Evaluation of chosen benefits on environment and landscape coming from Czech agriculture

Hodnocení vybraných přínosů českého zemědělství na životní prostředí a krajinu

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Abstract: The objective of the study was to assess public goods coming from agriculture. Decisions about subjects of the assessment was the first step which was followed by the choice of suitable methods in view of data availability. The choice came out mainly from the most significant agricultural subsidies in the framework of public finance extent and were introduced as multifunctional agriculture maintenance (landscape maintenance, grassing, vulnerable farming in protected landscape areas and national parks etc.). Landscape maintenance was considered as the most relevant and it was quantified by direct valuation method (contingent valuation method). The other public goods were assessed by indirect valuation methods (opportunity costs, replacement costs, prevention costs).

Key words: multi-functionality, public goods, externalities, direct valuation methods, indirect valuation methods, contingent valuation methods, prevention costs, replacement costs, opportunity costs

Abstrakt: Cílem studie bylo provést ohodnocení veřejných statků pocházejících ze zemědělství. Samotnému hodnocení předcházelo rozhodování, které zemědělské aktivity budou předmětem kvantifikace a jaké metody lze aplikovat vzhledem k dostupnosti dat. Výběr veřejných statků v podstatě vycházel z nejvýznamnějších podpor současné zemědělské politiky z pohledu vynaložených veřejných prostředků (údržba krajiny v kulturním stavu, zatravnění, hospodaření v CHKO a NP, atd.). Největší důraz byl kladen na ohodnocení přínosů údržby krajiny jako celku, které bylo provedeno přímou metodou hodnocení (tzv. kontingenční metodou). Pro kvantifikaci ostatních veřejných statků byly využity nepřímé metody hodnocení (náklady příležitosti, náklady na odstranění škod, náklady na prevenci).

Klíčová slova: multifunkčnost, veřejné statky, externality, přímé metody hodnocení, nepřímé metody hodnocení, kontingenční metody hodnocení, náklady na prevenci, náklady na odstranění škod, náklady příležitosti

INTRODUCTION

There is an increasing interest in the agricultural multifunctionality or non-commodity outputs research (Cammarata 1997; OECD 2000). The political need to describe and quantify this part of agricultural practise has been brought with the growing share of agricultural subsidies with intention to keep the dimension of the agricultural sector. At least a part of these subsidies has been justified as a payment for services to environment, therefore, to the whole society (Cammarata 1997). In addition to the production function of agriculture, another, especially the environmental and social functions started to be recognised. Developed countries have already considered these non-production functions relevant to be maintained through public funds. To justify the expenditures for these subsidies, a crucial question arose then: what is the actual benefit or the value of the agricultural "non-production" functions. Cost-benefit analysis of public expenditures belongs to current practises of developed countries which is held before a policy tool implementation – ex ante evaluation; during its operation – mid-term evaluation; and mainly when it is ending – ex post evaluation (European Commission 1999). The above mentioned evaluations help to a feasibility reference compilation, monitoring outputs and a judgement especially of the impacts of schemes. Particularly schemes financed from EU funds are required to be evaluated on impacts or effects in each member state (Commission Regulation 1999: article 41–45).

OBJECTIVES OF THE STUDY

The objective of the study was to quantify public goods or positive non-market benefits coming from current agricultural practises in the Czech Republic. The objective was found as a huge task to be provided especially in relation to time and financial limits. Therefore, structuring was necessary. Seven areas were identified and respective partial objectives and outputs were specified on the basis of in-depth review of the original com-

plex problem and in relation to the priorities of the client (the Ministry of Agriculture): i) landscape maintenance, ii) extenzification of production on grasslands, iii) grasslands maintenance, iv) grassing, v)organic farming, vi) sensitive farming in protected landscape areas (PLA) and national parks (NP), vii) genetic resources maintenance of native Czech breeds (methodology).

