Social Preferences for Multifunctional Agriculture in the Czech Republic: Willingness to Pay for Public Good

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Abstract

The central purpose of the paper is to investigate social demand for public goods of multifunctional agriculture. Survey-based stated preference methods (AHP, CV, n = 1703) were used to identify importance, rank and estimate annual willingness to pay to ensure the provision of a variety of public goods for the future. Survey results confirm the existence of a significant social demand for agricultural multifunctionality in the Czech Republic. The estimate of the individual and aggregated values of public goods produced by agriculture per year can be used to support policy discussions on public support for multifunctionality in agriculture.

Keywords: Social demand; Multifunctional agriculture; Sustainable development; Public good evaluation

Abbreviations: MFA: Multifunctional Agriculture; WTP: Willingness to Pay; NCOs: Non-Commodity Outputs; TEV: Total Economic Value; CVM: Contingent Valuation Method; ABCM: Attribute-Based Choice Modelling Method; AHP: Analytical Hierarchy Process; CBA: Cost- Benefit Analysis; TOA: Trade-Offs Analysis

Introduction

One of the most debated policy problems nowadays is the complicated system of agricultural subsidies in the EU that can send inadequate signals to decision makers, and could lead to the unsustainable agricultural practices, underproduction or overproduction of public goods. However, matching agricultural provision of public goods to growing and diverse public demands raises two main questions for decision makers [1,2]; what the actual demand for public goods is and how to integrate preferences of citizens to the policy-making process. By extension verifying the existence of social demand for each type of nonmarket goods and services of agriculture in a particular country and measuring the magnitude of such demand, are central to the justification and evaluation of existing CAP support schemes [3]. Although according to many authors [4] the entitlement for supporting multifunctional agriculture (MFA) and the role of its different attributes are sometimes considered controversial, it is important to study citizens' attitudes towards multifunctional agriculture and their willingness to pay (WTP) for the non-commodity outputs (NCOs). Citizens' preferences also reflect possible changes in the demand for food products and its attributes. Therefore, these issues are highly important not only to policy makers, but also to agribusiness managers.

The paper focuses on the evaluation of the social demand for non-commodity outputs of agriculture in the Czech Republic. The main aim is to examine public preferences for non-commodity outputs (NCOs) and WTP to support the provision of NCOs of agriculture.

Theoretical Background and Methodology

Achieving multiple expectations placed on agricultural production is challenging, especially when public policy resources allocated to agriculture are being reduced [5]. The literature on the social demand and valuation of the MFA has been rapidly growing in recent decades, but the methodology remains controversial and the conceptualization of the public goods is rather inconsistent [6]. Most of reviewed agriculture-related evaluation studies address environmental services, particular agricultural landscapes or agro-ecosystems defined at specific local or regional scale [7-9]. The dominance of stated preference methods can be explained by their ability to provide estimates of non-use values, which can represent significant part of Total Economic Value (TEV) of non-commodity outputs of multifunctional agriculture. However, the observed preference for Contingent Valuation Method (CVM) and recently for Attribute-Based Choice Modelling Method (ABCM) can be associated also with the flexibility in terms of valued NCO definition and suitability for ex-ante scenario evaluation. Attention of researchers is addressed also to generalizing from the substantial body of non-market evaluation literature. Meta-analysis has become the standard method of searching for general patterns in an evaluation study result [10,11]. The number of non-market

valuation databases was assembled responding to the extensive data requirements of meta-analysis (ENVRI, Envaluate, RED and others).

Growing number of agricultural NCOs valuation studies can be recognized also in the Czech Republic in recent years, employing both supply-based shadow pricing [12] and demand-based preference valuation [13,14] approaches. The review studies [15] and meta-analytical studies [16] were also identified. Most Czech case-studies address agricultural landscapes or agro-ecosystems. Empirical evidence in the European context shows, that the partial approach and regional scale of non-commodity public demand valuation prevails. The main challenge for the future development of valuation methodology is to increase the usefulness of valuation studies to end-users in the broader decision-making context of rural development project, programs and policies. According to Randall [10], the progress in valuation methods requires that the range of valid application of market–based methods be expanded and/or the credibility issues with stated preference methods be resolved. New studies will continue to be desirable and should be done to further develop and test method and to augment, update and improve the body of empirical evidence.

