devoted to the result of the willingness-to-pay (WTP) for the conservation of the agricultural landscape.

## 2 MATERIALS AND METHODS

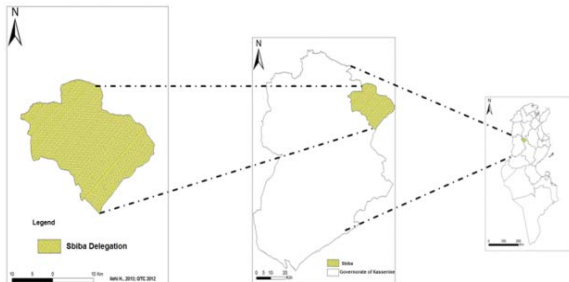
### 2.1 Study Site

Since the introduction of irrigated area in the 1960s, several agricultural crops marked the Tunisian-western area, particularly olive cultivation, which covered about 40% of usable land and in spite of rainfed crops, fruit growing appears in most of the delegations of Kasserine, with an

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uneven distribution has strongly influenced the agricultural landscape of the region. The governorate of Kasserine is ranked the first producer of apples nationally; Sbiba and Foussana are the first and second producers at the scale of the Governorate, follow up by Sbeitla that is classed the third.

This study is conducted in Sbiba, this region is located in the Governorate of Kasserine, west-central Tunisia, covers an area of 46,253 ha (5.6% of the total area of the Governorate).



**Fig. 1.** Localization of the site of study

The agricultural area of the delegation of Sbiba represents 97% of its total area. Noting that surface occupied by apple orchards represent 90% of the irrigated arboricultural area (Ilahi, 2014).

## 2.2 Contingent valuation method – Contingent survey

The contingent valuation method is the most appropriate methodological support to meet the primary objective of the study (Ilahi, 2014). Indeed, applications relating to the agricultural landscape have become widespread in the last decade in different countries which we cite the work of Halstead (1984) and Bergstrom et al. (1985) to the United States; Drake (1992) in Sweden; Redies (1992) Switzerland; Willis (1994) in the United Unie; Pruckner (1995) in Austria; Bonnieux et al. (1995); Colson and Stenger-LETHEUX (1996) and Noublanche (2000) in France.

The investigation of this study was in the form of individual interviews with citizens of the region to identify their points of view and their responses. The sample consisted of 320 respondents.

The data analyzed according to the survey questionnaires reveal two types of information: socio-economic information and information about the revelation of the WTP.

The socio-economic profile of those surveyed is established on the basis of criteria that have direct or indirect influence on the preferences and consumption patterns of the agricultural landscape. These included age, education, number of children per household, occupation and income.

The information on the respondent's profile can be used as an explanatory variable (table 1), as a mechanism for identifying the real nonuse value for the respondent and their real attitude towards the environment and space or to identify the authenticity of the willingness-to-pay values (Verbic and Erker, 2007).

We use the parametric model of choice of Hanemann (1984) which is consistent with utility theory. This discrete choice model is based on a random utility function and offers a measure of the WTP on the basis of the variation compensated the surplus. Essentially, referendum votes can be interpreted as a utility maximizing process (Le Goffe and Bonnieux, 1997).

The contingent evaluation is the method recommended by the NOAA Panel (1993). It is called dichotomous doubled if two values are proposed by the contingent ranking (Arow et al., 1993). In order to avoid the implausibly high estimates of the mean WTP, the integration is truncated at some finite value for A. Moreover, possible negative WTP values are not taken into account (Jakobsson and Dragun, 1996).

The contingent scenario is carried as follows: "In terms of pleasure and approval of which you get by visiting the agricultural landscape (photo) and / or during recreational activities, would you pay Mi Dinars as a contribution in the form of donation for farmers so they continue to maintain the land occupation by agricultural activities generating the agricultural landscape of the study area. The value Mi corresponds to a value or taken randomly from the elements of a vector six auction (25, 50, 75, 100, 125, 150, 175, 200 DT) and to which the respondent is required to answer yes or no. These values were determined from the preliminary survey.

The revelation of the values is conducted through a closed question with single dichotomous choice (yes / no) (NOAA, 1993), coupled with a second question proposing a value superior to the person questioned in case of a positive answer (in the first bid) and a lower value in case of a negative answer (Hanemann and al., 1991).