Landscape maintenance has appeared to be the most important scheme in the framework of government support to non-production functions of agriculture (MZe 2000). That is why most of the attention was paid to this area.

THEORETICAL ASSUMPTIONS

Agriculture affects significantly all components of the environment when it consumes them in production e.g. factors or materials (e.g. nutrients in soil, irrigating water). The other nature components are influenced indirectly as joint effect with production. In can be pollution when the farm intensity exceeds a certain level (e.g. leakage of nitrogen to groundwater), but it might be a positive effect as well. Impacts on utility and production functions of other subjects (additional cost or benefit) and even on natural components are not included in economies/accounting of externality producer (Hill 1990). There is no market for external effects because there are no commodity transactions with their typical features given by institutions that: define the choice domain of independent economic actors in the status quo; define the relationship among individuals; and define who may do what to whom (Bromley 1989). Due to this imperfections, a price for externality does not exist. Governments try to use their mainly regulatory tools to eliminate negative externalities (organic waste facilities in bad condition causing pollution of groundwater by nitrates) and, by budgetary transfers, to stimulate positive externalities provision (grassing of fields threatened by erosion in order to reduce soil and nutrients outflow to water). On the other hand, there is an increasing demand for goods and services that prevent further pollution of environment or improve it. However, these goods have features of public goods as non-competitive in consumption (if one consumer consumes the good the other can consumes as well); non-excludability from consumption (there is no power to exclude a consumer from the public good consumption); and its non-separability (the public good is consumed by all consumers). Because of the above mentioned features, there is a high risk of public good insufficient provision or even it not bring provided. According to Slangen (2001) with "missing" markets there is a strong incentive to develop institutional adjustments capable of changing the farmer's behaviour so as to achieve unachievable via market signals alone. This arises because consumers´ marginal willingness to pay for sustainable agriculture and "clean" environment is greater than what is reflected in the market prices. Then there is a role for a government to pay for the public good provision.

METHODOLOGY AND DATA

According to Winpenny (1991) and Hanley (1997), a range of evaluation methods of non-production outputs can be separated into two basic groups: direct and indirect evaluation methods. A typical example of direct methods are so called contingent valuation methods (CVM). The nature of the CVM methods is a simulation a fictive market when making interviews with respondents about their preferences – willingness to pay for certain "non-market" output.. There is a vast literature on the CVM dealing with both theoretical and empirical issues. Perhaps the most important objection to the CVM concentrates on the hypothetical survey setting (Pruckener 1995) since respondents are not effectively forced to back up their opinions by cash. There is also an adding up problem, if questions do not refer each to other in budgetary terms. On the other hand, the advantage of the CVM method is that values of environmental qualities are incorporated into population (consumer) overall values and preferences. The group of indirect methods include approaches based on calculations of social costs. Some of them quantify costs of preventing the loss of an environmental quality (prevention costs method) or costs which would appear if the environmental quality disappeared and the society wished to restore the good (replacement costs method). Another approach to the later is to consider opportunity cost (income loss) in the case of the quality relinquishment. Anthropocentric valuation does not play a key role when indirect methods are used in comparison with direct methods which are often criticised because of this feature. In addition to the objective cost calculations discussed above, there are so called hedonic methods in the group of indirect methods. They calculate changes of real estate values, risks of income loss or changes of transport costs due to the presence (or absence or a change) of an environmental quality (higher pollution causes decline of the real estate prices in the area). Hedonic approach usually requires large surveys and results can be lumbered when failing to include other relevant variables (prices of real estates can be affected by other factors than by state of the environment in the area).

Generally, available data could only be used in the view of time and financial constraints (additional collecting or purchase of data was limited). Thus, only evaluation of landscape maintenance was organised by questionnaire survey.

Data availability, time and financial constraints and shaped the set of methods actually used in the study:

Opportunity costs

Extenzification of production on grasslands: a contribution of farmers to conservation is given by low application of fertilisers and pesticides that enhances grassland biodiversity and favours nutrient balance. The value of this positive externality can be estimated as an income loss from lower production intensity in compari-

son with intensive farming in average (fertilisers savings deducted).

