

# Valuing the non-market production of agriculture

## Bewertung nicht-marktlicher Agrarproduktion

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### Abstract

As a consequence of the negotiations for a new agricultural policy of the EU the multifunctionality of agricultural production has come into new prominence in the public. The philosophy that subsidies for the agricultural sector should be calculated not only by agricultural market production but also according to agricultural non-commodity production like e.g. the conservation of the countryside, makes it necessary to assess the social value of this part of agricultural production. In this paper we scrutinize the welfare theoretical background of the economic valuation of non-market production as well as the existing practical valuation techniques. Further, the applicability of these techniques to the valuation of agricultural non-commodity production is considered.

### Key words

valuation of non-market goods; cost-benefit analysis; contingent valuation; multifunctionality of agriculture

### Zusammenfassung

Infolge der Verhandlungen über die EU-Agrarreform gerät die Multifunktionalität der landwirtschaftlichen Produktion zunehmend in den Blick der Öffentlichkeit. Der Ansatz, Direktzahlungen an den landwirtschaftlichen Sektor nicht nur auf Basis der Produktion von Marktgütern zu berechnen, sondern auch überbetriebliche Leistungen, wie z.B. die Landschaftspflege als Bemessungsgrundlage heranzuziehen, macht es notwendig, deren Wert für die Gesellschaft zu ermitteln. In diesem Beitrag beleuchten wir sowohl den wohlfahrtstheoretischen Hintergrund der ökonomischen Bewertung der Produktion von Nicht-Marktsgütern, als auch die vorhandenen Bewertungsmethoden für die Praxis. Ferner wird die Anwendbarkeit dieser Methoden bei der Bewertung überbetrieblicher Leistungen in der Landwirtschaft betrachtet.

### Schlüsselwörter

Bewertung von Nicht-Marktsgütern; Kosten-Nutzen-Analyse; kontingente Evaluierung; Multifunktionalität der Landwirtschaft

## 1. Introduction: the multifunctionality of agriculture

One of the most acrimoniously debated problems of EU policy is the complicated system of agricultural subsidies in the European Union. It is well known that this system sets wrong incentives to farmers, which lead to the overproduction of the agricultural sector that has been characteristic for European agriculture for many decades now. In the future payments will depend more and more on the non-commodity production of the agricultural sector like conservation of the countryside, biodiversity protection or the preservation of the cultural heritage and tradition of agriculture in Europe. In other words, the agricultural sector will be paid to an increasing extent according to its production of externalities which are essential for society but which are not rewarded through the normal markets for

agricultural products. As is known from economic theory, leaving the agricultural sector solely with its market income would lead to an undersupply of these externalities.

The fact that the agricultural sector produces different kinds of goods and services has also been officially acknowledged by the OECD. In its report on the multifunctionality of agriculture (cf. OECD, 2001) it is emphasized that in addition to food and fibre the agricultural sector also provides non-commodity outputs like environmental amenities, preservation of biodiversity, food security and rural viability in general. One could add that agriculture also supplies environmental services like water filtration and CO<sub>2</sub>-sinks. One should not forget that the agricultural sector is, of course, also responsible for the production of negative externalities like e.g. soil and water pollution.

Since a great part of agricultural production cannot be traded in markets because it has public good characteristics like non-excludability and – to a certain extent – non-rivalry in consumption other ways of compensating the agricultural sector for this non-market production must be found. In principle, there are two possibilities for the construction of such a subsidy systems. One possibility is that government acts as a landscape architect and determines what parts of the landscape should be fields, pasture, forest, hedges etc. and pays specifically defined subsidies for each of these landscape elements up to the point where the officially laid down quota of each element is fulfilled. In such a system the preferences of ordinary people are completely left out. A more democratic alternative to this authoritarian solution would be a subsidy system where payments to farmers were calculated according to the utility they create for the population. A precondition for such a “bottom-up” solution would be that the base for the calculation of such (positive or negative) payments, i.e. the social values created or destroyed by agricultural non-commodity production, can be assessed. Otherwise an incentive compatible tax-subsidy system for the agricultural sector cannot be designed.

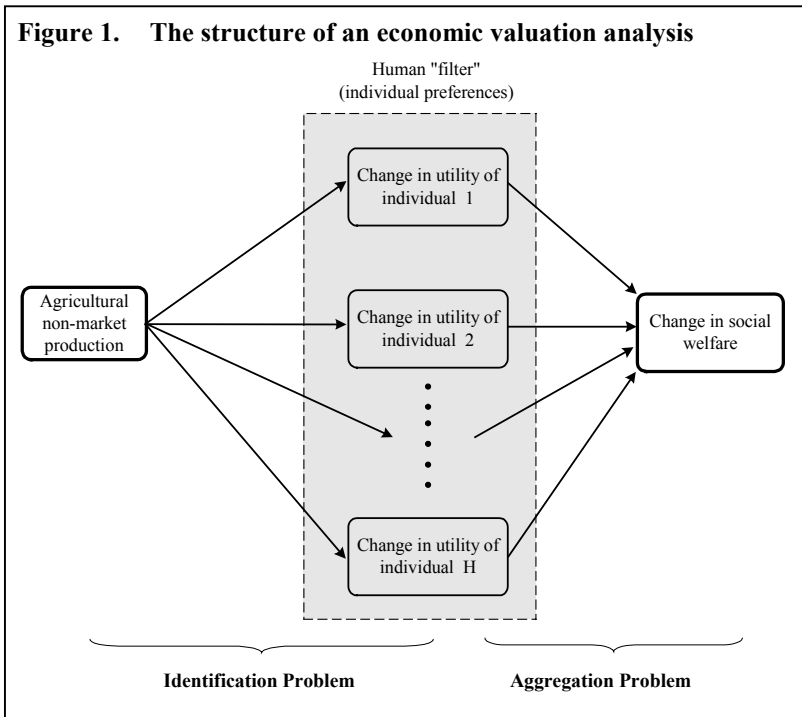
In this paper we focus on the possibilities to assess the social benefits or costs created by agricultural non-market production that might form the calculation base for a bottom-up system of agricultural taxes and subsidies. In the next section we briefly highlight the theoretical background and the principles of economic valuation. In section 3 different practical assessment techniques are discussed, in section 4 we show how these assessment techniques can be applied to the specific problems of the economic appraisal of agricultural multifunctionality and section 5 contains some concluding remarks.

## 2. Welfare theoretical background – a short reminder

It is advisable to scrutinize the theoretical background of welfare measurement before turning to the practical assessment of agricultural non-commodity production, because especially in the environmental sector the neglect of theory has often led to grotesque misinterpretations of cost-benefit studies.

