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Willingness to Pay for Rural Landscape Preservation: A Case Study in Mediterranean Agriculture

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NOTA DI LAVORO 59.2000

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Version of Friday, May 19, 2000.

Paper submitted to European Review of Agricultural Economics

Second Submission

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Acknowledgements: The authors wish to thank for useful comments on previous drafts M. Hanemann, K. Willis, G. Garrod, one anonymous reviewer of this journal, and participants to the 1999 seminar series at the Department of Agricultural Economics and Food Marketing of the Univeristy of Newcastle, U.K.. The usual disclaimer applies.

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Summary

In this paper we present welfare estimates from a contingent valuation (CV) study which investigates the potential benefits derived by tourists from the implementation of a programme aimed at preserving the traditional agricultural landscape in a typical Mediterranean area: the National Park of Cilento (Southern Italy). Here, under current market conditions, farming activities are being gradually abandoned. As a result, the alternative to the cultivated landscape is a much less appealing one, where the various stages of progression of land abandonment dominate. To ease the cognitive task of respondents, CV responses were elicited using the discrete choice referendum format. To supplement the inherent inefficiency of discrete choice responses one follow-up question was also administered. The sample responses are analyzed by three methods. First, by a log-normal model which allows a random utility interpretation. Then by a series of beta models, which require the definition of the maximum in the range of willingness to pay and reflect a purely statistical approach. Finally, by means of the non-parametric Kaplan-Meier-Turnbull probability estimates, which is robust to potential parametric mis-specifications. The welfare estimates obtained by various methods were similar and approached one Euro per day-visit.

Our results indicate that referendum CV provides plausible estimates of WTP for agricultural landscape conservation from the tourists' population. From a conservative inference it appears that in 1997 the traditional farming produced a landscape externality for tourists which reached at least 8 million Euro. Provision of landscape is only one of many unremunerated activities provided by farmers, so more research should be aimed at valuing public goods produced by farming in recreationally valuable areas and elsewhere. We argue that the policy tools currently employed in the European Common Agricultural Policy, for the purpose of rural landscape preservation, are inadequate in the context of typical Mediterranean agriculture. Here the main cause of rural landscape deterioration seems to be the abandonment of agricultural production, rather than its intensification, so the main features of interest are other than those currently protected by EU policy.

JEL Classification: C51,H23,H41,Q15,R14

1. Introduction

In the last decades, there has been a steady and marked growth of interest in the contribution of farming to the supply of positive externalities. In this category of agricultural outputs the provision of valuable landscapes appear to assume a particular connotation, especially when these are representing values linked to cultural heritage and regional identities that are threatened to disappear under current market contingencies. In the OECD countries one of the main sources of interest in rural landscape preservation has certainly been the deep and relatively quick transformation of the countryside that took place in the post war period. In Italy this transformation was particularly dramatic: between the early fifties and early eighties the national economy underwent a period of turbulent and spectacular growth which deeply impacted on large part of the national territory.

As a consequence, the agricultural landscape was also subject to much transformation in this period. This was fuelled by various processes, both external (i.e. urbanization) and internal (i.e. structural farm adjustments) to the agricultural sector. On one side, large tracts of land were progressively abandoned in now economically marginal areas. Here the "cultivated" landscape was mostly substituted with the "abandoned" one. The intensification of agricultural production in more productive lands was mainly driven towards profitable monocultures. These gave rise to a "simplification" of the various landscape traits which previously added to the scenic value of the countryside. These dramatic changes promoted the gradual disappearance of locally typical Mediterranean landscapes that are a by-product of traditional farming practice and have characterized many local landscapes since the Renaissance.

According to the data of the 1960-90 censi 4,5 million hectares of cultivated arable land were lost in Italy during this period of time on a total of 19,5 million hectares in the 1960. Seventy-five percent of the lost farmland (3,4 million hectares) is located on hills and mountains where the traditional rural landscape has been mostly substituted by the abandoned one, while 1,1 million hectares of cultivated land on the planes was mainly developed into urbanization.

Previous studies on threatened landscapes supplied by traditional Mediterranean agriculture identified the following landscape types to be at risk given current tendencies: *huerta*, *coltura promiscua*, *dehesas* and *montados* (Pinto Correia 1991, Naveh 1993, Stanners and Bourdeau 1995). In 1990, Meeus *et al.* were already warning the international community that the traditional cultivation of the *cultura promiscua* in Central Italy and Northern Portugal were strongly affected by the prevailing tendencies of the time in agricultural practices.

