

THE VINEYARD LANDSCAPE OF THE OASIS NORTE OF MENDOZA ARGENTINA. ECONOMIC ASSESSMENT OF THE RECREATIONAL USE THROUGH CONTINGENT VALUATION METHOD

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Abstract:

Oasis Norte's vineyards of Mendoza Argentina have shaped along their existence, a characteristic landscape; this area is close to Mendoza City, a regional metropolis with about one million inhabitants. Throughout the last 25 years the urban expansion and urban sprawl have been changing this landscape as a result some views are altered by residential patches. The aims of this work are to know how the local urban population perceives this landscape and its changes and to assess the economic value through the willingness to pay for recreational use. Landscape is an environmental good and among other uses, the recreational use of landscape is considered an environmental service of cultural type; this offers improvements in human's feelings like spiritual pleasure, aesthetical enjoyment, and sense of identity or pride. The economic assessment of this kind of goods and services is more complex than the valuation of traditional ones –productive uses-, because there are not any transactions and reference prices.

Contingent Valuation is a direct method of valuation where the economic value is calculated through the declared preferences of people to use or feel the existence of this service. The parametric estimation of value of landscape is the main result obtained through an arithmetic model. Also confidence intervals, the significance of covariates like allocation, social or economic status, vision etc. have been estimated. We conclude that local people value their landscape and they declared that its degradation alters their lifestyle; the answers and values depend mainly on income, allocation, education level and age.

This awareness led to back public policies to keep the provision of aesthetical services confronting the real estate sector and provides a more realistic valuation of the losses – much more than grape production- when a vineyard is removed to build a new neighborhood. The valuation of the touristic use with other methods like travel cost is the following step of this research.

Keywords: *Mendoza, urbanization, landscape, ecosystem services, perceptions.*

INTRODUCTION

Maipú and Luján de Cuyo are two counties of Mendoza Province in Argentina. Both have developed an irrigated agro ecosystem specialized in viticulture during the last four centuries (Richard Jorba 1998). Mendoza City - a regional metropolis with more than a million inhabitants- is close to this area. The city is expanding over the agricultural land as sprawl, transforming the traditional vineyard landscape into a mosaic of land uses. Aside of its role as grape supplier for winemaking, this system generates positive externalities – ecosystem services- to the whole society of diverse nature. This work is focused in the supplying of cultural services like recreation, contemplation, scenic and spiritual enjoyment as it is a cultural heritage and source of local identity (UNEP 2003),(Scholes, Hassan et al. 2003). We suppose that urban population enjoys this place and by this reason people assigns a value to this landscape, distinguished by the view of vineyards framed by the snow peaks of the Andes range (Figure 1).

Cultural services need a specific demand to exist, this is to say they must to have a social recognition, different from other services like regulation ones, that are so *per se* (Bürgi, Silbernagel et al. 2015). Landscape is a typical case of cultural service (Ulrich 1986), as it is defined as a social aesthetical perception of land. The valuation of this kind of services is complicated (Swinton, Lupi et al. 2007). Urban sprawl is a spatial process registered along the whole History, but it was labeled as a global problem after the sixties. Snyder and Bird (1998) marked it as the development out the border of cities, over non urban land and where population settles attracted by a low density population style life, easy access and a peaceful environment. In the other hand these authors rated this phenomenon as a mistake of land planning as a result of biases in market mechanisms and unfair policies. They affirm that costs –

including hidden costs- are higher than benefits because this lifestyle increases car dependency, congestion and more energy consumption, also demand higher investments in road infrastructure and the land losses have not return. The loss of population in cities carries also a process of degradation, Bowker and Didychuk (1994) point out the phenomena of perceptual loss of open space



Figure 1: Typical landscape of Oasis Norte de Mendoza

By working with Focus Groups the impacts of this local transformation were identified (Van den Bosch, Alturria et al. 2012). The impacts are: 1) fragmentation and losses of the quality of the landscape quality (Barau & Quresh 2015); (Vos & Meekes 1999);(Wrbka, Erb et al. 2004), 2) irreversible losses in agricultural land, 3) exodus of rural residents, 4) interruption of irrigation network, 5) increased car flow with more gaseous and noise emissions, 6) increased production of garbage, 7) loss of wine production with particular identity and prestige, 8) loss of heritage vineyards (old Malbec), 9) loss of habitat of some animals, especially birds.

All these facts confer to urban sprawl particularly relevant connotations; the exposed area is scarce and irreproducible. We assume that this agro ecosystem provides diverse benefits to local society, which are more than the supply of raw materials to the wine industry and that this society assigns values to these benefits. In a previous work it was assessed the use and the vision of local people about this space. 42% of respondents declared that urban sprawl is a very important problem, 60% are directly affected by this problem, 55% practice recreational activities in this area, 69% considered this area the most affected and 76% thinks that an ordered landscape is beneficial (Van den Bosch, Alturria et al. 2015).