First of all it should be emphasized that economics is an anthropocentric science, i.e. all that counts (for economists) is what is perceived by man. Of course, there are modifications to this strict neoclassical principle but as a general rule it holds that there is no room for purely intrinsic values of nature in an economic valuation analysis. This is one of the main differences between an economic and an ecological analysis of natural values.

Technically speaking, if we want to assess the benefits agriculture creates for society we have to measure the change in social welfare (or social well-being) caused by agricultural activities. In a democratic society the concept of social welfare has to be based on individual welfare or utility. Therefore, the economic valuation of agricultural activities aims at the assessment of the change in social welfare, which must be “filtered” out of the preferences of all individuals affected by these activities. An economic valuation analysis then consists of two steps: in the first step the individual utility changes resulting from agricultural activities have to be assessed and in the second step they have to be aggregated to obtain the resulting change in social welfare. The first step is known as the identification problem while the second step is the aggregation problem of economic valuation. This is illustrated in the figure 1 below.



As mentioned above the anthropocentric character of neo-classical welfare theory implies that the economic value of some good or service is equal to the utility it creates for

man, i.e. to the change in utility it causes. It is clear that such a change in well-being cannot be measured in “utility units” since such units are neither uniquely defined nor empirically observable. The obvious measuring rod is, of course, money. If we measure the utility change caused by agricultural activities in monetary terms the respective amount can serve as a basis for potential compensation payments to farmers.

The most important theoretical money measures of utility are the Compensating Variation and the Equivalent Variation which both go back to HICKS (1942). Both measures can be interpreted as specific transformations of the household utility function, which normalize the utility function so that it measures utility changes in monetary terms. Since the economic interpretation of the Compensating Variation (CV) is more intuitive and can, therefore, be better communicated to non-economists than the Equivalent Variation most applied valuation studies use the CV as an individual welfare measure.

The Compensating Variation for a utility increasing (decreasing) experience equals the maximum (minimum) amount of money that could be extracted from (must be given to) an individual after this experience without making her or him worse off than in the initial situation. Therefore, the CV for a utility increasing experience can also be interpreted as an individual's maximum willingness to pay (WTP) for that experience while the CV for a utility decreasing experience can be interpreted as an individual's minimum willingness to accept compensation (WTA). From the mathematical definition of the CV it follows that this money metric is strictly monotonically related to the utility changes it represents. It is positive, zero or negative if and only if utility increases, is constant or decreases, respectively.

It should be noted that within the framework of ordinal utility theory for a given utility change only the sign of the utility measure representing this change is uniquely determined while its absolute amount is arbitrary. It depends on the specific (continuous, strictly monotonic) transformation of the utility function used to construct this measure. As mentioned above, the CV corresponds to one specific transformation of the utility function, while e.g. the Equivalent Variation corresponds to another transformation of the same utility function. This implies that one and the same utility change can be represented by two different amounts of money according to which of these two money measures is used. Of course, any other strictly monotonic transformation of the utility function could also be used as a utility measure, which means that the absolute value of a utility measure depends on a pragmatic convention and is, therefore, arbitrary from a theoretical point of view. Its sign, on the other hand, is uniquely determined and, therefore,

also significant from a theoretical perspective. While this point has been common knowledge among economic theorists for a long time now (cf. e.g. BLACKORBY and DONALDSON, 1985, 1988, 1990) it is often neglected in

practical cost-benefit analyses, especially, when it comes to the interpretation of results.

It is well-known from the seminal work of ARROW (1950) that under fairly reasonable assumptions a uniquely defined social preference ordering cannot be derived on the basis of individual preference orderings as long as we stay within the world of ordinal utility theory. Any form of aggregation implies interpersonal utility comparisons, which are not viable within the framework of ordinal utility theory since the absolute values of utility levels and utility changes are not uniquely determined there. However, it has become common practice in applied valuation studies to simply add up the Compensating Variations over all individuals and to interpret this sum as the social value of the public good or project under consideration. This aggregation mode is not satisfactory from a theoretical point of view but we shall accept the sad facts of life for the rest of this paper and concentrate on the identification problem.

### 3. Practical methods for the economic valuation of agricultural services

In this section we deal with the empirical assessment of the Compensating Variation for agricultural non-market production, which has many features of a public good. If farmers act more and more as "landscape gardeners" in the future the countryside might - even more than today - turn into a recreation area with hiking grounds and beautiful sceneries, streams might be dammed to create new lakes for fishing, swimming and boating etc. The economic valuation of "goods" like rural amenity is, of course, much more difficult to solve than the assessment of the CV for goods that are traded in markets. In the latter case the CV is represented by the integral over the Hicksian demand functions of an individual, where this integral can be computed on the basis of the Marshallian demand system (cf. e.g. VARTIA, 1983; BRESLAV and SMITH, 1995). The computation of the CV for market commodities depends, therefore, on the observation of individual market behavior, which is represented by the respective Marshallian demand functions. This assessment strategy, i.e. the observation of actual consumption behavior in order to derive households' preferences for some good, can only in part be applied to the valuation of non-market goods.

The various techniques for the valuation of public goods are often classified either into direct and indirect valuation methods or in revealed and stated preference assessment methods. *Direct valuation methods* are typically based on surveys where people are directly asked their WTP for the public good in question. *Indirect valuation methods* on the other hand try to value public or non-market goods in analogy to market commodities by assessing the cost an individual incurs to utilize these goods. This cost is then interpreted as an individual's WTP for the public good. Some of the indirect valuation methods are interview-based like the Travel Cost Method or the Contingent Behavior Method, others rely on the evaluation of statistical market data like the Hedonic Price Method. Still others like the Averting Behavior Method employ either interviews or statistical data to estimate the expenses people undergo to enjoy the non-market commodity to be valued. *Revealed preference* (RP) valuation methods are based on utilization behavior

shown in the past, i.e. prices people paid (e.g. real estate prices) or the cost they incurred to use some public good (e.g. travel cost, entrance fees, equipment cost etc.) while *stated preference* (SP) methods rely on interviews in which people are asked hypothetical or contingent questions about their WTP or their potential utilization behavior in the future ("How much would you be willing to pay for the creation of a new lake in your region?", "How often per year would you visit the new lake?"). The direct valuation methods obviously belong to the SP valuation methods while the class of indirect valuation methods comprises RP techniques like e.g. the Travel Cost Method as well as SP techniques like the Contingent Behavior Method.