The valuation of complex goods should involve the joint valuation of the whole set of their attributes. Otherwise there arises the real risk of part-whole bias [17,18]. Despite this, studies adopting this methodological approach have been scarce [19]. While the basic evaluation framework has been outlined [20], it remains a considerable challenge to achieve consistency in empirical implementation.

To avoid the independent piecewise valuation problem, the NCOs of agriculture are valued as a package on NUTS II scale. This article is part of a long-term research on the development of social demand for non-commodity outputs of agriculture (which it follows methodically). There are two methods combined in the study (according to suggestions of a number of authors, see for example Hall et al. [21]; Kallas et al. [20]:

a. CVM (Contingent Valuation Method) to obtain an aggregated value for the bundle of non-commodity outputs; the distribution of economic benefits in a target population is inferred from statements of WTP elicited from a random sample of respondents [22].

b. AHP (Analytical Hierarchy Process) is used as a multi-criteria technique to obtain partial values for each of the individual NCOs identified.

The utilitarian foundation of economic valuation is welfare change measurement. The value of some proposed action is the welfare change it will generate, measured in monetary terms. The analytical hierarchical structure of non-commodity outputs of multifunctional agriculture was designed and explained in three levels: the complex NCO of MFA at the highest level of the structure, types of output according to three main sustainability

functions (production, environmental, socio-economic) at an intermediate level and main attributes/NCOs of each function forming the base of the structure. This valuation structure was based on cognitive hierarchies [23], and postulate that situation-specific cognitions and behaviour are well embedded in systems of fundamental values, beliefs and generalised attitudes to MFA. It is assumed, that respondent (representing society as a whole) is consistent in judgements about any one pair of outputs/attributes, so $1/2n(n-1)$ comparison was necessary. The square Saaty's matrix for consistent preferences possesses two key properties: its principal diagonal is filled by 1's ($a_{ii} = 1$ for any i), and reciprocity among pair comparisons (if $a_{ij} = x$ then $a_{ji} = 1/x$). Thus, for the rational respondent scores given to pair comparisons represent rations among weightings allocated to the corresponding sub-criteria ($a_{ij} = w_i/w_j$ for all i and j). As a result, the Saaty's matrix can be expressed as follows:

$$A = \begin{bmatrix} \dfrac{w_1}{w_1} & \cdots & \dfrac{w_1}{w_n} \\ \vdots & \ddots & \vdots \\ \dfrac{w_n}{w_1} & \cdots & \dfrac{w_n}{w_1} \end{bmatrix} \cdots\cdots\cdots(1)$$

However, as the personal subjectivity plays an important role in preferences for NCOs, the geometric mean was used to estimate the weigh vector that reflects the respondent´s preferences [24]. For the purposes of group decisions, Saaty propose the geometric mean method to aggregate the pair comparisons. Thus, particular weights assigned by respondents (k) to each attribute of MFA were estimated as follows:

$$w_{ik} = \sqrt[n]{\prod_{i=1}^{i=n} a_{ijk}} \; \forall i,k. \cdots\cdots\cdots(2)$$

These individual weights (w_{ik}) were aggregated for all respondents using following expression:

$$w_i = \sqrt[m]{\prod_{k=1}^{k=m} w_{ik}} \; \forall i. \cdots\cdots\cdots(3)$$

The normalized relative weights are equivalent to relative weight of attribute i, divided by the sum of all NCOs were obtained through:

$$w_i' = \dfrac{w_i}{\sum_{j=1}^{j=n} w_j} \; \forall i. \cdots\cdots\cdots(4)$$

Assuming following linear utility function specification, AHP allows us to estimate relative attribute weigh wi for each non-commodity output/attribute Ai:

$$U(NCO) = w_1 A_1 + w_2 A_2 \cdots + w_n A_n \cdots\cdots\cdots(5)$$

Hence the WTP for an individual attribute/NCO i of is as follows:

$$WTP_{Ai} = w_i WTP_{NCO} \cdots\cdots\cdots(6)$$

Assuming an additive utility function, multiplying attribute weights by the corresponding aggregated WTP provides estimates of the WTP for various levels of the attributes.