Sensitive farming in PLA and NP: farmers cultivate their land according to legislative limits given especially in I. and II. zone of PLA or NP. Their farming can be assessed as a difference between the potentially reachable level of production in the given climatic conditions and the level of production with lower intensity enforced by legislation (mainly application of fertilisers is limited). This approach is similar to the assessment of extensive farming on grasslands but the difference results from restrictions on property rights in PLA and NP.

Maintenance of genetic resources: We used a different concept, because we assessed private cost of a farmer if he or she keeps native breeds. We used opportunity approach calculating income forgone –monetary expression of the difference between the average productivity of current and native breeds.

Replacement costs

Grassland maintenance: an abandonment of grasslands, on which farming is currently economically inefficient, would cause overgrowing those fields by invasive trees. The area of the grasslands which is vulnerable to abandonment relates to the balance of forage consumption by cattle and forage production (on arable lands and grasslands together). The value (benefit) of grasslands maintenance as a public good provision can be assessed as a future expenditure for renewal of degraded meadows and pastures which were once abandoned as they produced unusable (economically) surplus of forage. We assumed 5–7 years of degradation.

Grassing: decline of water erosion risks is the one of the most significant benefits coming from grassing under the Czech natural conditions. The valuation of benefits from erosion prevention, in our concept a cost per hectare of all off-side effects, was assessed in two steps. First we calculated a cost per hectare for removal of sediments in water streams as a result of soil run-off. According to Edwin and Clark (1985) the sediments constitute just 1/8 of all erosion impacts. Hence, in the second step we expanded the sum 8 times to get the estimate of the cost of all off-side effects.

Prevention costs

Organic farming – the concept comes out of a calculation of income which would be lost if a conventional farm tried to ensure some of the benefits of organic farming (pollution prevention by an exclusion of fertilisers and pesticides, costs savings deducted).

Contingent valuation method (willingness to pay)

Landscape maintenance: farmers deliver a complex of public goods (services) associated with landscape maintenance. Their value was assessed by asking respondents about their willingness to pay for a quality of landscape in two dimensions – aesthetic, and richness of species. The initial price was calculated as a share of direct taxes which are paid by economically active population for actual landscape maintenance scheme. Then the respondents expressed their willingness to pay a higher price. The presentation of cultivated landscape and in fact an introduction to the problem was done by sets of photos. A great attention was paid to the questionnaire preparation and questions about price because these steps were identified as the key factors of the successful research. In spite of the above mentioned difficulties of the CVM, its results reflect an actual demand of the society for a public good as landscape in the context of current social values. This advantage could be found as important when a policy looks for relevant arguments for compensating farmers for public good provision.

THE ASSESSMENT OF THE VALUE OF AGRICULTURAL LANDSCAPE

The central research question was if the Czech society represented by consumers wanted to preserve Czech cultural landscape at least in its actual form and were willing to pay even more (for example on taxes or levies) for its future improvement. The assessment supposed to get and merge answers for a set of partial questions was structured in the following groups:

(a) Does the society really want an open landscape (in contrast with spontaneous afforestation)?
(b) How does the society perceive the role of farmers and the state when providing the landscape?
(c) How much are the consumers willing to contribute to this public good provision and what reasons lead to their unwillingness to pay anything or less?

The (c) group was the key group of questions. To avoid or reduce the risk of the ignorance problem resting in insufficient awareness of respondents of open landscape loss due to the agricultural land abandonment (esp. grassland), the questionnaire included an explanation that meadows, pastures or even arable land were let idle as long as there were not any subsidies in the recent past.