#### 3.1 Indirect valuation

As explained above the indirect valuation methods focus on the utilization of a public good like e.g. visiting a recreation area or buying a house situated in a beautiful landscape. The cost people incur for this utilization is interpreted as their WTP for that good. The most important indirect valuation techniques are the so-called Travel Cost Method (TCM), which goes back to CLAWSON (1959) and the Hedonic Price Method (HPM) first used by RIDKER (1967). Other indirect valuation techniques are the Contingent Behavior Method and the Averting Behavior Method.

##### The Travel Cost Method

Differently from what its name suggests the TCM does not only focus on the mere costs it takes to travel to some public good like a beautiful scenery but takes into account all expenses an individual undertakes in order to make use of this amenity. TCM studies are based on interviews with a random sample of potential users of the public good in question where respondents are asked questions concerning their actual utilization behavior like "How often per year do you visit this site?", "How much time does it take you to get there?", "How much does it cost you to get there?", "How long do you usually stay?", "How much do you spend on equipment for hiking there?" etc. From these data demand functions for natural amenities are estimated which express the number of trips to some site as a function of the costs per trip (including travel time). Recent TCM studies estimate multiple site demand models that explain the demand for recreational trips as a function of costs and of several environmental attributes that vary over different sites. The social value of changes of environmental quality is then calculated by taking the integral over such a demand function in the limits between the old and the new quality standard.<sup>1</sup> Since these demand functions are, of course, of the Marshallian type their integration generates all the problems known from the discussion of the Marshallian consumer's surplus (like path-dependency of the integral) and it does not lead to the CV because Hicksian demand functions would be needed then.

Another difficult - if not unsolvable - problem in this context is the valuation of time. On the one hand it is far from obvious which part of the utilization time should be regarded as "costs" and on the other it is not clear which "price" for the time should be chosen for the valuation. If an indi-

<sup>1</sup> For a clear description of the various forms of TCM studies see e.g. BOCKSTAEL (1995).

vidual enjoys driving his car to the site or riding the train this part of the utilization time cannot reasonably be counted as visiting "costs". In early TCM studies the utilization time was valued by an individual's wage rate, but today more sophisticated methods for the valuation of time are used.<sup>2</sup> For more detailed treatments of this problem see e.g. RANDALL (1994) or FEATHER and SHAW (1999). Another problem is what part of the expenditures on e.g. meals eaten on the site or hiking boots and other equipment should be ascribed to the utilization of a specific hiking site or landscape since they could also be used for other sites.

Apparently, there is a good deal of arbitrariness connected with the TCM so that its use for the valuation of non-commodity production of agriculture (or other public goods) seems to be rather questionable from a theoretical point of view.<sup>3</sup> Nevertheless, the TCM as well as other RP valuation methods still carries the myth of an "exactness" it does not really possess. The information on the utilization behavior of a household or individual used to calculate the "travel cost" or utilization cost is received from interviews just like the information underlying the SP methods. Therefore, it is also subject to errors or wrong statements on the side of the respondents, though the incentives for strategic false answers is definitely smaller than in interviews aiming directly at the WTP. Nevertheless, today TCM studies are mainly used in combination with SP methods like Contingent Behavior or Contingent Valuation and very often they serve to test the validity and reliability of the latter (cf. e.g. ADAMOWICZ et al., 1994; HUANG et al., 1997; MCCONNELL et al., 1999; AZEVEDO et al., 2003).

### The Contingent Behavior Method

A related valuation technique is the so-called "Contingent Behavior Method" (CBM). While traditional TCM relies on actual or "revealed" utilization behavior in CBM surveys people are asked their hypothetical future utilization behavior contingent on a change in the quality or quantity of an environmental good. In CBM interviews the intended improvements of an amenity are first explained to respondents and then they are asked how these improvements will change their future utilization behavior. The resulting change in utilization costs is then interpreted as the WTP for the change in the quality of the site. Since it deals with hypothetical questions the CBM is counted as an indirect SP valuation method. CBM is used as a complement to RP studies and as a means to test the validity of TCM results (cf. e.g. GRIJALVA et al., 2002; AZEVEDO et al., 2003).

### The Hedonic Price Method

Another important indirect assessment technique is the Hedonic Price Method. It is based on the idea that the prices of commodities can be expressed as functions of the characteristic properties of these commodities. This idea that goes back to LANCASTER'S (1966) "New Approach to Consumer Theory" was already used by MOREY in the 1980s for his "Characteristics Approach" to value recreati-

onal projects like e.g. the creation of a new ski area (cf. MOREY, 1981, 1985).

The HPM is often applied to the real estate market where data from sales of houses and building sites in a certain region are collected. These data refer to various characteristics or attributes of the houses and sites traded in this region (like technical condition and age, space and number of rooms, socioeconomic characteristics of the neighborhood and environmental characteristics like air quality, view, noisiness etc.) on the one hand and the prices at which they were sold on the other. From these data the so-called hedonic price function is estimated which expresses the price of an estate as a function of its various characteristics. Since it is estimated from market data it is supposed to represent market equilibria. Taking the partial derivative of the hedonic price function with respect to one of the characteristics at some point (i.e. for a given bundle of attributes) leads to the implicit price of this characteristic which indicates how much a buyer would have to pay more if he desired a marginal increase in this characteristic (all other attributes remaining unchanged). This implicit price can also be interpreted as the individual marginal WTP for the respective attribute (e.g. a beautiful landscape in the neighborhood) of all buyers who have contracted at this point of the hedonic price function.

If we want to value a marginal improvement of the quality of this landscape we can just add up the marginal WTPs of all individuals affected by this change. Things become more complicated if we want to value non-marginal changes. In this case correct assessment would require to identify the individual (income-compensated) WTP functions ("bid-functions") of all households and to take the integrals over these functions in the limits between the new and the old quality level. Unfortunately, only one point of such an individual function, its intersection with the hedonic price function, can be observed empirically. A very rough approximation to the "true" welfare change induced by a finite improvement of an environmental good would be to compute the integral over the respective derivative of the hedonic price function in the limits between the new and the old quality level (cf. e.g. FREEMAN, 1995: 680-681). In practice a HPM survey can become highly complicated and still capture only a small part of the total social benefits it wants to measure. Recent examples for HPM studies are IRWIN (2002) where the social value of preserving open space preservation is measured by its effects on the real estate prices in nearby residential areas or SCARPA et al. (2003a) where the social value of indigenous cattle breed in Kenya is assessed by a hedonic analysis of the local cattle markets.

