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Evaluation of cost-effectiveness of organic farming support as an agri-environmental measure at Swiss agricultural sector level

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ABSTRACT

The economic efficiency of financial support of organic farming has been questioned by economists and policy makers. However, little empirical research has been done in order to evaluate the economic performance of these payments. Thus, the aim of this paper is to calculate the cost-effectiveness of organic farming support in achieving environmental policy targets compared to other agri-environmental measures.

The cost-effectiveness of agri-environmental measures can be understood as a function of policy uptake, environmental effects, and public expenditure. Taking the Swiss agricultural sector as an empirical case study, cost-effectiveness of organic farming support and other single agri-environmental measures was calculated. For this purpose, the sector-representative PMP model FARMIS was extended by three modules encompassing: (a) life cycle assessments for fossil energy use, biodiversity and eutrophication according to the SALCA methodology, (b) public expenditure, including policy-related transaction costs, and (c) uptake of agri-environmental measures.

The calculations revealed a slightly higher policy cost with organic farming support of 14 CHF/ha for a 1% average improvement in the environmental indicators, compared to a combination of three single agri-environmental measures (11 CHF/ha), including both extensification of arable land and meadows. In view of an average public expenditure on agriculture of 2.5 kCHF/ha in Switzerland, these differences can be considered as marginal. Sensitivity analyses confirm that the cost-effectiveness of organic farming support is very similar to combined agri-environmental measures. Furthermore, the model reveals that the cost-effectiveness of specific agri-environmental measures is higher when implemented on organic farms rather than on non-organic farms.

Introduction

Like other agri-environmental measures (AEM), organic farming area support payments provide incentives for farmers to comply with defined production standards. According to CRER (2002), such payments lead to better environmental performance compared to conventional or integrated farming systems, since compliance with organic production standards averts many negative environmental effects, whilst also promoting positive effects. For instance, organic farming relies on ecological processes and cycles and thus aims at minimizing the use of external inputs (IFOAM, 2012). This reduces the resource use of the farming system and limits the nutrient loads in the system, which in turn avoids over fertilization and reduces the risk of nitrogen and phosphorus eutrophication (Haas et al., 2001; Köpke et al., 1997).

Given limited public budgets, efficiency in generating environmental benefits plays a fundamental role in the further development of direct payment schemes (Swiss Federal Council, 2009). The targeting and tailoring of policies to achieve maximum effectiveness with a given budget is essential (OECD, 2007). It is therefore useful to compare both environmental effects and the societal costs of different AEMs in order to provide a basis for economically sound policy design (Pearce, 2005). In this paper, we compare the effectiveness and efficiency of the Swiss organic farming area support payments with a combination of other individual Swiss agri-environmental payments.

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The Swiss direct payment system consists of two types of payments (Mann, 2003b): general and ecological direct payments. To be eligible for general direct payments, farms have to provide proof of compliance with ecological requirements, similar to cross-compliance criteria in the EU's Common Agricultural Policy (CAP). The criteria for this ecological performance requirement include a balanced nutrient budget, basic soil conservation measures and a minimum share of ecological compensation areas. Only farmers who receive general direct payments are eligible for the second type of Swiss direct payments: the ecological direct payments. Ecological direct payments reward farmers for the provision of public goods and include (Mann, 2003b):

(i) Payments for specific measures for ecological compensation areas (see proof of compliance with ecological requirements): e.g. "payments for less-intensive meadows", "payments for extensive meadows";
(ii) Payments for animal welfare measures;
(iii) Payments for extensive production of grains and rapeseed (so-called extenso payments);
(iv) Organic farming area support payments.

Under the framework of the Swiss ecological direct payments, farmers can take up measures cumulatively, thus payments per ha add up. For instance, farms opting for "organic farming support" or "extenso payments" are also eligible to adopt specific measures for ecological compensation areas like the before mentioned "payments for less-intensive meadows" and "payments for extensive meadows". Organic farms automatically comply with the requirements for "extensive production of grains and rapeseed" ("extenso payments") and therefore automatically receive both organic farming payments and extenso payments. Total direct payments per ha add up to, on average, 2.5 kCHF (Swiss Francs).