Then each respondent was exposed to sets of photos which illustrated:

1) current agricultural landscape – more than 50% of intensive areas (large arable field tracks); about 30% of extensive areas (mosaic of arable fields, grasslands and forests); and 7% of not cultivated areas. Presentation included an introduction about current subsidy level which was found not to be sufficient to exclude abandonment risks (tempo of its growing share);

and future landscape drifting to some alternatives:

2) system with nosubsidies to landscape maintenance – higher risk that the share of not-cultivated fields will grow up at the expense of extensive areas share); or
3) system with higher subsidies in comparison with the current level – higher probability that the share of not-cultivated fields will decline and the share of extensive, even species rich areas will grow.

The initial price for landscape maintenance was 350 Czech crowns (CZK) when calculating as a landscape maintenance subsidy in 1999 per economically active person. After the presentation of photos, the respondents were asked if they are willing to pay for the landscape and how much. Then they were asked once more but with knowledge of the price that could provide efficient landscape maintenance (1200 CZK[1]). Following questions should elicit factors having an impact on investigated area and they provided a short overview about knowledge of agriculture versus environment problems by Czech society.

The survey was organised by a commercial agency which approached 1000 respondents. Results of the contingent valuation can be summarised as following:

– landscape maintenance where farmers work is considered as one of agricultural functions (93% respondents rather or absolutely agreed) and the state should subsidises farmers to provide the landscape even they do not need to cultivate the land (88% respondents rather or absolutely agreed),
– more than two fifths of respondents agree with cultivation of agricultural land which is not competitive enough even if it would require higher subsidies, and about the same number of respondents agrees with the maintenance of landscape even without agricultural production,
– 78% respondents would accept to pay for the landscape maintenance in the case of deficient competitiveness of agricultural land, there should be both state and farmer participation in landscape maintenance (state should carry the main share of expenditures),
– after the photo set presentations and without knowledge of the sufficient level of subsidy (1200 CZK), the respondents proclaimed their willingness to pay for the landscape maintenance: 53% respondents would be willing to pay more than 350 CZK – in average they would contribute 620 CZK/year; if we include the remaining respondents and supposing 350 CZK as their response, they would be willing to pay 492 CZK for landscape enhancement (the marginal value of WTP is 142 CZK),
– with the knowledge of the sufficient level of subsidy: less than a third of respondents would be willing to pay 1200 CZK (twice more respondents who are interested in environmental problems), more than one third definitely refused such a price,
– willingness to pay higher price grows with the education level, household income and interest to environmental problems (the average WTP of "high" respondents is 773 CZK), distinctly lower WTP is exhibited respondents who do not have any relatives working in agriculture,
– definitely dominating reason for unwillingness to pay more is the distrust in correct allocation of public money (73% respondents – especially with higher education and income). This fact was confirmed by an independent question about the state budget distribution – 81% respondents did not trust the public finance allocation process.

The total value of landscape maintenance was calculated as a product of prices per capita (492 and 620 CZK) the number of economically active population (about 7.9 mil.). The value amounts 3.9 mld and 4.9 mld CZK/year respectively. This value cannot be taken as a definitive one because it consists especially from anthropocentric view overvaluing aesthetic value of landscape and undervaluing other benefits, particularly, biological diversity and intrinsic value of wildlife.

SUMMARISED RESULTS

Results of public good and externality evaluation can be summarised as following:

– consumers will be willing to spend 3.9 or 4.9 mld CZK per year for landscape maintenance (4 282 thousand ha incl. all agricultural land) – estimated by using CVM;
– extenzification of production on grasslands costs 2.8 mld CZK by using opportunity costs;
– grassland maintenance amounts 2.5 and 5.3 mld CZK by using replacement costs (at farm and contract prices respectively);
– grassing benefits on land with erosion are 4500 CZK/ha by using replacement costs; it is the only sum expressed per hectare.
– the organic farming benefit is 92 mil. CZK by using prevention costs (in the extent of 110 thousand hectares in 1999);
– the externality coming from sensitive farming in PLA and NP (I. and II. zone: about 57 thousand hectares) costs 130 mil CZK by using opportunity costs.

