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Contingent Valuation Method (CVM) for Agricultural Wastes in the Area of Central Macedonia in Greece.

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Abstract

The present study investigates the tendency of farmers in the greater area of Central Macedonia in Greece, to participate in a program of environmental management. The aim is to determine the amount of Willingness to Pay (WtA) against which the farmers would be willing to allow anyone to gather and carry away the leftovers of theirfarming exploitation. This is the first step towards the estimation of initial capital for the activation of a collaborative scheme of utilisation of disposable agricultural biomass. The agricultural leftovers are considered as an environmental non-market economic commodity. The evaluation of the value is carried out by means of the Contingent Valuation Method (CVM). By the term Biomass we mean the biodegradable products fraction, wastes and leftovers coming from agricultural, plants and animal substances inclusive, the forestall and the like industrial plant, as well as the biodegradable fraction of industrial wastes and urban effluents and sewage wastes. We conclude that the minimum amount each interviewee is willing to accept as minimal remuneration, is affected by the way these biomass leftovers are managed, the age of the interviewees and the area in which they live. Those interviewees who use such biomass leftovers in alternative applications wish to be remunerated higher compared to those who relinquish such leftovers.

Keywords: Willingness to Accept, WtA, biomass, ordinal model, parametric approach, questionnaire

Introduction

The Contingent Valuation Method (CVM) is a survey-based technique, frequently used in Experimental Economics, especially useful for the valuation of non-market resources/goods/services, and cultural heritage objects (of aesthetic, historic, scientific or social value), such as conservation of monumental remains and preservation of the physical and anthropogenic environment [1-2]. The basic partial techniques used in CVM are (i) willingness to pay (WTP), which is the maximum monetary amount that an individual would pay to obtain/preserve a good, and (ii) willingness to accept (WTA) compensation, which is the minimum monetary amount required to relinquish the good. Therefore, WTP provides a purchase price, relevant for valuing the proposed gain of the good while WTA provides a selling price, relevant for valuing the proposed loss of the good. According to classic economic theory, a

significant difference between WTP and WTA should not occur, on condition that there is (i) no transaction cost, (ii) perfect information about goods/services and corresponding prices, (iii) no income effect, (iv) a market that engenders truthful revelation of preferences. Although these conditions were generally met in several economic experiments that used inexpensive market goods with readily available substitutes, the ratios WTA/WTP obtained were significantly greater that unity. This result was attributed to the fact that participants in these experiments lacked market experience [3].Contingent Valuation Method is the first technique of hypothetical experiments using a questionnaire applied to assess the economic value of public goods and services and is the predominant assessment technique in the scientific field of Experimental Economics.

The economic value of natural resources is often defined as the value of the goods and the services they offer. The environment economics have developed a series of methods for assessment of the monetary price of the environmental goods and services, which are based on investigation of the public preferences and reflect the practical need of translation of the monetary amount into management policies, in which the public concession and participation in the process of decision making are indispensable.

By the term Biomass we mean the biodegradable products fraction, wastes and leftovers coming from agricultural, plants and animal substances inclusive, the forestall and the like industrial plant, as well as the biodegradable fraction of industrial wastes and urban effluents and sewage wastes.

Implementation

We compare the results of the descriptive statistical analysis among the answers of the interviewees in the mainland Greece (Thessaloniki) and on two Greek islands – Samos and Ikaria. The similarities and differences in the attitude of these two categories of rural population are outlined. We observe that the interviewees in the previous year owned bigger areas of land (more stremmas) per cultivated item on Samos and Ikaria compared to Thessaloniki. Also the interviewees stated that they had almost the same number of stremmas against the average stremmas owned by the farmers in Thessaloniki, on Samos and on Ikaria. Most of the interviewees in Thessaloniki utilize the crop leftovers in other applications but on Samos and on Ikaria they gather it for fuel at home. It is worth noting that management of the rejected biomass does not differ among the above areas.

On the contrary, however, we notice that the minimum compensation amount each interviewee asks in order they may be in a position to gather and carry away the leftovers differs among the areas. More specifically on Samos and on Ikaria the farmers ask for higher remuneration compared to farmers in the Thessaloniki area. However, the willingness shown by the farmers for participation in gathering the crops without any extra remuneration does not differ among the areas.

As regards the income of each interviewee farmer against that of inhabitants in other areas of similar agricultural exploitation it does not differ between the two area categories, as the results

show. Additionally we notice that the percentage of the interviewees' income originating in farming is bigger in Thessaloniki compared to that on Ikaria and on Samos. In order we correlate the amount WTA with the rest of the parameters of our example, we apply the model «ordinal regression», given that the dependent variable (WTA) is scaled and the independent variables are discreet (nominal or scaled).