Survey Design and Implementation

Focusing on the social demand for NCOs of multifunctional agriculture the target population of all citizens of Region NUTS II South-east (the Czech Republic) was chosen. Agricultural land covers 60% of the total area of 13,919km^2 of this region. The total population is 1 647 929 inhabitants and GDP per person is approx. 11 000€ (72% of EU27 average and 92% of CZ average). Agriculture generates from 5.1% (in the Region NUTS III South Moravia) to 12.6% (in the Region NUTS III Vysocina) of regional employment, both values being higher than the national average (4.8%). Survey approach to estimating the preferences of the South-East population for the NCOs of agriculture requires taking the dual character of the territory into account.

The survey sample was split into two categories

Residents of the region with prevailing intensive agriculture (South Moravia) and residents of the region with a higher share of LFA (Vysocina). The questionnaire survey was carried out at:

a. The end of the 2007-2013 CAP programming period: (September - December 2013).

b. Mid-Term of the 2014-2020 Program (January - April 2017).

The questionnaire is consistent with the previous research Miškolci [25]. The characteristic of the questionnaire distribution and response rates are summarized in Table 1. Sample points were selected across these regions. Sub-stratification was determined using a quota system based on social grade, age, and gender.

Table 1: Characteristics of the questionnaire survey in households.

Year	2013	2017	Total Sample
Distributed Questionnaires	1000	1000	2000
Fully Completed Questionnaires	868	835	1703
NUTS III			
The South Moravian Region	50%	62%	56%
The Vysocina Region	50%	38%	44%
Total Response Rate	87%	84%	85%

The questionnaire consisted of

a. An information package regarding the multifunctionality of agriculture.

b. Beliefs and generalised attitudes to MFA.

c. AHP pairwise comparisons of the attributes/NCOs according to the hierarchical structure.

d. CV hypothetical market scenario to elicit WTP to support the NCOs provision of agriculture (payment vehicle taxes), and follow-up WTP questions.

e. Socio-demographic characteristics of the respondents. The questionnaire was administered in face-to-face interviewing and personal collection. The team of 25 trained researchers conducted a face-to-face questionnaire survey to address study area and interest groups. Of all respondents, 52% were females, and 60% were living in urban municipalities. The statistical analysis of sample composition shows that younger respondents between 24 and 43 years of age were the majority (46%), followed by age category 44-63 years (23%). Most respondents were economic active employees (49%). The overall educational level of the interviewees was relatively high (secondary education 39%, university education 34%).

Results and Discussion

The survey of generalised attitudes to MFA indicated the long-term consensus (80% of respondents) in the opinion that agriculture in rural areas produces a number of public goods that increase the well-being of society. In the reference periods of 2013 and 2017, respondents' consensus rates decreased slightly (from 81% to 78%). Of the 13% of respondents who opposed, only 3 % of respondents strongly disagree that agriculture produces socially beneficial NCOs (public goods). A slightly higher degree of disagreement was observed among respondents from the region with favorable conditions for intensive agricultural production (South Moravian Region). The majority of respondents (70%) expressed the belief that farmers should be compensated for providing public goods to society (a slightly higher level of consensus was recorded in a Vysocina Region 74%). In the region South Moravia it was only 66%. A moderate decrease in the consensus was again recorded from 70% in 2013 to 68% in 2017 in this case. A slightly higher level of consent to payments to farmers for the production of public goods was indicated by the respondents with higher education, younger and middle age categories, living in larger municipalities. On the other hand, 5% of respondents do not agree with the compensation, and 15% rather disagree.

Application of AHP was aimed to examine the citizen's preferences for agricultural multifunctionality, both at the aggregate level and for each of the individual attribute of NCO. The most significant are the NCOs of production functions (normalised weight of preference w´= 0.49), followed by environmental (0.26), and socio-economic public goods (w´= 0.25). In the reference periods, slightly increasing preference for socio-economic functions was observed in responses (w´2013 = 0.24 to w´2017 = 0.25) at the expense of the benefits of environmental functions, which decreased by 0.01 preference point (w´2013 = 0.27 to w´2017 = 0.26) in the reference periods (particularly in the region Vysocina).