The HPM is a typical indirect valuation technique which derives the WTP indirectly from preferences people reveal through their market (trans)actions, i.e. it is also a classical RP assessment technique.<sup>4</sup> The reliability of the HPM depends decisively on the availability of a sufficient number of real estate market observations to make the result of a HPM study significant. Often there are not enough suitable data available since not enough houses with comparable characteristics change their owners within a reasonable

<sup>2</sup> A quite extensive survey of the role of time can be found in HAAB and MCCONNELL (2002: 145 ff.).

<sup>3</sup> For more comprehensive treatments of the TCM see e.g. BOCKSTAEEL et al. (1991: 238 ff.) or BOCKSTAEEL (1995).

<sup>4</sup> For more detailed presentations of this method see e.g. PALMQUIST (1991), FREEMAN (1995) or STEWART and JONES (1998).

period of time. If this period is too long price differences between houses cannot be ascribed unambiguously to differences in their characteristics alone. In such cases the results of a HPM study are misleading. Another problem arising in the context of the valuation of natural amenities is that only those benefits are captured that arise to people who buy houses or land near the site in question. But when we are dealing e.g. with a beautiful rural landscape created by agriculture where people come from far away for hiking and sightseeing only a small part of the total benefits generated by this agricultural activity is measured by the HPM. Nevertheless, the HPM is still quite popular for the practical appraisal of natural amenities. Typical examples for recent HPM studies are GEOGHEGAN et al. (1997) who apply the HPM to value agricultural and forested land, TYRÄVINEN and MIETINEN (2000) who assess the influence of urban forests on real estate prices, GEOGHEGAN (2002) or IRWIN and BOCKSTAEEL (2001) who deal with the influence of open space land on state prices. An increasing number of studies uses the HPM to complement the results of Contingent Behavior or Contingent Valuation studies or to test the validity of these SP techniques (cf. e.g. IRWIN, 2002; SCARPA et al., 2003a).

### The Averting Behavior Method

Another indirect RP valuation technique is the Averting Behavior Method (ABM). If e.g. the quality of drinking water in some region is improved people may reduce their efforts to compensate for the formerly bad water quality, i.e. measures to avert the negative effects of using polluted water in their households. Such averting efforts are typically the installation of water filtering systems in people's houses, boiling the drinking water, buying bottled water or drilling private wells. The cost for these measures can be saved if the water quality improves. The basic idea of the ABM approach is that people will invest the more money in averting measures the more they are worried about the prevailing water quality and the more they would, therefore, appreciate its improvement. Therefore, the cost people incur in order to avert the negative effects of contaminated drinking water is taken as their WTP for the improvement of water quality.

The economic appraisal of improvements in drinking water quality, especially in developing countries, has been the main field of application of the ABM approach (cf. e.g. ABDALLA, 1990; ABDALLA et al., 1992; UM et al. 2002), but it is also used for the valuation of other environmental changes (cf. BARTIK, 1988; LAUGHLAND et al., 1996) or of health care measures (cf. WILSON, 2003). It is obvious that the ABM can produce only very rough approximations to the "true" social value of e.g. improved drinking water quality. Especially, in developing countries many people might not be aware of the technical possibilities to avert the negative effects of water pollution or they might not be able to afford them. Further, the availability of the necessary technical equipment might be restricted due to political failure or bad organization. Nevertheless, it seems that ABM has been used quite often in developing countries.

Another problem of the indirect valuation methods has not been mentioned here until now. By definition all these assessment techniques evaluate people's activities to utilize the environmental good under consideration. This implies

that all welfare effects, which are not directly connected with such utilization activities, are not registered by indirect valuation techniques. As first noticed by WEISBROD (1964) and KRUTILLA (1967) public goods and, especially, environmental public goods generate not only such use values as measured by the indirect valuation methods but often have also so-called nonuse values to households like existence or bequest values which are completely independent of any observable utilization activity. Especially, in the context of the typical agricultural non-commodity output "food security" the concept of option value might be of importance, which is also independent of observable utilization activities.<sup>5</sup> Since the indirect valuation methods depend on the observation of utilization activities of households they are "blind" to nonuse values. For the assessment of the total value of a public good, including use and non-use values, therefore, different methods must be used as will be shown in the next section.

### 3.2 Direct valuation

In contrast to the indirect valuation methods the direct assessment techniques aim directly at the elicitation of people's WTP for some public good. They are based on face-to-face interviews, mail surveys or telephone interviews where respondents are directly asked their WTP for the good in question. Since these are typically hypothetical questions (because the public good usually is supplied for free) the direct valuation methods belong to the SP techniques. The most important direct assessment methods today are the Contingent Valuation Method (CVM) which aims at the valuation of a public good as a whole and the so-called Attribute Based Choice Modeling (ABCM) methods like Conjoint Analysis, Choice Experiments, Contingent Ranking etc. As variants of CVM and ABCM the group-based so-called participatory valuation techniques have gained increasing importance during the last couple of years.

### Contingent Valuation

For a CVM survey typically a random sample of the population affected by some public good like e.g. a beautiful landscape is drawn. Then the average (or median) WTP of this sample is assessed and multiplied by the total number of all households affected by this public good in order to calculate its social value. The basic idea of the Contingent Valuation Method is to create hypothetical or "contingent" markets for the public good in the course of an interview and to assess a respondent's WTP for that good.

The structure of a CVM interview can be divided into three main steps. In the first step the public good to be valued must be described to the respondent. This is an important task since if the respondent gets a wrong or inexact picture of the good to be valued the resulting so-called "information bias" may turn the whole study worthless. In the second step the design and mechanism of the hypothetical market must be explained to the respondents. In this context it is especially important to find a realistic payment scenario in which the so-called payment vehicle, the payment

<sup>5</sup> For more detailed descriptions of the relationship between use and nonuse values see e.g. MITCHELL and CARSON (1989: 67 ff.), SHECHTER and FREEMAN (1994) or CUMMINGS and HARRISON (1995).