The aim is to calculate the economic value of the recreational use according with the methodological frame presented below.

2 MATERIALS AND METHODS

METROPOLITAN AREA OF MENDOZA (MAM)

The MAM is the main urban core in the Province, with more than million people (Table 1). The growth of population in Luján de Cuyo and Maipú counties has been very dynamic as consequence of migration of people from the city to well connected areas, with availability of land and high quality water, scenic environment, climatic comfort – fresher in summer nights. Only 3% of the land in Mendoza is under irrigation and cultivated – because of water restrictions. Luján de Cuyo registered a cultivated area of about 19 thousands hectares and Maipú 26 thousands, where the main crop is the vine.

Table 1: Number of inhabitants registered by National Population Censuses 2010 & 2001 and variation for MAM

Department	Census 2010	Census 2001	Variation %
Guaymallén	280.880	223.365	26
Godoy Cruz	189.578	182.563	4
Las Heras	203.507	169.248	20
Capital	114.822	110.993	3
Maipú	172.861	89.433	93
Luján de Cuyo	124.418	73.058	70
Total	1.086.066	848.660	28

Source: CNPYV 2001 & 2010

ECONOMIC VALUATION OF COMMON GOODS

Common goods can be provided by a public or private source, but they are enjoyed by whole society. They have not any particular market. Land market assigns land values according with marginal productivity of private goods and it do not consider other benefits like recreation (Bowker & Didychuk 1994). Landscape enjoyment is considered a direct use (without consumption), option use and bequest use (Cristeche & Penna 2008) ;(Millennium Ecosystem Assessment 2005). This kind of assessment requires specific procedures, in this case Contingent Valuation (CV). This one is based in choice models where the Willingness to Pay (WTP) of people is used to elicitate the economic value (McFadden, 1980). This direct procedure asks people their revealed preferences through what they say, instead of studying how people behave.

THE SURVEY FORM

As the answers are perceptual and there in is not need of any expertise, the questions were focused to residents (Ulrich 1986). The survey -with 33 questions- had the following goals a)introduce the respondent to landscape concept, b)supply information about urban sprawl, c)ask his/her valuation of different images of landscapes, d)identify the main environmental problems that people perceive e)identify the actual use that people do of the area and their attitude about the transformation of land, f) shows different choices, where the pollster offers to respondent a set of cards with different money amounts in the reverse and respondent has to extract randomly one by one and answer if he /she is 1- definitively willing to pay monthly through taxes this amount, 2-probably, 3- no sure, 4 probably not and 5 definitively not willing, g)the last part has the intention of characterize social and economic variables of the household.

The advantages of the random extraction of cards are that in this way starting point biases are neutralized (Cunha-e-Sá et al., 2015) and respondents feel less intimidated about money questions.

THE CHOICE

This is the core of VC. Each respondent is asked about his/her WTP to the implementation of a Land Use Planning Program focused in the protection of vineyard areas of the two counties. The payment cards were introduced with values from \$5 to \$150 scored with Likert scale (five appreciations from Definitively Yes to Definitively Not). This game is repeated until the logical options are exhausted.

SAMPLE SELECTION AND SURVEY

For sample selection 33 census radios were raffled from urban cartography. In each of them one block was raffled again; this was the segment to work. Each surveyor had to complete 20 questionnaires circumvented to the head of household, responsible of economic decisions. This process was conducted by students majoring in Agricultural Engineering and Engineering in Natural Resources FCA UNCuyo between September and December 2012. The households surveyed were 657.

DATA PROCESSING

With the answers a database was built and these were analyzed with Gretl statistical package, written in C language. Gretl is a free statistical package with open code; new variables were created from the original as **bid1**. This is the highest amount for the respondent that is definitely WTP.

Protest answers

It is important to discriminate about a real negative WTP because the service or good is not important from a protest situation where people feel that this function do no belong to him/her (Bowker and

Didychuk 1994), (García-Llorente, Martín-López et al. 2011). These answers were removed from database.

The theoretical model

Desvousges, Smith et al. (1983) and Edwards & Anderson (1987) established that if sample is representative of the population and protest answers are removed, the arithmetical average of maximum WTP is a suitable way to assess the value assigned by a community.

Then Hanemann, Loomis et al. (1991) said that the conventional, single-bound CV survey involves asking an individual if he/she would pay the highest given amount, B. The probability of obtaining a "no" or a "yes" response can be represented, respectively, by:

- (1) $\pi^n(B) = G(B; \theta)$,
- (2) $\pi^y(B) = 1 - G(B; \theta)$

Where $G(B; \theta)$ is some statistical distribution function with parameter vector θ . This statistical model can be interpreted as a utility-maximization response within a random utility context, where $G(B; \theta)$ is the Cumulative Density Function (CDF) of the individual's true maximum WTP because utility maximization implies:

$Pr\{No\ to\ B\} \Leftrightarrow Pr\{B > \text{maximum WTP}\}$,
 $Pr\{Yes\ to\ B\} \Leftrightarrow Pr\{B \leq \text{maximum WTP}\}$.