TABLE 1. VARIABLES FOR EXPLAINING THE WILLINGNESS TO PAY OF HOUSEHOLDS

Variables	Description
<b>socioeconomic Characteristics</b>	
Gender	Dichotomous variable: 1 if man and 0 if woman
Age	Age group to which belongs the questioned person
Matrimonial status	Dichotomous variable: 1 If the interviewee is married and 0 if single
Level of education	Dichotomous variable taking the value 1 if the person questioned at a level of study equal or upper to the High school diploma and 0 so lower
Income	Class of income to which belongs the questioned person: Class 1 : < 600 DT; Class 2: [600 – 1000 DT]; Class 3: > 1000DT
<b>Types of Contact with the agricultural landscape</b>	
Agricultural activities	Dichotomous variable taking the value 1 If the interviewee exercises an agricultural activity and 0 if not
Family or a secondary residence in the countryside	Dichotomous variable taking the value 1 If the interviewee had relatives or have a second home in the countryside and 0 if not
<b>forms of utilization of agricultural landscape</b>	
Leisure and relaxation	Level of frequenting: 1 = low, 2 = medium, and 3 = high
Appreciation of the quality of the landscape	Variable representing the scores obtained by the individual (0 - 6) on the questions of appreciation of the agricultural landscape put.

**2.2.1 Modeling and calculation of the average willingness to pay**

The respondent will choose one of the two alternatives offered (to carry out or not the development and the conservation of agricultural landscape).

The responses in the discrete formats (yes / no) allow having information only on the sensitivity of the utility of individuals with regard to the auction offered. But compared to the objective, the important step remains the measure, monetary magnitude of the change in use of individuals given their individual preferences and motivations.

Either the function of random utility U of the individual (i) given by:  $U_i(j, R, x) = u_i(j, R, x) + j$  where  $e_j$  is a discrete variable indicating if the person agrees pay a sum of money to preserve the agricultural landscape ( $j = 1$ ) or refuse ( $j = 0$ ), R is the income, x is a vector of individual socioeconomic characteristics and  $e_j$  is the random part. This is actually an indirect utility function, where prices are omitted since they are considered constant, which has two components: an observable component  $u_i(j, R, x)$  and another unobservable  $e_j$  ( $j = 0,1$ ).

The proposed auction (M) to preserve the agricultural landscape, the individual will accept (yes answer) to pay if its utility will be improved:

$$[u_i(1, R - M, x) + e_1] \geq [u_i(0, R, x) + e_0];$$

Otherwise he will refuse (if not). It follows that the individual's response is a random variable with probability distribution is written:

$$(if\ Yes): P_a = P_a [u_i(1, R - M, x) + e_1 \geq u_i(0, R, x) + e_0],$$

$$(if\ refused): P_r = F(M) = 1 - P_a \text{ (avec } F(M))$$

The probability that the individual (i) accept the offer can also be written in the form:

$$P_a = P_a [u_i(1, R - M, x) - u_i(0, R, x) \geq e_0 - e_1]$$

**2.2.2 Method of Calculating the Average WTP**

The average willingness to pay (WTPm) can be calculated on the basis of econometric estimation results of the logit model by the following expression:

$$E(WTP) = -\frac{1}{\alpha_1} \ln \frac{1 + e^c}{1 + e^{c - \alpha_1 M_{max}}}$$

With ' $\alpha_1$ ' is the estimated coefficient relating to the effect of the proposed auction, 'c' is the sum of the products of the estimated coefficients and the average levels of significant explanatory variables of the model and 'Mmax' is the maximum value of the proposed auction.

### 3 RESULTS AND DISCUSSION

#### 3.1 Analysis of the Socioeconomic Profile of Interviewees

The database includes 320 observations is to say 320 citizens who have answered all the questions asked during the interviews. The results show an average age of 41 years,

the age variable is included in a 21 and 76 year interval (table 2).

TABLE 2. DESCRIPTIVE STATISTICS OF MAIN VARIABLES

Variables	Arithmetic Mean	Standard deviation	Highest value	Lowest value
Age	41.2	15.4	21	76
Number of years of education	12.5	2.6	18	0
Monthly income of respondents	745.25	254.26	1000.00	250.45
Number of members per household	4.5	2.5	2	9

We noticed that more than 40 % of the questioned population have a secondary level, 37,5 % have a university level. The rest is presented by people having a primary and Koranic formation. These results explain the strong proportion of the questioned population that occupy a post in the public service (65.93 %). The unemployed, in particular the retired people, present only 2 % of the questioned population. As consequence of these results, the monthly income, to 55.93 % of the investigated, is between 600 and 1000 DT and at only 80 people (25 %) is lower than 600 DT (the structure of our sample reflects that of the national scale).

The analysis of results of the conducted survey shows that 80% of respondents rest rural origin or they have second homes in the countryside.

These characteristics reflect a direct influence on their willingness to pay, these results indicate a rural population, relatively young, predominantly male with a average level of education and average income.