We conclude that the minimum amount each interviewee is willing to accept as minimal remuneration, is affected by the way these biomass leftovers are managed, the age of the interviewees and the area in which they live. Those interviewees who use such biomass leftovers in alternative applications wish to be remunerated higher compared to those who relinquish such leftovers.

The interviewees aged 15 to 25 years wish to be remunerated with smaller amounts compared to those aged 56 up (p-value=0,045<0,05). Further, we notice that the farmers aged 26 to 40 years wish to be remunerated with higher amounts compared to those of 56 years up (p-value=0,018<0,05). Finally, the interviewees in the Thessaloniki area wish to be remunerated with smaller amounts compared to those on the islands of Samos and Ikaria.

The ordinal logistic mode is listed in a broader category of Generalized Linear Models for arrangement data. The model is based on the assumption that a latent continuous outcome variable exists and that the observed ordinal outcome results from the continuous discreteness of that subjected to j scaled groups.
The specimen of generalized linear models is given here:

$$\mathrm{link}(\gamma_j) - \frac{\theta_j - [\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k]}{\exp(\tau_1 z_1 + \tau_2 z_2 + \ldots + \tau_m z_m)} \qquad (1)$$

Where:
γi : cumulative possibility for category j
θj: threshold of category j
$\beta 1 \ldots \beta \kappa$: reciprocation coefficients
$\chi 1 \ldots \chi \kappa$: predictor variables
κ: number of predictions

The specimen numerator determines the location of the model while the denominator determines the scale. The terms $\tau 1..\tau m$ are coefficients for the scale components while the terms Z1…Zm represent the m predictor variables for the scaled components. The scaled components are the cause of differences in the variable of different values of the predictor variables.

The question formulates the Willingness to Accept (WTA) of the interviewee that is their wish for remuneration in order to allow someone to gather and take away the leftovers of the agricultural exploitation. It is impressive that the majority of the interviewees, i.e.71.7% of the specimen, answered that they would relinquish their farming leftovers without asking for any monetary remuneration. Out of the remaining 28.3% of the specimen, 11.7% answered that they would ask for 1-5 euro to relinquish the farming leftovers in each cultivated stremma on a yearly basis. Similarly another 11.7% of the specimen answered that they would ask for 6-10 euro for

the same above reason. Finally, one person in each category(1,67% of the specimen), answered that the remuneration he would ask to relinquish his farming leftovers would be 11 – 15 euro in the first instance, 16 – 20 euro in the second instance and 21 euro up in the last instance.

We observe that in the first category , that is the one of those stating that they do not ask for any remuneration to relinquish their farming leftovers, 58.1% of the specimen would participate without any recompense in the entire process, while 41.8% would not participate without recompense.

In the second category, that is the one of those wishing to collect monetary remuneration to relinquish their farming leftovers, 47% of the specimen answered that they would participate in the relevant procedure, contrary to the 52.9% of the interviewees who stated that they would not participate.

In the first category, i.e. those who stated that they do not wish any remuneration to relinquish their farming leftovers, 58.1% of the specimen would participate in the whole procedure without recompense while 41.8% would not participate without recompense.

In the second category, i.e. those wishing to collect monetary remuneration to relinquish their farming leftovers, 47% of the specimen answered that they would participate in the relevant procedure, but 52.9% of the interviewees stated that they would not participate.

Out of the first category which concerns those not wishing remuneration to relinquish their farming leftovers, 26% of the specimen stated that they abandon their farming leftovers in the field. An equal percentage (26%) states that they burn the leftovers in the field. Only 2.3% gather the leftovers as fuel at home while, finally, the majority that totals 45.2% mention utilization.
Out of the second category, which concerns those wishing remuneration to relinquish their farming leftovers, 26% of the specimen stated that they abandon the leftovers of their farming exploitation in the field.

Out of the first category, i.e. those stating that they do not wish any remuneration to relinquish their farming leftovers, 18.6% of the specimen report an income smaller of the average of the farmers in the area who are involved in similar farming exploitation, 67.4% of the specimen report an income approximately equal to the average and finally only 13.9% of the interviewees report an income bigger than the average in the area.

Out of the second category, that is the one wishing to collect monetary remuneration to relinquish their farming leftovers, 23.5% of the specimen report an income smaller than the average of the farmers in the area with similar farming exploitation, 47% of the specimen report an income approximately equal to that of the average and finally only 29.41% of the interviewee report an income bigger than the average in the area.