The results of AHP for individual attributes of NCOs shown in Table 2 indicates that "Contribution to production of healthier and safer food products" was the most valued attribute of NCOs of agriculture with an aggregated weight w´= 0.21. Second in importance was indicated "Production of food for reasonable prices" with an aggregated normalised weight w´= 0.20. The third most valued attribute was "Guarantee long-term national food security"

with the overall normalised weight w´= 0.12. The "Protection of natural resources using practices compatible with environmental conservation" appears to be the most important environmental NCO, with aggregated normalised weight of 0.11 (forth in AHP preference rank). Surprisingly, considering the long-term emphasis on environmental issues, particularly agricultural landscapes in the Czech Republic, maintaining of the rural landscape was the least important attribute of the non-commodity output of agriculture. However, indicated preferences are stable and slightly growing. Similar results are reported by Yrjölä and Kola [26] in Finland. The last attribute of environmental outputs "Maintenance and protection of ecosystems, biodiversity, and valuable natural habitats" was sixth in AHP preference rank of NCOs with the normalised relative preference weight w´= 0.08. The indicated importance of ecosystems and biodiversity related non-commodity outputs seems to increase during the recent years in the region of South Moravia.

Table 2: Estimated WTP for non-commodity outputs attributes.

Non-Commodity Outputs	2013					2017				
	Normalized Preference Weights (w´)	WTP/Person/Year				Normalized Preference Weights (w´)	WTP/Person/Year			
		CZK		EUR*			CZK		EUR**	
Type of Function/ Attributes		Min	Max	Min	Max		Min	Max	Min	Max
Production Functions	**0.49**	**620**	**1018**	**23.26**	**38.19**	**0.49**	**817**	**1593**	**30.24**	**58.97**
Production of food for reasonable prices, ensuring adequate income and competitiveness of farms	0.2	258	424	9.69	15.9	0.18	300	584	11.09	21.63
Guarantee of safe and healthy food	0.2	253	415	9.48	15.57	0.21	355	692	13.13	25.61
Utilization of agricultural production base for nonfood production and contribution to rural employment	0.09	109	179	4.09	6.72	0.1	163	317	6.02	11.74
Environmental Functions	**0.27**	**349**	**573**	**13.09**	**21.49**	**0.26**	**435**	**848**	**16.1**	**31.39**
Protection of natural resources using practices compatible with environmental conservation	0.12	155	254	5.81	9.53	0.11	191	372	7.06	13.77

Maintenance and protection of eco-systems, biodiversity, and valuable natural habitats	0.09	116	190	4.35	7.14	0.08	142	277	5.25	10.25
Contribution to the formation and maintenance of rural landscape	0.06	78	128	2.94	4.83	0.06	102	199	3.77	7.36
Socio-economic Functions	**0.24**	**303**	**497**	**11.36**	**18.65**	**0.25**	**428**	**834**	**15.84**	**30.88**
Guarantee long-term national food security	0.11	134	220	5.02	8.24	0.12	195	380	7.21	14.05
Guarantee animal welfare	0.07	89	147	3.35	5.5	0.08	130	254	4.81	9.38
Maintenance and improvement of the rural quality of life and conservation of rural cultural heritage	0.06	80	131	2.99	4.91	0.06	103	201	3.82	7.44

*Exchange rate EURO/CZK 4th quarter 2013 = 26.657

**Exchange rate EURO/CZK 1st quarter 2017 = 27.02

The results of comparative analysis indicate that the respondents from the South Moravia Region with favorable conditions for agricultural production increasingly emphasize following non-commodity attributes: Guarantee of safe and healthy food, guarantee animal Welfare and Guarantee long-term national food security, while respondents from the Vysocina Region increasingly emphasize Production of food for reasonable prices, ensuring adequate income and competitiveness of farms, Contribution to the formation and maintenance of rural landscape, and similarly Guarantee animal welfare and long-term national food security. The decreasing significance was similarly indicated in both regions for Utilization of agricultural production base for nonfood production and Maintenance and improvement of the rural quality of life and conservation of rural cultural heritage.