#### 3.2 Different Forms of Use of Agricultural Landscape

The results of the analysis of different forms of agricultural landscapes consumption with the citizens of the study area show the relationship between the surveyed population and agricultural areas. The agricultural landscape is valued differently depending on the type of personal contact with the farming community.

We noticed that 76.5 % of investigated persons are closely attached to the agricultural areas: 32% reported that they have orchard or agricultural exploitation; thus they practice the agricultural activity. The rest said that they had relatives in the rural area.

The rest of the respondents (23.5% of respondents) practice professional activities in relation with the campaign products (13.12%) or they are visiting the

campaign for relaxation or for occasions such as socio-cultural festivities.

These results demonstrate the existence of permanent contacts, wanted or unannounced, between citizens and agricultural landscapes, which allow them to have sufficient knowledge on recent developments and current situation of the agricultural landscape and quality. This is also a prerequisite to the revelation of preferences and the calculation of willingness to pay for conservation of the agricultural landscape.

To make some highlighting on the motivations of individuals we interviewed them about their attitudes towards the preservation of the agricultural landscape. Four types of attitudes emerged: highly motivated, moderately motivated and unmotivated and indifferent.

The attitudes of motivation combine between the sensitivity of the individual and his predisposition to participate in actions to conserve and restore the agricultural landscape.

The preservation of the agricultural landscape seems motivated approximately 78% of the survey population with different degrees, 47% very motivated and 31% moderately motivated. Then very low motivated persons or indifferent persons to the preservation of the agricultural landscape represent 12 % and 8 % of the surveyed population.

#### 3.3 Results of the Contingent Valuation

Considering the importance of the agricultural land in the governorate of Kasserine and specially tree-dwelling orchards: olive and apple orchards that occupy more than 80 % of the tree-dwelling irrigated exploitations in the site of study.

The willingness to pay is the financial contribution which offers the person questioned to protect the agricultural space of their region and afterward insure the continuity and the development of the agricultural activities.

The results of the contingent valuation is twofold; the first one concerns the reaction of the population surveyed to the contingent valuation scenario, the second presents the econometric analysis of WTP of individuals and the calculation of the average WTP.

(84.06%). A low proportion said that they are indifferent (table 3).

Willingness to pay increases as the auction value decreases.

### 3.3.1 Results of the Contingent Scenario

A large part of those interviewed agreed to contribute to pay for the protection of agricultural land in the study area

TABLE 3. REACTIONS OF THE INTERVIEWED PEOPLE TO THE CONTINGENT SCENARIO

Reaction	Number of respondents	%
Accepted Scenario	<b>269</b>	<b>84.06</b>
First Auction accepted	153	56.87
First Auction refused	116	27.19
Refused Scenario	<b>51</b>	<b>15.93</b>
Total	<b>320</b>	<b>100</b>

Among those who accepted the contingent scenario, the major proportion agreed to participate to pay the auction which has the lowest value, between 25 and 50 DT (56%),

Globally, the higher the share of the auction in income increases, the chance of being accepted is lower. The effect

of income on the acceptance of the auction of conserving agricultural landscape is similar to that of consumers in the market for goods and services. We note that the higher value (200 DT) is refused by all the respondents (table 4).

TABLE 4. DISTRIBUTION OF THE ACCEPTANCE RATE OF THE FIRST AUCTION

Willingness to pay (Tunisian Dinars DT)	25	50	75	100	125	150	175	200
Acceptation of the first auction proposed (n)	85	65	45	25	23	16	10	0
Acceptance rate (%)	31.5	23.04	16.72	9.29	8.55	5.94	3.71	0

Tables 5 and 6 present the values of the estimated parameters and their statistical significance (t-statistics) as well as indicators on the robustness of the econometric estimations ( $R^2$ , Log-likelihood and the fraction of the correct predictions) both models logit short and long. Globally, the signs of the estimated parameters obtained for both versions of the logit model are in accordance with the economic theory, as far as the probability to accept the WTP decreases with the value of the proposed offer and increases with the income. With regard to the obtained expressed preferences, we can say that the questioned urban households have a behavior of requesting of the agricultural landscape conservation.

The analysis of the effects of the individual explanatory variables on the WTP shows that the more the income is important, the more the household accepts the proposed bid. Among the 296 people who accepted the first auction, 187 responded positively to the second auction too. We noted that this category of respondents have a monthly income above 600 DT. As against those who refused to participate have an income below 600 DT.