The early Common Agricultural Policy (CAP), which was based on price subsidy and unlimited guarantee, amply contributed to this process. Not only was it not capable of reducing the abandonment of marginal areas, but it also created incentives to abandon regular crop rotations in favour of monoculture successions. Widespread mechanization and emphasis on efficient use of farm inputs determined the disappearance of landscape elements with marked visual impact, such as stone walls and natural hedges (see amongst others, Bowers and Cheshire 1983) in Northern Europe, but also terracing and important mixed cultivation of perennial and annual crops in Southern Europe.

In the last decade the attention of the general public toward the issue of rural landscape preservation has strongly increased and generated an intense policy debate in all EU countries. The controversial aspects of this debate have been fuelled by the reform of the CAP that recognized the importance of the European agriculture as a producer of positive externalities (environmental, cultural, historical and scenic).

In the 90s many rural landscape studies (see Santos 1998 for a thorough review) were conducted to inform this important debate. Most of these aimed at deriving estimates of social benefits from selected agricultural landscapes in various countries of the EU. In a cost-benefit setting these values should be compared with the estimated cost of supporting preservation by means of public programmes to inform public decision making with regard to the issue of economic efficiency.

The study presented in this paper contributes to this theme by supplying some results from a referendum contingent valuation (CV) survey which investigates tourists' willingness to pay (WTP) for landscape preservation in a typical rural area of the Mediterranean: the Cilento National Park (henceforth the Park). In the CV scenario respondents were proposed to pay a daily charge during their visit to the Park. This was to be exclusively destined to support those agricultural activities contributing to landscape preservation. As an alternative to this scenario respondents were proposed the landscape resulting from abandonment of the traditional agricultural activity in the Park, which was illustrated to them by means of photographic aids. Unconditional estimates of expected WTP are derived by analyzing the observed sample responses by various maximum likelihood estimators, all of which maintain the interval data assumption. From these estimates we infer the magnitude of benefits to the population of tourists in the Park produced by the existing level of provision of agricultural landscape.

In the light of our results we argue that referendum CV may well produce plausible WTP estimates in this context and may therefore play an informative role in the public decision making. Although the provision of traditional landscape is only one of the many externalities produced by agriculture in this area, the benefit value estimates for this component are sizeable. We further speculate that the policy tools currently employed in the CAP for the purpose of rural landscape preservation may be inadequate in the context of Mediterranean agriculture threatened by abandonment.

2. The role of agricultural landscape in the study area

Cilento National Park is the second Italian park in terms of extension. It is completely within the Campania region, with a total area of 285,975 hectares, 181,048 of which are effectively protected from further development. The main economic activities in the Park are tourism and agriculture. In 1997, the year in which the survey was completed, the Park management agency recorded 3,768,931 tourist-days. Although from the private viewpoint farming is at the margin of economic performance, it still has an important role from the social viewpoint in terms of ratio of actively farmed area over the total territory of the Park (40.8%) and as a supplier of positive externalities for tourism. The actively farmed area is estimated at 73,500 ha, 28,386 of which are grazing area and permanent pastures, 24,488 under permanent cultivation and 20,626 used for yearly crops.

Farming has been steadily dwindling over the last few years, with a gradual increase in farmland that is employed below its productive potential, or outright abandoned. In a recent study Coppola and Verneau (1997) analyzed the the 1982-90 censi data with respect to farmland in the Park. They found that during the 80s yearly crops were reduced by 40%, and substituted mainly with grazing area and Mediterranean bush. The number of cattle heads was also drastically reduced and the rate of labor days to arable land fell by 12%. The increase in grazing area coupled with the decrease in the number of heads shows, according to Coppola and Verneau, a path were the relative growth of grazing land can be clearly interpreted as a first step toward abandonment. This is often followed by the establishment of Mediterranean bush, which typically marks the final phase of abandonment in this area. The final result of the process of increasing abandonment and extensification is that 83,3% of farms in this area produces a standard gross income of less than 4 EDU, showing an agricultural sector that plays only a marginal economic role, if measured only according to market values.

The remaining active farms are characterized by the presence of tree cultivation with a predominance of olive trees and vineyards. The presence of olive tree cultivation is an important historical trait and salient landscape feature of this area, which has been destined to olive cultivation since remote times. Some of the most spectacularly large olive trees in Mediterranean Italy can be found in the Park farms, with a unique impact on the landscape (Filangieri 1994). In particular, the *cultivar* Pisciottana has been historically cultivated in the Park territory. Trees belonging to this *cultivar* are quite distinctive sizes and can reach the exceptional height of thirty meters, dominating the rest of the rural landscape. This much aesthetically appreciated *cultivar*, however, imposes high harvesting cost, because of its height. For this reason, in the absence of a protective and supportive policy, its cultivation tends to be abandoned, and with its abandonment the peculiar landscape associated with it is destined to disappear.