Subsequently, respondents were asked to express their WTP to support the provision of NCOs (non-declining level of supply) using the carefully worded hypothetical CV scenario. The WTP for the non-market benefits of agriculture was expressed by the majority of sample respondents (56%). Although the number of respondents willing to support the provision of non-commodity outputs of agriculture (respondents indicated WTP> 0) via tax payment fell from 61% in 2013 to 51% in 2017. When the pro-test bidders are excluded from the total sample of respondents, the share of respondents that are willing to pay for the provision of non-commodity outputs of agriculture was slightly more than 80% in both periods and both regions. The higher share of respondents willing to pay was observed in the region with a higher share of LFA (Vysocina Region) in both periods. The estimated mean WTP of the total sample was CZK 123/person/month. The mean WTP increased from CZK 106 in 2013 to CZK 140/person/month in 2017. A significant increase of respondents WTP was recorded in the Vysocina Region (mean WTP increased by CZK 60/person /month). The mean WTP indicated by respondents with WTP > 0 was estimated at CZK 174 in 2013 and CZK 273/person/month in 2017.

By combining the mean WTP with the aggregated preference weights for multifunctional attributes the mean values for each attribute/public good were estimated. The WTPs for each attribute are shown in Table 2. Finally, WTP values were regressed with individual's socio-demographic characteristics to identify differences among individual valuations of multifunctionality. Younger respondents with a higher level of education, and those living in municipalities below 2000 inhabitants, valued multifunctionality more than other segments of the community. Obtained results also indicate that older people and respondents with low income and no relation to agriculture attach lower values to multifunctionality. However, the regression analysis results showed that basic socio-economic characteristics can explain only a part of the variability expressed by WTP so that individuals do not have homogenous valuations of multifunctionality. As can be seen from the literature, it is common problem of preference-based evaluation studies that can limit the possibility of adapting WTP to the regional socio-economic characteristics of the population when transferring results.

Conclusion

The fundamental question of what the public expect from agriculture is increasingly addressed in the research and literature. The proposed holistic top-down valuation approach to explore more general (stable) preferences for basic attributes of non-commodity outputs was employed to overcome the main methodological and practical drawback regarding existing valuation studies and to increase the usefulness of valuation of agriculture-related NCOs for politicians and decision-makers. Combination of AHP and CV methods offers scope for including a set of non-commodity attributes/public goods and their constituent qualities.

Thus, it can deliver inputs not only to the Cost- Benefit Analysis (CBA) but also to the Trade-Offs Analysis (TOA) and measurement [27]. However, to enhance the usefulness of economic valuation in the MFA context other methodological standardization issues need further development, namely the questions related to the validity standards and the benefits transferability. Survey results confirm the existence of a real social demand for agricultural multifunctionality in the Czech Republic. This demand is not homogeneous, either among different types of non-commodity outputs considered as part of the multifunctional bundle or among individuals. The non-commodity outputs related to a more "private good" facet of multifunctionality (such as food quality and safety, provision of food for reasonable prices, long-time food security) seem to be more valued than those related to "pure public goods and services". The aggregated value of social demand for NCOs provided by multifunctional agriculture per year was calculated for two levels:

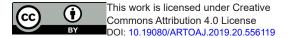a. Population of the South-East region (NUTS II).

Population of the Czech Republic. The total social value of public goods provided by agriculture in the South-East region per year (estimated for total population of the region) was CZK 2.8-5.4 billion (EUR 101-198 million), and that gives the value of the non-commodity benefits of agriculture CZK 3900-7400/ha/year of agricultural land (140-273 EUR/ha/year). By the aggregation of investigated individual WTP to support non-commodity outputs of agriculture for the total population of the Czech Republic, it was calculated, that the total annual value of non-commodity outputs of agriculture was CZK 17.8-34.8 billion (EUR 655-1278 million) and that gives the value of the non-commodity benefits of agriculture CZK 5156–10055/ha/year of agricultural land (190-370 EUR/ha/year). Comparing with the total market value of commodity production of the agricultural sector (CZK 127 billion in 2016), the social value of non-commodity outputs represents additional 20-30% of the economic value of agricultural production. The average willingness to pay CZK 1680-3276 person/year (EUR 62–121 person/year) for the provision of non-commodity outputs under a policy scenario of multifunctional agriculture after aggregation justifies the current level of public support.

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