TABLE 5. EXPLICATIVE VARIABLES OF WTP FOR THE CONSERVATION OF THE AGRICULTURAL LANDSCAPE IN SBIBA (RESULT OF THE SHORT LOGIT MODEL)

Variables	estimated parameter	standard error	t statistic	Probability
Constant	3.01	0.365486	8.45628	[0.000]
Value of the auction (M)	-0.020	0.002453	-7.24586	[0.000]



Log-likelihood = -215,2	Percentage of correct predictions = 67.5%
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TABLE 6. EXPLICATIVE VARIABLES OF WTP FOR THE CONSERVATION OF THE AGRICULTURAL LANDSCAPE IN SBIBA (RESULT OF THE LONG LOGIT MODEL)

Variables	estimated parameter	standard error	t statistic	Probability
Constant	-3,4566	1.145671	2.02455	[0.002]
<b>Value of the auction (M)</b>	0.023152	0.003152	7.34572	[0.000]
Gender	0.012457	0.002354	1.514235	[0.209]
Age	0.053564	0.358569	0.965853	[0.841]
<b>Level of education</b>	1.523580	0.458721	1.178600	[0.000]
Marital status	0.458751	0,4125742	0.358261	[0.524]
Member of household	0.145823	0.358236	0.45154	[0.652]
Secondary residence in rural area	-0.025801	0.358952	0.536992	[0.030]
Agricultural activity in rural area	0,252381	0.535212	0.812501	[0,456]
visits and leisure	-0,481526	0,362540	-1.025682	[0,215]
Number of observations = 320				
R <sup>2</sup> = 0.51				
Log-Likelihood = -112.6				
Percentage of correct predictions = 74%				

We notice from the results shown in the table 3 that the influence of educational level on the probability of accepting to pay is higher when the level of education is higher than the primary level. This result allows to link attitudes to the conservation of the agricultural landscape and the individual education levels. The population sample who responded positively to the double auction, 73% had a secondary and university level. However, the sample structure by level of education is not representative of the Tunisian society where the illiteracy rate is very high.

As for the motivations of individuals for the preservation of the agricultural landscape, the effect obtained shows a positive effect on the probability of accepting the auction. Individuals who claim to have responsibilities in the rural area (family, agricultural activity) are more likely to accept the bid for the preservation of the agricultural (table 2).

**3.3.2 Calculation of the Average Willingness to Pay**

The result of the method of calculation the average WTP lead us to a value of 110 DT/year (for the short logit model) and 125 DT for the Long Logit Model.

The average willingness to Pay is estimated to be equal to a value of 117.5 DT/year (table 3).

TABLE 4. RESULT OF THE CALCULATION OF THE AVERAGE WTP

	Average value	Long logit Model	Short Logit Model
WTP	117.5	110	125

The correlation between the personal characteristics of interviewees presented in the figure 2 shows that:

- The income, the level of education and the moral responsibility are strongly positively correlated with WTP. The more the individual has a high

level of education or a high income, the more he is willing to pay a higher value.

- The number of members of household is negatively correlated with the WTP. The more the number of people in the household is high the more they may refuse to pay.

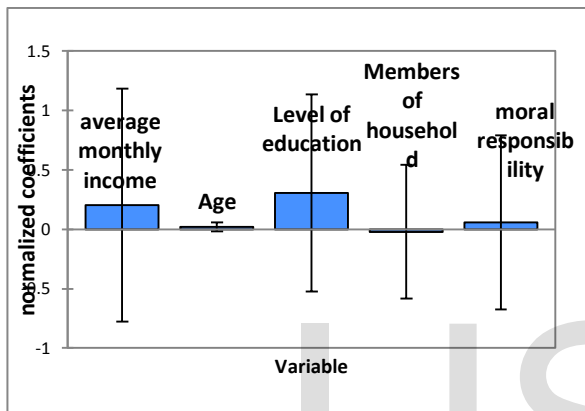


Fig. 2. Correlation between the average willingness to pay and socioeconomic variables

The willingness to pay is strongly affected by the socioeconomic characteristics of the population. It is positively affected by the respondent income, level of education, the number of the member of the household and it is also affected by his moral responsibilities and perception of the value of the agricultural landscapes

#### 4 CONCLUSION

The purpose looked for by this study is to express in monetary size what the households in the study site are ready to pay for the preservation of the agricultural landscape. The produced results allowed drawing

methodological conclusions as analytical and practical conclusion.

As an exercise of communication, contingent valuation has initiated a part of the Tunisian city population to the valuation contingent, so far unfamiliar with this kind of evaluation. Using the referendum technique with double dichotomous choice, preceded by a pre-survey based on the open question, she reduced the systematic bias dominance of extreme values.

The application of the contingent valuation method in Tunisia, that is a developing country, is a controversial issue but it helps to develop more new knowledge on how Tunisian society is thinking, so as to enrich the debates about its relevance and limitations.

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