In this study we estimate the value of the Park's rural landscape for tourists. The magnitude of this form of social benefits turns out to be sizeable and would probably justify – at least in part – a conservative policy aimed at correcting current market tendencies which cause the abandonment of traditional farming practices.

3. Econometric issues in WTP estimation.

The logic of CV studies is that of inferring the distribution of economic benefits in a target population from statements of intention elicited from a random sample of respondents. WTP statements are probed according to a sample design, which systematically distributes respondents over a range of different bid amounts. These are asked to compare and choose hypothetical landscape scenarios described in the survey instrument. Although there has been a revival of open-ended CV studies (Ready et al. 1996, Halvorsen and Sœlensminde 1998, Bohara et al. 1998), we employ here the popular referendum format, whereby the statements are elicited in a form of "Yes-No" WTP responses at given bid amounts by means of close-ended questions. In as much as the survey design incorporates the necessary ingredients for incentive-compatibility, such as decisiveness and decoupling[1] (Green *et al.* 1998), respondents are assumed to truthfully reveal their individual value for the public programme under valuation – at least on average. A typical analysis focuses on the estimation of measures of central tendency of the WTP distribution, and when needed – by using covariates and conditional probability estimation – on its shifters. However, we follow McFadden (1994) who argues that covariates are neither necessary and often not desirable in models aimed at estimating WTP, and focus exclusively on unconditional estimation[2].

The assumptions upon which the estimation of the various features of the WTP distribution is conducted from the collected responses are numerous and they depend on the estimation strategy chosen by the analyst. In the empirical literature there is wide agreement on the plausibility of few basic assumptions. First, that WTP be distributed asymmetrically with a positive skewness (fat tail in the right hand side). This justifies the widespread adoption of specifications based on skewed distributions such as the log-logistic (Ready and Hu 1995, Scarpa *et al.* 2000a), log-normal (Alberini *et al.* 1997), flexible Box-Cox (Halvorsen and Sœlensminde 1998, Boman and Bostedt G. 1999, Scarpa *et al.* 2000b) distributions, and gamma, Weibull and Beta distributions (Haab and McConnell 1998, Bohara *et al.* 1998). Secondly, the range of WTP should be delimited by plausible lower and upper limits consistently determined with the problem at hand (Hanemann and Kanninen 1999, Haab and McConnell 1998). Thirdly, account should be explicitly made of the fact that a fraction of the population may well not be benefiting at all from the proposed programme, and will therefore have zero WTP (Kriström 1997, Ayala and An 1996, Reiser and Shechter 1999).

In our study it is quite possible that a fraction of the tourist population be indifferent between the two landscapes and have a zero WTP for the proposed landscape conservation programme. The adopted specification must therefore accommodate a positive mass probability at WTP=0. Note here that a textbook application of a continuous c.d.f., such as normal and logit, would not satisfy this last condition. In these, by definition $\Pr(X=x) = 0$ for any x in the domain, where X is the random variable, and x is the value that this takes. Further, in our case, focus groups, pilot study and field survey shown that the landscape resulting from abandonment of agriculture is generally regarded as positively worse than the cultivated one, so we expect no probability density for negative WTP.

The range of the WTP domain must therefore be defined by an adequate specification of the utility function, and/or by adequately modeling the probability distributions. In order to handle these implications in a general case for a non-negative parametric specification we choose to combine two distributions. The first regulating the stochastic behaviour of responses in the strictly positive interval of WTP, the second determining the probability of the Bernoulli event WTP=0. In the model employed here we use a mixture of distributions according to the following law:

$$M(WTP \le x) = M(x;\theta,0) = \begin{cases} 0, & if\, x<0 \\ \rho, & if\, x=0 \\ \rho+(1-\rho)H(x,\theta), & if\, x>0 \end{cases}$$

Where $H(x,\theta)$ is a cumulative distribution function with $H(0,\theta) = 0$ and $M(\cdot)$ is the mixture density function.

The logarithmic transformation can always be employed to restrict the WTP distribution to the positive orthant, while the Bernoulli probability of observing WTP = 0 is estimated independently, by means of the parameter r, which defines the fraction of population that is indifferent between the two landscape states described in the scenario. An upper limit to the WTP range can be defined either by truncating the integral of the expectation at some upper limit or by imposing this in a distribution well defined over a given range. The first option is used here in the log-normal model, while the second one is chosen in the beta function[3].