rule and the implementation rule are fixed. As a payment scenario one could tell respondents e.g. that (1) an additional tax is planned to compensate farmers for their non-commodity production (payment vehicle), that (2) without this tax many farmers would have to close down their farms which would lead to a severe loss in biodiversity and rural amenities (implementation rule) and that (3) every household living in the region under consideration would have to pay the same tax if it was approved by a majority of the people concerned (payment rule). The last step aims at the elicitation of the respondents' WTP. In the early days of Contingent Valuation the open-ended question format ("How much would you be willing to pay for the good under consideration?") was used but it was abandoned soon since people seemed to have no clear idea of how they should value environmental goods like e.g. a beautiful landscape. As an alternative to the open-ended elicitation method BISHOP and HEBERLEIN (1979) proposed the so-called dichotomous choice or referendum question format where respondents are confronted with a fixed payment proposal (e.g. 50 Euro per year) at which they can "buy" the agricultural service considered or leave it. By confronting several groups of households with different WTP proposals one can derive a kind of aggregate WTP function for the environmental good in question from which the "social" WTP can be calculated. In most dichotomous choice surveys today one or even two follow-up questions are added to the single-question format of the original dichotomous choice version in order to obtain more observations per interview and, thereby, lower the costs of such surveys (cf. e.g. HANEMANN et al., 1991; LANGFORD et al., 1996; CAMERON and QUIGGIN, 1994). It is interesting to note that recently the debate on the best question format has shifted back towards open-ended questions since they have considerable statistical advantages as compared to the dichotomous choice format. A number of CVM studies during the last couple of years dealt with the differences and relative advantages of both question formats using experiments (cf. e.g. LUNANDER, 1998; FRYKBLUM, 2000; BALISTRERI et al., 2001; BOTELHO and PINTO, 2002).

There has been a lot of criticism of the Contingent Valuation Method during the last years where the reliability and validity of the CVM has been questioned in many ways. It would be hopeless to review the debate on the CVM, which comprises between one and two thousand papers and articles now. One of the main points of criticism is that the CVM asks hypothetical questions, i.e. people state a WTP that they do not really have to pay. Therefore, it is feared that respondents do not observe their actual budget constraint and state an unrealistic WTP or that they overstate or understate their true WTP for strategic reasons in order to influence the outcome of a CVM survey (cf. e.g. DIAMOND and HAUSMAN, 1994: 46; LOOMIS et al., 1994; PORTNEY, 1994; AHLHEIM, 1998). Even "free riding" was suspected though respondents do not have to pay actually so that free riding does not really make sense here. Some authors argue that the WTP stated by respondents might refer to the "warm glow" they feel when they state a generous WTP for a good cause like an environmental improvement rather than to the specific good they are supposed to value (cf. e.g. DIAMOND and HAUSMAN, 1994). Still others find it puzzling that the WTP for a certain environmental improvement differs in its absolute value from the

WTA for a renunciation of this improvement though, as was shown above, WTA and WTP are different transformations of the same utility function so that one should expect different absolute values (cf. e.g. AHLHEIM and BUCHHOLZ, 2000). Another point of irritation is that WTP stated in CVM surveys sometimes did not increase strictly monotonically with the scale of environmental improvement so that the existence of a so-called "embedding effect" was suspected (cf. e.g. DESVOUSGES et al., 1993; KAHNEMAN and KNETSCH, 1992; CARSON and MITCHELL, 1995; CHILTON and HUTCHINSON, 2003 for a treatment of the related scope effect of CVM). In order to guarantee a minimum standard of reliability and validity of CVM studies the NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (1993) issued a catalogue of requirements for CVM surveys which has become a generally accepted guideline for such surveys today.

In spite of all the criticism, which is justified in some points and wrong in many others the Contingent Valuation Method still seems to be the most popular technique for a comprehensive assessment of environmental values, i.e. for the assessment of use and nonuse values of public goods. This impression is supported by the great number of CVM surveys that have been conducted and published recently (see e.g. RAJE et al., 2002; ZHONGMIN et al., 2003; CICIA et al., 2003) and papers dealing with special aspects of CVM (cf. AMIGUES et al., 2002; SVEDSÄTER, 2003), some of them testing its validity using other valuation methods as benchmarks (among many others cf. e.g. KWAK et al., 2001; KAMUANGA et al., 2001; AADLAND and CAPLAN, 2003). An essential task for the future is to decrease the costs of CVM studies, which are still very high today. One significant step into this direction is the development of benefit transfer techniques where the estimated parameters from completed CVM surveys can partly be used for the valuation of similar environmental goods in a similar socio-economic setting. For a closer analysis of this technique see e.g. SHRESTHA and LOOMIS (2001), MORRISSON et al. (2002) or AHLHEIM and LEHR (2002).

### Attribute Based Choice Modeling

While the CVM aims at the assessment of a comprehensive value for an environmental good like a beautiful landscape the Attribute Based Choice Modeling (ABCM) methods try to value the different characteristics of such a good: the forests, the meadows, the fields, the roads etc. So, ABCM is a multidimensional or multi-attribute valuation technique where CVM is, in principle, one-dimensional. Like Contingent Valuation ABCM is interview-based, but unlike Contingent Valuation an ABCM survey has to rely on face-to-face interviews (i.e. no mail or telephone surveys). ABCM comprises several different valuation methods like Choice Experiments, Contingent Ranking, Contingent Rating which are all closely related to Conjoint Analysis, a valuation method that has been very popular in marketing surveys for many years (ADAMOWICZ et al., 1998; LOUVIERE et al., 2000; OECD, 2002).

The definitional borderlines between the various kinds of ABCM techniques are not really clear-cut in the valuation literature. The ABCM technique closest to economic theory is Choice Experiments (CE), but often the same kind of analysis (or a rather similar one) is labeled Conjoint Analy-

sis (cf. e.g. FARBER and GRINER, 2000) or Multi-Attribute Utility Theory (cf. KWAK et al., 2001). In principle, all these methods are based on LANCASTER'S (1966) seminal paper on "A new approach to utility theory" where he holds that people derive utility not from commodities but from the properties (or characteristics or attributes) of these commodities. Consequently he tried to derive demand functions for the different attributes of commodities rather than for whole commodities. Analogously, ABCM surveys try to value e.g. an environmental good not as a whole but as the sum of the values of its various characteristics.

In a typical CE interview respondents are confronted with different versions of the same environmental good, e.g. a rural landscape, where one version differs from the others by the level of several attributes like the expanse of woods or fields, the existence of a lake or a stream, the possibilities for hiking, fishing, swimming etc. and the financial contribution the respondent would be asked to pay for the provision of the respective mix of attributes. Treating this financial contribution as just one attribute among many others abolishes the outstanding position that WTP has in CVM surveys. Each set of attributes characterizing one possible version of the good to be valued is listed on a so-called choice card, where each card differs from the others by the quantity or quality of several attributes so that, strictly speaking, each card describes another good. The respondent makes his choice in several rounds where in each round he has to choose the card he prefers most out of a number of two to five different cards. In a typical CE survey between 200 and 400 persons are interviewed. For example SCARPA et al. (2003a) interviewed 310 people, which lead to a number of 2500 choice tasks. From the resulting data set a random utility model is estimated from which the average WTPs of the population for the various attributes of the environmental (or other) good in question can be calculated (for the technical details of estimating and analyzing random utility models cf. e.g. MCFADDEN, 1974; ANDERSON et al., 1992).