The WTP is a linear function of B with a series of covariates. The covariates selected were evaluated through statistical tests of significance.

The resulting model provides: the estimation of the Dependant variable (WTP arithmetic average) as a function of several covariates that resulted statistically significant plus a constant term. This information is complemented with standard deviation of parameters, Determination coefficient, F, likelihood log, Akaike coefficient, Schwarz Bayesian coefficient and Hannan Quinn criteria.

The Akaike information criterion (AIC) measures the relative quality of models. Hence, AIC is a way for model selection but it tells nothing about the real goodness of the fit. The selection criterion is so smaller better fit. The total WTP results of the extension to the whole population. In this way the value of the service is the sum of the WTP for it.

3 RESULTS AND DISCUSSION

The database has 657 files, each one to the responses on one household. Once deleted protest answers and missing values were deleted, 496 observations remain. We consider a linear model with the whole set of co variables: County of residence, Gender, Age, Main environmental problem perceived, House level, links with agriculture, Car, Income and last school level. Those variables that test indicate statistical significance is exposed in Table 2.

Table 2 Maximun WTP Estimation MCO from 496 observations with significant covariables

Variable	Coefficient	St. Dev.	t	P value	Sign.
Const.	7,35912	12,9569	0,5680	0,57032	
Capital	12,0474	5,02617	2,3969	0,01691	**
Las_Heras	10,6067	6,61446	1,6036	0,10946	
Lujan	21,6855	9,3743	2,3133	0,02112	**
Age	-0,594823	0,122414	-4,8591	<0,00001	***
Urban sprawl	4,73316	1,31822	3,5906	0,00036	***
Environ_link	25,0703	6,67335	3,7568	0,00019	***
Car	10,7569	4,41236	2,4379	0,01513	**
Primary school	34,5244	12,7342	2,7112	0,00694	***
College	28,0692	11,9503	2,3488	0,01923	**
Terciary	40,5378	12,809	3,1648	0,00165	***
Universitary	35,687	12,0337	2,9656	0,00317	***

In this model it is shown that the age of the respondent has high significance and negative trend. People concerned with urban sprawl and linked with environment organizations showed different WTP than

others. The last school level of respondents explains also differences. The allocation of the households explain also some differences in the WTP
 As it is exposed in Table 3 the average mean of the WTP in the model is \$41 per household and month¹ with standard deviation of \$51.

Table 3 Criterium functions of the model

Arithmetic Average of Dependent variable (WTP)	41,4444
Standard Deviation of WTP	50,8569
Sum of squared residuals	1,01666e+006
Standard Deviation of residuals	46,5588
R ²	0,204297
F	4,81665 (p value < 0,00001)
Log – likelihood	= -2590,18
Akaike information criteria	5232,35
Schwarz Bayesian information criteria	5341,67
Hannan-Quinn information criteria	5275,27

According to these results, it can be concluded that under the proposed model, younger people, those linked with environmental organizations and those who have a better perception of the urban sprawl have a higher WTP, explained through their independent variables. Old people are less worried about this problem and Halstead (1984) has written about this fact about 30 years ago in Massachusetts, he found that with the same driving forces than here, while farmers can obtain revenues from production, sale or development of agricultural land, they do not perceive anything.

WTP is also higher as higher is the educational level of respondents. Car availability explains also a fraction of WTP, this derived probably of the accessibility for recreational use. The allocation of respondent seems also to influence in responses, the differences are significant among departments; probably people who lives in Capital (main city)– with scarce green open space- assigns higher values by this reason. People of Lujan de Cuyo – witnesses of the impact of urban sprawl in their own local territory- do this by this different reason.

The other variables do not provide explanations of the WTP.

One of the main objectives of this work was to estimate of the value of the farmland, it was found that this value is increased by extreme values, and however there are a high number of zero bids.

Next studies will be focused in improving the accuracy of models, based in different distributions like log normal. Also the available data allows double bound treatments and the Likert scale open the door to probability distributions of WTP, not only restricted to “*definitively yes*” as in this first approach.

The final product of this study is a measure of some nonmarket benefits (social values) of the viticulture land of the two counties. The survey discovered that citizens of MAM agree that government assign an amount of their taxes to put in practice a Land Use Planning Program to avoid residential development in the farmland of Luján de Cuyo and Maipú. The average value is about \$41 per month and household, this means more than 11 millions Argentinean pesos per month to be applied to a Land Use Plan focused in recreational use.

We are conscious that the total value assessment of these landscapes has to account the other direct uses as touristic one. This has to be approached by other methods like Travel Cost.

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¹ In December 2012 1US\$ = \$4,9

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