In our study we supplement the inherent inefficiency of discrete choice responses by following Hanemann *et al.* (1991): we use responses to one follow-up question and maintain *a-priori* the interval-data hypothesis during estimation. That is, we hold that both responses are affected by unobservable components drawn from the same distribution. This double-bound assumption allows us to use a relatively small sample size and yet achieve quite accurate estimates[4]. Extending this bounding by means of a second follow-up, leading to a third level of bounding, has recently been shown to produce only small additional efficiency gains (Scarpa and Bateman 2000), and would therefore appear not to be worthwhile. We believe that in the particular context where we operated, both the notion of referenda for public decisions and "huggling" over price are quite familiar to the population at large. Hence no significant and systematic distortions are expected to be generated by using an interval-data of the observed responses.

We focus on estimation of the expected value of WTP and use three distinct estimation approaches, all of which incorporate the three issues described above. The first two analyses employ a parametric approach: the first uses a classic log-normal random utility specification based on a mixture of distributions with a spike at zero to account for that component of the population which does not have a positive value for the programme (zero-bidding). We estimate mean WTP by computing the expectation integral at different upper limits to explore the sensitivity to truncation points in the neighborhood of the highest bid and beyond.

The second parametric analysis postulates a mixture of a beta function with a spike at zero with various ranges for the WTP distribution corresponding to the analogous set of upper limits used in the log-normal analysis. Beta distributions were recently proposed by Haab and McConnell (1998) in the context of referendum CV analysis to incorporate intuitive bounds to the range of WTP variation and maintain both the skewness of the distribution and ease of tractability. This eminently statistical approach, however, lacks a behavioural interpretation of the estimated coefficients. In fact, they cannot be reconnected to the structure of neither a random utility nor a valuation function.

Finally, as a term of comparison, we provide analogous welfare estimates obtained non parametrically by means of the Kaplan-Meier-Turnbull (KMT) estimator, the use of which is illustrated by Haab and McConnell (1996) for single bounded referendum CV data, and is extended in An and Ayala (1996b) to double-bounded across censored data that may be generated by DC-CV with a follow-up, such as in our study. The KMT is a Maximum Likelihood estimator which imposes only a very weak assumption (weak monotonicity) to the data, assumption that is theoretically supported. It is hence very robust to mis-specification errors, which afflict parametric approaches, and this makes it a useful term of comparison for this class of estimates. Notice that this estimator is not used by interpolating endpoints to the intercept of the axis or between probability estimates. It therefore returns a “step-function” and as such the *E*(WTP) estimate can be computed by either using a conservative Laspeyres index, or its Paasche counter-part, We choose the former and hence obtain a conservative estimate of the real population values (Boman *et al.* 1999).

The log-normal specification is the only one of the three whose coefficients can be interpreted as those of a random utility model fitted to discrete responses. Respondents chose from two alternative scenarios, each associated with a given level of utility. In our study the first scenario is associated with the presence of a policy that ensures, at a given cost for the respondent, the conservation of the current cultivated landscape. The alternative scenario is associated with the inevitably degraded landscape that will ensue from the abandonment of the agricultural activity. The respondent is therefore comparing two utility states: $u(m-A,\mathbf{q}^1,\mathbf{s})$ with $u(m,\mathbf{q}^0,\mathbf{s})$, where m is income, $\mathbf{q}^1$ is the vector of attributes characterizing the agricultural landscape to be conserved by the proposed policy program, $\mathbf{q}^0$ is the vector of attributes characterizing the landscape typical of similar areas in which agriculture has been abandoned, as it would happen in the absence of the policy program, while $\mathbf{s}$ is a generic vector of socio-economic variables, A is the proposed cost the individual is asked to pay in the presence of the proposed policy program. A derivation of the RUM approach is formally reported in the appendix.

The most common motivation to conduct CV study is to estimate welfare changes, that is, to derive Hicksian measures of some kind. In this context – which is also the one of our study – the main advantage of RUM interpretation of the observed discrete responses is their immediate correspondence with the preference parameters of the relevant population. This allows the researcher to derive Hicksian measures directly from the estimated parameters. There is no need to derive the preference properties from conceptually secondary functions such as the demand or expenditure function.