The proponents of ABCM hold that the elicitation of the WTP is more subtle in Choice Experiments than in a CVM interview and that, therefore, the danger of strategic answers of respondents is much lower. Another advantage is that more information is obtained and that different forms or versions of the same good can be valued. This might be an advantage with respect to the valuation of agricultural outputs like the conservation of the countryside. On the other hand ABCM has the same theoretical and empirical disadvantages as CVM. It is prone to the same biases, e.g. the choice situation is only a hypothetical one ("hypothetical bias"), the answers of respondents depend on their pre-information on the goods to be valued and their ability to process new information ("information bias"), their ability to imagine the hypothetical goods to be valued, their attitude towards the interviewer ("interviewer bias") etc. Especially, the hypothetical and artificial character of the goods to be valued becomes more obvious when respondents are confronted with different versions of the same good. Last but not least it should be noted that the econometric techniques used for ABCM surveys are more complicated and more prone to mistakes than the models used for the analysis of CVM data. Therefore, the enthusiasm for ABCM that could recently be observed in the valuation literature is not really understandable.

## Participatory Approaches

One point of criticism of CVM and ABCM is that ordinary people have not enough information on many environmental issues like e.g. the preservation of biodiversity or the importance of fields and forests for climate policy to form a serious judgment about their monetary value. Therefore, the results of traditional CVM or ABCM surveys are not meaningful enough to base political decisions on them. As an alternative to these valuation techniques so-called participatory approaches, often also termed discursive or deliberative methods, have recently been proposed. These approaches recommend group based decisions to improve the validity of valuation results. The main idea behind these proposals is that laymen can increase their knowledge of environmental issues and get a better foundation of their value judgments if they have the possibility to discuss these issues with other people and with experts in the respective fields.

There are many different forms to organize participatory valuation of public goods where the most popular are Citizen Juries (CJ) and Market Stalls (MS). For both approaches representative random groups of citizens are chosen from the relevant population to discuss the issues to be valued over several days. Citizen Juries consist of 10 to 12 people who meet over two or three days to discuss within their group and with external experts the implications of the problem they have to decide on. At the end of the last meeting they agree on how to proceed with the matter under consideration. In some but not all cases a common monetary assessment of e.g. a specific environmental good is asked after the last meeting. Unlike the Citizen Juries MS groups aim directly at the monetary valuation of the environmental goods under consideration. Again there are several group meetings with internal and external discussions where at the end of each meeting the participants have to write down confidentially their WTP for the good in question. In the meantime between meetings group members are asked to write down their thoughts and questions regarding the environmental good to be valued in a personal diary. In the next meeting these notes are discussed in the group and then participants have to write down their "updated" WTP for the good in question again (for more detailed descriptions of these and other participatory valuation techniques see e.g. KENYON and NEVIN, 2001; MACMILLAN et al., 2002; ANANDA and HERATH, 2003).

The advantages of these approaches are obvious: people can gather information on matters formerly unknown to them which makes their judgments more profound and their stated WTP more meaningful. Apart from the information problem it is sometimes argued that environmental concerns often involve e.g. ethical judgments, which are determined independently of any economic use (SAGOFF, 1998; O'CONNOR and SPASH, 1999; HILL and ZAMMIT, 2000). Particularly in situations that are characterized by ecological change, uncertainties, social conflict and complexity (common to research concerning the development of traditional agricultural landscapes), meaningful monetary value estimates for rural amenities or ecological processes are difficult. In such cases group discussion might help people to form preferences with regard to issues they had never thought about before. NIEMEYER and SPASH (2001) argue that prior to a valuation task such a process of

preference formation has to take place so that a firm preference structure can develop before people are asked their personal valuation of some environmental good. For the same reasons SAGOFF (1998), NORTON et al. (1998) and SÖDERHOLM (2001) advocate instruments that include reasoned dialogue, public articulation and argument based on evidence and different points of view. Their main argument is that people do not correspond to valuation techniques as individual 'consumers' but rather as 'citizens' voicing a collective point of view (cf. BLAMEY et al., 1995) and O'NEILL (1997) states that individual values and preferences are rooted in institutional, social and cultural contexts, anyway.

The idea of participatory valuation of environmental goods means a serious challenge to the welfare theoretical roots of economic valuation. Traditional welfare theory assumes that individual preferences are independent and not dominated by other people's preferences. The group processes and discussions with experts implied by the participatory valuation techniques are apt to violate these assumptions. Especially problematic is the fact that the WTPs stated by the participants of Citizen Juries or Market Stalls are extrapolated to the whole population affected by the environmental good or project to be valued. Since the participants of CJ or MS have information on the good or project in question the rest of the population (the majority!) does not have the WTP assessed by generalizing the CJ or MS valuation is not representative for the population concerned. It is a hypothetical valuation that would hold if all people had had the chance to participate in the group discussions. This valuation might be more competent and also "better" for society as a decision criterion than a mere CVM result but there remains a certain uneasiness concerning our understanding of democracy. Therefore, the participatory valuation techniques should be further developed and tested and they should be part of complicated decision processes but they should not be the sole decision criterion in environmental questions. CJ and MS should rather complement than substitute CVM in environmental policy.

#### 4. Specific problems of assessing the value of agriculture to society

The multiple functions of agricultural landscapes interact in complex ways, one activity may have positive external effects on some aspect, e.g. beauty of the landscape, but the same activity can have negative effects on other aspects, e.g. groundwater contamination, depending on the level of intensification, for instance. Therefore, we consider it a futile attempt to integrate all the multiple functions that agriculture may have into one valuation study and, instead, suggest to consider for the time being each function by itself in order to shed light on the specific problems involved in the assessment of their values to society and to review the empirical studies carried for their assessment.

Following a study of the OECD (2001) on multifunctionality in agriculture, the main functions of agriculture are (among others) the provision of rural amenities, the preservation of biological diversity, the sustenance of beneficial ecological processes, food security and rural viability. Other aspects like e.g. animal welfare will not be discussed in this paper. We will now deal with each function in turn

and assess the possibilities for employing the described valuation techniques in conjunction with a survey of the relevant empirical literature.