It would not be apposite to sum up all the benefits to "one number". Grassland maintenance together with sensitive farming in PLA and NP could be considered as a part of landscape maintenance, because they contribute to it significantly. Moreover, the use of different methods and valuations of different types of benefits (partial benefits) do not allow meaningful interpretation of the "one" number. Values of the same benefit could vary highly with various methods. A common weakness of all used methods is that they assess the value of only some benefits or costs while neglecting some essential attributes of the environmental quality like for example biological one.

SUMMARY AND EXPECTATIONS

The choice of externalities and public goods for valuation was subjected to those activities which were subsidised by the current Czech agricultural policy. The emphasis was given especially on methodology discussion and we tried to present as much methods as it was

[1] The price was based on qualitative estimates about subsidies level to landscape maintenance after the EU accession.

possible. It turned out that evaluation of benefits coming from agriculture is very complex and it requires an interdisciplinary approach and large data collections (e.g. erosion prevention – real impacts of erosion affect all natural components). Because of "chain" impacts of each agricultural activity, it has to be always calculated with a certain level of simplification which should be mentioned during the result interpretation.

In spite of above mentioned difficulties and open questions, we can expect the growing relevance of public goods or externalities evaluation at the policy level. Then a main goal of each evaluation should be a significant contribution to improving of decision-making processes.

REFERENCES

Bromley D. W. (1989): Economic Interests and Institutions – the Conceptual Foundantions of Public Policy. Basil Blackwell Inc., Oxford.

Cammarata A. (1997): Agriculture and Environment. Office for Official Publications of the European Communities, Luxembourg.

ČSÚ (1991–1999): Statistické ročenky ČR a ČSFR 1990–1998. ČSÚ Praha.

Edwin H., Clark H. (1985): The off-site Costs of Soil Erosion. Journal of Soil and Water Conservation, *40,* (1).

European Commission (1999): Evaluating soci-economic programmes – evaluation design and management. Office for Official Publications of the European Communities, Luxemburg.

Commission Regulation (EC) No 1750/1999 of 23 July 1999 laying down detailed rules for the application of Council Regulation (EC) No 1257/1999 on support for rural development from the EAGGF, Official Journal1999.

Hanley N., Shogren J. F., White B. (1997): Environmental Economics in Theory and Practise. MacMillian Press ltd., London.

Hill B. (1990): An introduction to Economics for Students of Agriculture (Second Edition). Pergamon Press, Oxford.

Kavka M. a kol. (1997): Příručka pro zemědělce a poradce (2. díl). MZE, Praha.

Komberec S., Homola V., Knobová A. (1993): Ekologické zemědělství pro chráněná území. Institut výchovy a vzdělávání MZE ČR, Praha 1993

Lampkin N. H., Padel S. (1994): The Economics of Organic Farming – An international Perspective. CAB International, Wallingford.

Librová H. (1987): Sociální potřeba a hodnota krajiny. Universita J.E. Purkyně, 134 s.

Míchal I. (1992): Ekologická stabilita. Veronica, Brno.

MZE (2000): Zpráva o stavu zemědělství ČR za rok 1999 (Zelená zpráva). MZE, Praha.

Novák J. a kol. (1999): Nákladovost zemědělských výrobků v zemědělských podnicích ČR za rok 1998. VÚZE, Praha.

OECD (2000): The production relationships underlying multifunctionality. Directorate for food, agriculture and fisheries; Trade directorate, Paris.

Pražan J., Kříž Z. (1997): Vliv zemědělství na životní prostředí. Studie VÚZE, Praha, 49 s.

Pruckner G. (1995): Agricultural landscape cultivation in Austria. An application of CVM, ERAE, Vol. 22, pp. 173–190.

Slangen H. G. (2001): Sustainable agriculture – getting the institution right. CEESA Discussion Paper No. 1, 1/2001, Berlin.

Winpenny J. T. (1991): Values for the Environment – A Guide to Economic Appraisal. HMSO, London.

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