4. Survey and data

In the summer 1997 a random sample of 350 tourists was randomly selected and interviewed in person while visiting the Park, producing 344 useful responses. The final version of the questionnaire employed in the survey instrument was designed on the basis of information collated during two pilot studies. These allowed us to improve the original survey draft in terms of scenario perception and communication, and ascertain the credibility of the political market employed, as well as to probe respondents about the features of their WTP distribution to design an adequate vector of bid amounts to be used in the subsequent full scale survey (Kanninen 1993, Cooper 1994, Cooper and Signorello 1994). In particular, the elements of the initial bid vector were chosen by using data from a pre-test study carried on 70 tourists and using the observed WTP percentiles plus conventional criteria (Alberini 1995b, Kanninen 1993) to select the follow-up bids. The values of the first bid vector correspond to the 0.2, 0.4, 0.6 and 0.8 percentiles of the empirical WTP distribution of the pilot studies, while the follow-up question doubled the value after an initial Yes response, and halved it following a negative response. The respondents were unevenly distributed among bids. More were set on the 0.4 percentile (Lit. 2,000), so that with the follow-up bids (Lit. 1,000 for a first No answer and Lit. 4,000 for first Yes answer) the explored interval could cover the central part of the distribution. Ex-post this resulted in a quite adequate choice: the respective percentiles estimated from the observed referendum CV responses and the log-normal analysis turned out to be respectively the 34th, the 49th and the 64th.

The final survey instrument was composed of three parts. The first, was an introductory part investigating the reasons of the choice of a visit to the Park, the length of the stay and the origin of the visit. Overall the survey design and conduction complies with most of the NOAA panel guidelines (Arrow *et al.* 1993).

In the second part the respondent was shown two sets of photographs. One set portraits the traditional rural landscapes under the current cultivation regime. The other set portraits landscapes from areas of the Park where the agricultural practice had been abandoned for some time. In this part the respondent was also made aware that the process of agricultural abandonment is still taking place and that the abandoned landscape is therefore likely to dominate the Park area in the future if no landscape conservation programmes are put in place. Respondents were than told that a targeted policy for rural landscape conservation cost money, and were asked whether or not they would support such a programme by paying a daily fee per head of an amount X, where X was a value from the vector of Lit. 1000, 2000, 3000, 4000 (Euro 0.5, 1, 1.5 and 2, approximately).

Zero bidders were identified as follows. Those respondents that answered with a "no" to both value elicitation questions were further debriefed and asked to explain their reason for doing so. Then the following debriefing question was also asked: " *If most tourists didn't want or were not able to bear their own share of costs for preserving the traditional rural landscape in the Park, the landscape depicted in the pictures of the B group could substitute completely the actual rural landscape depicted in the pictures of the A group. Do you disagree with this alternative?*" Amongst 106 survey outcomes with "no-no" responses, only fourteen could be identified from this debriefing exercise as true zero bidders: seven declared themselves indifferent between the two landscapes, and seven denied their financial support to the programme because they considered a policy supporting traditional agricultural landscapes a waste of public money. All others are to be considered not indifferent to the proposed scenario, because although they declared themselves unwilling to pay the amount of money requested, their debriefing showed that they were not indifferent to the existence of traditional landscape.

5. Estimation results

Table 1 shows the breakdown of the responses observed in the survey while Table 2a presents the parameter estimates of the log-normal model. As it is often the case with logarithmic models, the estimated distributions show a relatively "fat" upper tail, as visible from the plots of the estimated density distributions (Figure 1). Since expected WTP is strongly affected by the high estimated density values in the upper tail, we follow the advice of Duffield and Patterson (1991) and use a truncated integral to conservatively estimate expected WTP. Clearly, the choice of truncation point is an arbitrary one and it affects the value estimates. However, one should remember that extrapolation off the support, that is, beyond the highest bid used in the sample (A^{max} = Lit. 8,000, approximately 4 Euro), is entirely reliant on the choice of functional form of the distribution which – at this sample size – can hardly be tested with sufficient power (Alberini 1995c). Table 2b explores the sensitivity of the estimates to various upper truncation points at and beyond A^{max}, with increases of about the value of one Euro in Lit.. The integrals were computed numerically with the Simpson's approximation method and approximate confidence intervals were obtained with parametric bootstrap procedures (Krinsky and Robb 1986). Sensitivity of the value of *E*(WTP) estimates results to be quite low. For example, increasing the truncation point by approximately one Euro it increases the estimated of less than a ten cent of an Euro. This means that the "fat tail" problem is not prominent in this case. The log-normal model would seem to estimate the expected WTP in the range of Lit. 2,500 - 3,500 depending what truncation point is considered.