#### Rural amenities

The agricultural output "provision of rural amenities" refers to aesthetic and cultural features of a landscape, i.e. its "attractiveness to the mind". On the one hand, it is associated with use values, e.g. recreational activities in a beautiful surrounding or visits to a site of agricultural heritage. Therefore, the indirect valuation methods TCM and HPM discussed in section 3 are applicable here for the assessment of a countryside's use value to society. The influence of open space near residential areas on the housing prices has recently been analyzed by IRWIN (2002) and GEOGHEGAN (2002) employing the HPM. As main results both studies show that the presence of non-developable open space, e.g. public open space, is valued significantly higher than open space that carries a potential for future development, e.g. privately owned cropland or forests (see also CHESHIRE and SHEPPARD, 1995).

From what was said in section 3 it is obvious that CVM as well as the ABCM methods are suited best for the assessment of the total value, i.e. use and nonuse value, of rural amenities to society. Also the participatory valuation techniques can assess the total value of beautiful scenery where, of course, the above-mentioned reservations hold. It is not always easy to construct plausible and clearly defined landscape scenarios for the interviews, though it is of great importance that all respondents get the same idea of what is to be valued (FISCHHOFF et al., 1993). Most empirical studies employing SP methods have focused on the residents of a specific area while tourists and other visitors of the respective site were neglected. For example JUNG (1995) and ROSCHEWITZ (1999) aim at the elicitation of residents' valuations to prevent an imminent change of the traditional agricultural landscape. Other CVM studies focusing on residents' preferences for agricultural landscape conservation are e.g. KÄMMERER et al. (1996), DRAKE (1992), CORELL (1994), and V. ALVENSLEBEN and SCHLEYERBACH (1994).

In contrast to the just mentioned works, some authors focus on the preferences of tourists who form the other important stakeholder group of agricultural land design. PRUCKNER (1995) employs the CVM to elicit the WTP of tourists from different countries visiting selected scenic areas of Austria. He can show that WTP to compensate local farmers' caretaking activities through a per diem touristic surcharge is positively correlated with the tourists' ex ante perceptions about farmers' roles in the appearance of the countryside. It is particularly remarkable that tourists from countries in which farmed lands play only a minor role for recreational activities, like in the United States, showed only a low approval rate for compensation payments. Based on these findings HACKL and PRUCKNER (1997) construct compensation payment programmes in relation to tourists' benefits from agriculture and show the efficiency of this mechanism in a formal analysis. More recently, GONZÁLEZ and LEÓN (2003) tested the hypothesis that preferences for recreational attributes change over the course of the "consumption process". To this end, both a CVM and an ABCM (Contingent Ranking) approach were employed with samples of



tourists visiting natural and scenic areas on the island of Gran Canaria. It could be shown that the tourists' valuations of the hypothetical scenarios were generally larger during the "consumption experience" than when interviewed upon departure. These effects were more pronounced with the Contingent Ranking approach than with the CVM. A combination of direct and indirect valuation methods is employed by ROSENBERGER and LOOMIS (1999) and FLEISCHER and TSUR (2000) who combine the TCM with hypothetical scenarios of the CVM.<sup>6</sup> Based on actual visitation data for recreational purposes both studies calculate the change of a consumer's surplus welfare measure due to a hypothetical change of the quality of the agricultural landscape.

Finally, some authors consider tourists' as well as residents' preferences for landscape amenities within the same study. Both HACKL (1997) and ROMMEL (1998) employ the CVM with samples split into residents and tourists. However, practical difficulties arise since usually different payment vehicles, e.g. payments to a fund for the residents and per diem surcharges for the tourists, are used. MORRISON et al. (2000) show the biasing effect of different payment vehicles due to different degrees of payment vehicle aversion so that an aggregation of the results of the two samples is very problematic.

Conservation of the countryside and provision of rural amenities are the most important and the most visible non-commodity outputs of the agricultural sector. If EU subsidy policy will be oriented away from agricultural market outputs the valuation of rural amenities will become one of the central issues of the new subsidy system (cf. e.g. RANDALL, 2002). Adequate valuation techniques are definitely CVM and ABCM, while the TCM can only capture the use value of a beautiful countryside. The HPM assesses only the use values accruing to estate owners or renters, which is even more restrictive. In principle, participative approaches are also well suited for the appraisal of rural amenities but the above-mentioned reservations should be kept in mind.

### Biodiversity preservation

While the valuation of rural amenities proved to be rather multifaceted from a theoretical and practical point of view, the agricultural function "preservation of biological diversity" requires even more consideration. As LACHER et al. (1999) point out the conversion of natural lands to agricultural lands has both positive and negative effects on the diversity of organisms. The edge effect leads to higher species numbers at border lines between ecosystems, thus to an increased diversity. However, continuing fragmentation of habitats increase the risk of extinction when the habitats become disconnected and too small to sustain a population. In the last decades the practice of using agrochemicals for pest control resulted in an extreme loss of diversity on the farmland due to unspecific effects on non-target species. Only recently could this severe development be reversed through the creation of unsprayed field margins and more target specific pesticides.

Turning to the practical issues, the valuation of biological diversity in agricultural landscapes is associated with a number of problems that are not easily resolved. On the one hand, the existence of diverse plant and animal species in agricultural landscapes carries an aesthetic value. Most important due to their visibility are plants and with them the changing aspects of plant communities in the course of the year. On the other hand, plant and animal species perform important ecological functions within agricultural systems and natural landscapes, e.g. certain natural plants may be hosts for beneficial species for biological pest control (see COLLINS et al. (1998) for a comprehensive assessment of and OECD (2003) for suitable indicators for biodiversity in agricultural ecosystems). Within the general population the specific functions of the natural organisms within agricultural landscapes are hardly known and large groups of functionally important organisms remain hidden to the eye.

Even natural scientists state that there exists a lack of knowledge concerning the functional importance of species in natural ecosystems, let alone in agricultural systems (NAEEM and WRIGHT, 2003; TILMAN et al., 1997; WARDLE et al., 1997). Among biologists there seems to be consensus to distinguish keystone species from redundant species (LAWTON, 1994). Keystone species are seen to perform central and essential functions within an ecosystem at a particular state of the system while redundant species do not perform such unique functions and could, therefore, in principle be replaced by other species with a similar functional capacity. However, it is now common to acknowledge their "insurance value" within ecosystem functioning. Yet another layer of complexity needs to be added to the discussion of diversity's importance if its role as "production inputs" into the development of new agricultural seeds or substances for the chemical and pharmaceutical industries is taken into account (GOESCHL and SWANSON, 2002; CRAFT and SIMPSON, 2001; RAUSSER and SMALL, 2000; WEITZMAN, 1998).