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \left(y_i - \hat{y}_i\right)^2}{\sum_{i=1}^{N} \left(y_i - \bar{y}\right)^2} \tag{2}$$

Where N is the number of observations, y is the dependent variable, $\bar{y}$ is the mean of the y values, and $\hat{y}$ is the value predicted by the model. R2 is the determination coefficient that ranges from 0 to 1. According to the Ephron's R^2:

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \left(y_i - \hat{\pi}_i\right)^2}{\sum_{i=1}^{N} \left(y_i - \bar{y}\right)^2} \tag{3}$$

where $\hat{\pi}$ =model predicted probabilities, the dependent variable in a logistic regression is not continuous while the predicted value (a probability) is. MacFadden introduced the log likelihood of the intercept model.

$$R^2 = 1 - \frac{\ln \hat{L}\left(M_{Full}\right)}{\ln \hat{L}\left(M_{Intercept}\right)} \tag{4}$$

$$2\ln\left[L\left(M_{Intercept}\right) / L\left(M_{Full}\right)\right] \tag{5}$$

Where McFull is the model with predictors, M Intercept is the model without predictors, and $\hat{L}$ is the estimated likelihood. A likelihood falls between 0 and 1, so the log of likelihood is less than, or equal to, zero. If a model has a very low likelihood, then the log of the likelihood will have a larger magnitude than the log of a more likely model. Cox and Snell present the R2 as a transformation of the
Statistic that is used to determine the convergence of a logistic regression.

$$R^2 = 1 - \left\{\frac{L\left(M_{Intercept}\right)}{L\left(M_{Full}\right)}\right\}^{\frac{2}{N}} \tag{6}$$

Note that Cox & Snell's pseudo-R^2 has a maximum value that is not 1; if the full model predicts the outcome perfectly and has a likelihood of 1, and then we have

$$1 - L\left(M_{Intercept}\right)^{\frac{2}{N}} < 1 \tag{7}$$

Nagelkerke, Cragg and Uhler, adjust Cox & Snell's R2 so that the range of possible values extends to 1.

$$R^2 = \frac{1 - \left\{ \frac{L\left(M_{Intercept}\right)}{L\left(M_{Full}\right)} \right\}^{\frac{2}{N}}}{1 - L\left(M_{Intercept}\right)^{\frac{2}{N}}} \quad (8)$$

It should be noted that adjustment of the model is considered good by the coefficient Cox and Snell=0,656 and the coefficient Nagelkerke = 0,683.

Concluding Remarks

External effects are observed when supply or demand impose costs or confer a benefit to others. More specifically, the external effect is the impact of the behaviour of a producer or consumer well-being of another, which is not reflected in market transactions.

The economic evaluation of research aimed at improving overall social welfare. As an initial test for social welfare, the criterion used Pareto, under which a fully competitive market, an action or policy is socially desirable if it improves the position of all the individuals composing the society or at least some (weak criterion Pareto), but difficult position of any other (a strong criterion Pareto).Some benefits from the research are as follows: He offered a variety of options that allow the construction of statistical models capable. The number of interviews and the survey costs are lower compared to those required for investigations manifested preferences. However indicated drawbacks, such as the fact that: there was a bias due to discrepancies between stated intentions and actual behaviour of interviewees.

The specimen response on utilization of the rejected biomass was satisfactory, since a good percentage of the interviewees are willing to contribute to this procedure for a minimal of remuneration, although investigations of this type are novel for Greek reality. From this investigation it is perceived by the society the importance of alternative utilization of the rejected biomass.

It is impressive that the majority of the interviewees, i.e. 43 persons who represent 71.7% of the specimen answered that they would allow their gathering and carrying away of their farming leftovers without asking for any monetary remuneration. Further, encouraging are the results concerning the willingness to participate in the gathering since the majority of the interviewees, i.e. 55% of the specimen, stated that they would participate in the gathering of the leftovers without any remuneration.

With regard to the amount WTA (dependent variable) of the Logit Model we conclude that it is affected by the wish for remuneration (independent variable) at the level of importance 5% (p-value = 0.011). We also conclude that the amount of WTA is affected by the stremmas each farmer owns compared to other farmers at the level of importance 10% (p-value = 0.065). Similarly to Probit Model we conclude that the amount of WTA (dependent variable) is affected by the wish for remuneration at the level of importance 5%.

Since education is a crucial factor that increases WTP medium / long term, future research should be aimed at schools, colleges and universities in the region to increase the value of non-

use and to obtain useful information related to awareness of young people. Research using the hypothetical assessment has been used successfully overseas and now recognized as a valid argument. The survey can be a powerful tool in the hands of local and regional authorities for claiming generous funding for the purpose mentioned above.

In conclusion, our analysis shows that social science research can provide useful information about the complex issues of environmental policy, such as biomass management. The analysis of policy for such cases is particularly difficult because these systems provide multiple, interrelated services vary depending on the type of biomass, location and other factors. The work presented here has proved a useful integrated tool for determining the realistic cognitive burden on stakeholders and third parties.

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