In table 3a are reported the parameter estimates of the beta model with WTP range Lit. 0-8,000 (0-4 Euro). Notice that less than 1 percent of the sample was willing to vote in favour of the landscape conservation programme at A^{max}, hence limiting the distribution at 8,000 would appear to be consistent with the observed pattern of responses, and should not result in a strong bias downward. This model shows a higher likelihood fit to the observed responses than the log-normal one, however it produces a similar point estimate for *E*(WTP) at Lit. 2,346. Similarly to what is done for the log-normal model, it is possible to explore the sensitivity of the *E*(WTP) by estimating the model with higher upper limits for the range of WTP variation (Table 2b). Both these models showed lower likelihood than the one at Lit. 8,000, which therefore should be the best one in terms of fit. The beta model provides estimates of expected WTP in the range of Lit. 2,100 - 3,800.

Table 4 reports the probability estimates of the KMT estimator obtained with the algorithm developed by An and Ayala (1996b) for double-bounded across censored data, along with the pivotal statistics of the bootstrapped distribution used to obtain approximate confidence intervals (Efron 1981, Efron and Tibshirani 1993). Since this probability estimator is a non-parametric one no extrapolation can be computed off the support of the investigated bid range. It is therefore correct to compare these estimates of expected WTP only with the parametric ones obtained over the same range of 0-8,000. It is noteworthy how the estimate obtained, Lit. 2,332(2,081-2,582) are very similar to those obtained with the beta model (Lit. 2,346(2,118-2,591)), while the log-normal truncated at 8,000 are about 20% higher (Lit. 2,865(2,588-3,145)).

The process of inference to the population of tourists allows one to assess the aggregated benefit. The RUM-based parameter estimates allow us to interpret the estimates as the relevant Hicksian measure: the equivalent surplus. For the year 1997 the estimated benefits, once aggregated over the number of visit days, are around the 11 and 12 billion of Lit. (5.5-6 million Euro). Dividing the total estimated benefit value by the Park area under cultivation we obtain a value of Lit. 163,000 (80 Euro). If one excludes the area occupied by agricultural activities with little impact in terms of providing features for the traditional rural landscape, such as permanent grazing areas and other pastures, then the per hectare value of the benefit is of Lit. 266,000 (130 Euro).

Using the estimated mean WTP from the conservative KMT estimator we clearly obtain lower inference values of approximately 8.8 billion Lit./year (2.2 million Euro/year) for the value of the programme, equivalent to Lit. 120,000/year (60 Euro/year) for each hectare of farmland, and 195,000 Lit./year (approx. 100 Euro/year) for each hectare of farmland with relevant impact on the traditional landscape.

6. Policy consideration and conclusion

Agricultural activity is geographically diffuse and so are the externalities it produces. The supply of traditional agricultural landscape generates economic benefits for which farmers receive little if any remuneration. Any policy aimed at correcting this market failure and providing a socially optimal level of landscape supply needs to be informed about the social demand for this peculiar public good. On top of active use value, because of its special nature, traditional agricultural landscapes also have a high existence (passive use) value, foe example due to the landscape role as a store of cultural heritage and regional identities. For this reason stated preference are the non-market method of choice in the context of valuation of this production externality, especially contingent valuation.

We apply contingent valuation to value the traditional rural landscape as generated by the practice of traditional Mediterranean agriculture in the national Park of Cilento. Following the seminal papers by Kriström (1997), An and Ayala (1996a) and Haab and McConnell (1998), the distribution of WTP in the population of visitors is investigated by a mixture of distributions formulated to account for corner solutions. These may be prevalent amongst zero-bidders that express their indifference between the two proposed scenarios of a cultivated or abandoned rural landscape.

An effort is made to incorporate in the estimation process those restrictions suggested by the theory of consumer behaviour and good econometric practice, such as non-negativity, budget constraints, zero-bidding and robustness. The estimated benefit values for tourists is in the order of 9-11 million Euro/year.

On the regulatory side of supply, the optimal transfer to farmers should be designed according to the each farm's contribution to the supply of landscape. The implementation of a subsidy measure, though perfectly consistent with the Pigouvian approach, is certainly not free from practical problems. Since the landscape is a highly composite good, it is difficult to identify the single unit to employ in the design of the optimal subsidy policy. An incorrect policy measure of this unit may even create an incentive to worsen the overall landscape quality.

The idea of policies that only focus on some selected set of landscape attributes, such as those currently adopted by the EU with regulation 2078/92 which provides incentives for dry stone walls and hedges, is clearly inadequate when the alternative to cultivated landscape is its total abandonment or when the salient landscape features are other ones, as is the case in Cilento National Park and in much of the Mediterranean countryside. We argue that in these agricultural systems the choice is between the present status quo, that allows the abandonment to go on, and an adequate policy that should aim at preventing abandonment and encouraging the continuation of the landscape-relevant agricultural activities in a fashion that nurtures culturally prominent landscape features.