From this short discussion it becomes obvious that the role of diversity in agricultural systems remains hazy. What is the "right" level of diversity to be preserved within an agricultural landscape, which species could in principle be "sacrificed" in a region without much harm? Keeping the above discussion in mind, what is the role of the CVM or ABCM in the assessment of the societal value of preserving biological diversity in agricultural landscapes? The first aspect, aesthetic values, can be dealt with as in the case of rural amenities because they depend solely on personal preferences and in a CVM or ABCM survey for their elicitation reasonable results can be expected. The assessment of functional and option values is more problematic since, as mentioned above, the knowledge about species' functions in ecosystems and about their genetic uniqueness is on the one hand scarce among common people and on the other hand this knowledge is most probably unevenly distributed (SPASH and HANLEY, 1995; LEWAN and SÖDERQVIST, 2002). It is an important precondition, though, for reliable results in a CVM survey that the "good" to be valued be well defined and equally well understood by the respondents. Therefore, the participatory assessment approaches show important comparative advantages when it comes to valuing the functional and option values of biodiversity. Empirical work employing monetary partici-

<sup>6</sup> See LOOMIS (1993) and KLING (1997) for theoretical discussions about the validity of hypothetical visitation data and the combination of travel cost and contingent valuation methods, respectively.

patory valuation techniques are currently in the process of development and until now hardly go beyond single species scenarios (MACMILLAN et al., 2002).

It is astonishing that in spite of this lack of knowledge and expertise in the broad public many assessment studies based on individual valuations can be found in the literature. NUNES et al. (2003), NUNES and VAN DEN BERGH (2001) and LOOMIS and WHITE (1996) provide comprehensive overviews and discussions of results ranging from single species valuations to the value of entire ecosystems. Empirical studies aiming at a comprehensive valuation of genetic resources use the CVM like e.g. JUNG (1995) or CICA et al. (2003). Other studies focus on the valuation or ranking of single aspects of biodiversity like e.g. different genetic traits of plants or animals by using either CE (cf. e.g. SCARPA et al., 2003a, 2003b) or Conjoint Analysis (cf. e.g. TANO et al., 2003) and then compare these attribute based results to comprehensive valuations gained from CVM surveys on the same subject. The ranking of ecosystem services by respondents is studied e.g. by LEWAN and SÖDERQUIST (2003) and by MÜLLER et al. (2001) and MÜLLER (2002) using Conjoint Analysis.

This brief overview of empirical work illustrates that the economic valuation of biodiversity is still an unsolved problem. It is not even clear if biodiversity preservation is really a question that can be reasonably discussed with "common people" or if it is a question that should be discussed among experts only. If the public is to be included in this discussion the participatory approaches which imply a transfer of knowledge and expertise to those people who have to value biodiversity preservation projects afterwards seem to be a good compromise between pure expert circles and CVM surveys with "the man in the street" who has no previous knowledge on biodiversity at all.

#### **Sustenance of beneficial ecological processes**

This kind of agricultural non-commodity output refers e.g. to the provision of CO<sub>2</sub> sinks by agriculture or the filtration of ground water. There is a vast literature on the economic valuation of climate policy as well as on people's WTP for drinking water supply. This literature does not seem to be directly applicable to the assessment of agricultural non-market production. The contribution of agriculture to EU climate policy can hardly be perceived and appreciated by common people so that from our point of view it does not make much sense to appraise this facet of agricultural non-market production by standard valuation methods like CVM. The same holds for the non-market output "water filtration" which is explicitly listed by e.g. OECD (2001). In most European countries waterworks guarantee a certain quality standard of drinking water so that increased water filtration through agricultural land use is "compensated" by less filtration efforts by the water suppliers so that consumers do not perceive the difference. Therefore, consumer oriented valuation methods like CVM etc. must fail. Instead, the filtration cost saved by the water suppliers could be used to appraise this specific non-market output of agriculture. On the other hand, if households can perceive changes in drinking water quality like it is often the case in less developed countries the valuation methods discussed in section 3 are applicable. Especially, the ABM is rather

popular for the valuation of improved drinking water quality (cf. e.g. ABDALLA, 1990; ABDALLA et al., 1992; UM et al. 2002) but also CVM, ABCM and the participatory methods are applicable as the extensive literature on this topic shows.

A negative non-market output of agriculture is the contamination of groundwater as well as streams and lakes with residuals of fertilizers and pesticides. The results of this negative externality of agricultural production are visible to households as a changed fauna and flora in lakes and streams so that for the appraisal of these effects, in principle, all valuation methods discussed in section 3 can be applied - with all the reservations stated there.

#### **Food security**

In principle, the issue of food security refers to insuring a society against possible future supply shortages caused e.g. by global economic crises, deterioration of trade relations or wars. Therefore, it is theoretically expected that consumers attach a positive value to the knowledge that food supply will be maintained by domestic production if food imports are interrupted by some reason. The agricultural non-market output "food security" therefore, creates an option value which, by what was said in section 3, cannot be assessed by the indirect valuation methods. Instead, direct methods like CVM or ABCM can be applied here.

#### **Rural viability**

Turning to "rural viability", the main benefits of this agricultural function are seen in creating and securing rural employment in and around the agricultural value chain and maintaining the social structures, rural culture and agricultural tradition. However, in OECD (2001) it is argued that by an artificial maintenance of rural viability employment might be diverted from more productive activities and that unnecessary transportation, mostly by private vehicles, will take place. This problem seems to be too complex to be approached by economic methods alone. Interdisciplinary research groups comprising sociologists, economists, ethnologists, agricultural scientists and all kinds of cultural sciences are needed here.

## **5. Concluding remarks**

In this paper we shortly reviewed the principles of economic valuation and then turned to a thorough discussion of the advantages and disadvantages of the most important assessment methods available at the moment. We distinguished between direct and indirect valuation techniques where the indirect methods were shown to be suited for the assessment of use values of non-market goods only. For the assessment of the total value of non-market goods direct methods like the CVM for a comprehensive valuation or the ABCM for the valuation of single attributes must be used. Participatory valuation techniques like Citizen Juries or Market Stalls might lead to more sophisticated results but they violate the postulate of preference independence. Further, they do not reflect the preferences of the actual population, as has been explained above, but the preferences of a hypothetical population with a higher average standard of information and knowledge than the actual one.

Finally, the applicability of the various valuation methods to the assessment of the different non-market outputs of agriculture was discussed.

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