From an efficiency point of view such kind of policy could be justified if the value of all positive externalities outhweights the cost of preventing abandonment of farming. Our study gives a contribution to this line of research by estimating the willingness to pay for preserving traditional rural landscape in the Cilento National Park.

In this study we estimate that the contribution of the landscape to the benefits produced by the traditional agriculture in the Park for transient tourists is around 100-133 Euro/ha/year. There is no doubt that these amounts may seem inadequate for justifying – per se – a policy of preservation. However, we emphasize that landscape supply is but one of the externalities associated with traditional Mediterranean agriculture, so this amounts does not appear so small if we think that it is only a fragment of the combined bundle of positive externalities supplied by keeping in place this type of farming. Other externalities, for example, include biodiversity preservation and hydro-geological stability of hillsides, which are especially valuable in the territory of the Park.

If the social role of agriculture is to be correctly assessed in public policy, then further research is needed to assess the validity of estimates of positive externalities from farming from non-market valuation methods. In this empirical application, the obtained estimates seem to be both of plausible magnitude and robust across estimation methods.

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8. Appendix

Random utility specification.

Consider the following two utility states where utility is made up of a deterministic component $v(m,\mathbf{q},\mathbf{s})$ and an unobservable component u which is assumed to have a known stochastic behaviour, and superscripts 0 and 1 express respectively the absence and presence of the landscape conservation programme:

$u(m\text{-}A,\mathbf{q}^1,\mathbf{s}) = v(m\text{-}A,\mathbf{q}^1,\mathbf{s}) + u^1$ and $u(m,\mathbf{q}^0,\mathbf{s}) = v(m,\mathbf{q}^0,\mathbf{s}) + u^0$ (1.)

The Hicksian measure of interest in describing a potential worsening ($\mathbf{q}^0 > \mathbf{q}^1$) of the landscape supply is the equivalent surplus (ES) (Freeman 1993), that is, the amount that implicitly solves the following equality:

$u(m,\mathbf{q}^1,\mathbf{s}) = u(m\text{-ES},\mathbf{q}^0,\mathbf{s})$ (2.)

By manipulating the expressions 1-2 above, observing a truthful positive response implies the following sequence of disequalities:

$u(m\text{-}A,\mathbf{q}^0,\mathbf{s}) \geq u(m,\mathbf{q}^1,\mathbf{s}) \rightarrow v(m\text{-}A,\mathbf{q}^0,\mathbf{s}) + e^0 \geq v(m,\mathbf{q}^1,\mathbf{s}) + e^1$

$\rightarrow v(m\text{-}A,\mathbf{q}^0,\mathbf{s}) - v(m,\mathbf{q}^1,\mathbf{s}) \geq e^1 - e^0 \rightarrow \Delta v \geq \Delta e$ (3.)

Given the randomness of the sample, the formal analysis of the observed responses must be interpreted in a probabilistic sense. We assume that the probability of positive response is specified up to a column vector (n x 1) of estimable parameters $\mathbf{q}$. The conditional probability at bid amount A is:

$Pr(\text{Yes}|A,\mathbf{q},\mathbf{s};\mathbf{q}) = Pr(\Delta u \leq \Delta v;\mathbf{q}) \equiv F_{\Delta u}(\Delta v;\mathbf{q})$ (4.)

Where $F_{\Delta u}(\Delta v;\mathbf{q})$ is the parametric cumulative distribution function (c.d.f.) evaluated at the difference between the two deterministic components of utility Δv;

$\Delta v = \alpha + \beta \ln(A) \rightarrow \mathbf{q} = \{\alpha , \beta\}$;

By making assumptions on the form of $F_{\Delta u}(\Delta v;\mathbf{q})$ it is possible to estimate $\mathbf{q}$ starting from the responses obtained from the sample. The assumption made in this study is that the unobservables u^0 e u^1 be identically and independently distributed (i.i.d.) extreme value type I (Gumbel). In this case Δu is distributed logistically.

Log-likelihood for the RUM Model with spike at zero

$$\ln L(\rho,\theta)=\sum_{i=1}^{N} \{ZB_i\ln(\rho)+(I_i^1 I_i^2)\ln[(1-\rho)(1-H_i(x^A,\theta))]+I_i^1(1-I_i^2)\ln[(1-\rho)(H_i(x^A,\theta)- H_i(x,\theta))]+(1- I_i^1)I_i^2 \ln[(1-\rho)(H_i(x,\theta)-H_i(x^B,\theta))]+ [(1- I_i^1)(1- I_i^2)-ZBi] \ln[(1-\rho)H_i(x,\theta)]\}$$

Where in the RUM $H(x,\theta) = \Phi(\alpha + \beta \ln(A))$, and $\Phi(\cdot)$ is the normal standard c.d.f., while in the Beta model $H(x,\theta) = B(\alpha , \beta, A^{max})$, and $B(\cdot)$ is the beta c.d.f..

Expected WTP for RUM log-logistic model

$$E(WTP^{Amax}) = \int_0^{A^{\max}} (1-r)\Phi[a + b\ln(A)]dA$$

Expected WTP for Beta model

$$E(WTP^{Amax}) = \alpha/(\alpha + \beta)\,(1-\rho)\,A^{max}$$

Expected WTP for Kaplan-Meier -Turnbull model

$E(WTP^{Amax}) = \sum_{k=1}^{K} (A_{k+1} - A_k)\hat{p}_k$ where $\hat{p}_k$ is the maximum likelihood estimate of the probability of positive response at the k^{th} bid amount produced by the KMT algorithm.

9. Endnotes.

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[1] The *decisiveness* principle requires that the respondent clearly perceives that her answer is going to constructively inform decision makers, so that she is faced with an incentive to conduct the introspective effort necessary to provide an answer. The *decoupling* principle requires that the respondent clearly perceives that in case the programme being valued is enforced, her contribution to the funding of such programme will not be derived on the basis of the information she reveals in the answer to the WTP elicitation question.

[2] For an analysis of conditional probability estimation on this dataset see Cicia and Scarpa 1999.

[3] See Ready and Hu 1995 for a similar approach (pinching) in the logistic context.

[4] As pointed out by a reviewer, this assumption may appear restrictive because the second response might be affected by both the initial bid and the response provided to it (Cameron and Quiggin 1994, Bateman *et al.* 2000). However, in a Monte Carlo analysis Alberini (1995a) showed that – for the purpose of mean WTP estimation – interval– data analysis with a censored regression approach when the real data generating process has bivariate error terms provides efficiency gains that outweight the expected bias due to mispecification.

10. Tables.

Table 1. Break-down of responses at the various bid amounts

First bid amount	Yes-Yes	Yes-No	No-Yes	No-No	Total
1,000	19	32	1	25	77
2,000	24	36	21	33	114
3,000	10	36	8	19	73
4,000	2	45	4	29	80

Table 2a. Parameter estimates for log-normal RUM model

N = 344		Loglikelihood -537.442	
Parameters	Estimates	Std. err.	Est./s.e.
r	0.041	0.011	3.820
a	6.795	0.404	16.818
b	-0.890	0.052	-17.214

Table 2b. Estimates of *WTP* distributions from log-normal spike model at various truncation points.

	Features of Bootsrapped Distribution of *E*(WTP)		
A^{max}	$Q_{0.025}$	Point est.	$Q_{0.975}$
8.000	2.588	2.865	3.145
10.000	2.733	3.049	3.392
12.000	2.829	3.182	3.575

1 Euro = 1,936.27 Lit. (values in 1,000 Lit.)

Table 3a. Parameter estimates for Beta model with A^{max} = Lit. 8,000

N = 344		Loglikelihood -403.952	
Parameters	Estimates	Std. err.	Est./s.e.
r	0.041	0.011	3.826
a	0.764	0.083	7.352
b	1.735	0.236	9.169

Table 3b. Estimates of *WTP* distributions from Beta spike model at various upper limits of range.

	Features of Bootsrapped Distribution of *E*(WTP)		
A^{max}	$Q_{0.025}$	Point est.	$Q_{0.975}$
8.000	2.118	2.346	2.591
10.000	2.667	2.908	3.215
12.000	3.181	3.471	3.841

1 Euro = 1,936.27 Lit. (values in 1,000 Lit.)

Table 4. Non parametric probability estimates from KTM (values in 1,000 Lit.).

		Parameters of the empirical distribution from 10,000 resampling				
A	Point est.	Mean	St. Dev.	Median	2.5º perc.	97.5ºperc.
0	1	1	0	1	1	1
500	0.736	0.736	0.027	0.736	0.683	0.787
1.000	0.726	0.725	0.025	0.726	0.675	0.774
2.000	0.512	0.511	0.027	0.512	0.459	0.564
3.000	0.512	0.511	0.027	0.512	0.459	0.564
4.000	0.327	0.327	0.029	0.327	0.27	0.385
6.000	0.111	0.111	0.032	0.11	0.053	0.178
8.000	0.014	0.014	0.01	0.013	0	0.036
E(WTP)	2.332	2.331	124	2.329	2.091	2.582

Figure 1. Comparisons across Estimated WTP Distributions