Agricultural economists hold differing views on the cost-effectiveness of organic farming support payments. Von Alvensleben (1998) argues that the organic farming area support payments are not economically sound, as the policy goals could be achieved more efficiently using combinations of more targeted AEMs. The economic rationale behind this argument was introduced by Tinbergen (1956), who theorized that an efficient policy requires at least as many specific instruments as there are specific goals. However, the Tinbergen Rule may not apply fully in this case due to interactions between policies, conflicting goals and the limited determinability of different aspects of environmental performance. Furthermore, the multi-purpose character of organic agriculture could increase its cost-effectiveness due to its potentially lower transaction costs compared to more targeted AEMs (Dabbert et al., 2004).

Currently, there is only a limited number of empirical papers on this question. This paper therefore aims to compare the cost-effectiveness of (a) direct payments for organic farming support with (b) other AEMs, in providing environmental services using datasets representative of the Swiss agricultural sector. Furthermore, this paper aims to identify interactions between the direct payments for organic farming support and other AEMs.

To address these aims, this paper is structured as follows: in "Methods" section, we review the concept of cost-effectiveness, before introducing the Swiss FARMIS model. We then explain the extensions made to the FARMIS model for evaluating organic farming support and AEMs. Finally, the way of comparing organic farming support with the other AEMs is described. In "Results" section, we report the results of the FARMIS model on the environmental effects and abatement cost of (a) organic farming support ("Cost-effectiveness of organic farming support" section) and (b) other AEMs ("Cost-effectiveness of other AEMs" section). This is followed by the results of sensitivity analyses ("Comparison of organic farming support with other AEMs" section). "Discussion" section discusses the model results in the context of other papers in the field and the methodological challenges of modeling cost-effectiveness of agri-environmental payments at sector level. Finally, "Conclusions" section draws conclusion from this study for science and policy.

Methods

To assess the efficiency of the Swiss agri-environmental policy options, we utilize the cost-effectiveness framework. In cost-effectiveness analysis, given policy targets are assessed in terms of the costs of achieving these targets (Marggraf, 2003). Although cost effectiveness analysis does not require the assessment of the benefits of the policy in monetary terms (as would be the case in cost-benefit analysis), we note that other cost-benefit analysis evaluations of agri-environmental policies have demonstrated that such policies do generate significant net benefits (Christie et al., 2006; Pearce, 2005). Thus, through the adoption of cost-effectiveness analysis, the focus of our assessment is to evaluate how to best achieve policy targets; as opposed to whether or not to fund a policy.

In this section, first the general procedure of calculating cost-effectiveness parameters is explained ("Cost-effectiveness of direct payments" section). "The CH-FARMIS model" section describes how the input data for the cost-effectiveness analysis is derived using the CH-FARMIS model. This includes: (a) a general overview of the CH-FARMIS model, (b) the composition of farm groups in CH-FARMIS for this study and (c) the three additional CH-FARMIS modules that have been added to the general FARMIS model for this study (policy uptake module, environmental impacts module, public expenditure module). Finally, it is described what baseline is used an which scenarios have been calculated in order to derive: (a) the cost-effectiveness of organic farming support payments, (b) the combination of other AEMs and (c) interactions between organic farming payments and other AEMs.

Cost-effectiveness of direct payments

The cost-effectiveness (CE) of a policy is the relation between effects, expressed in physical terms and costs, expressed in monetary terms (Pearce, 2005). Eq. (1) is the basis for deriving cost-effectiveness algebraically for several policies (i) and environmental effects (j).

$$CE_{ij} = \frac{E_{ij}}{C_i} \quad \forall i, j \tag{1}$$

where CE_{ij} is the cost-effectiveness of policy i in relation to environmental effect j. CE is defined as a ratio of the environmental effect (E_j) of policy i and the cost (C) of policy i.

The total sector-level environmental effect can be calculated by adding up the effects per area unit multiplied by the areas where the effects occur (Eq. (2)).

$$E_{ij} = \sum_X EE_{ijx} AR_{ix} \quad \forall i, j \tag{2}$$

AR characterizes policy uptake. x is the index for uptake of the policy instrument (e.g. measured in hectares). EE_{ij} is the environmental effect of policy i on environmental category j per unit of uptake.

Alike the cumulative environmental effects, the total additional policy-related cost at sector level can be calculated using Eq. (3):

$$C_i = \sum_X ((PL_{ix} + TC_{FARM_{ix}} + TC_{VAR_{ix}})AR_{ix}) + TC_{FIX_i} \quad \forall i \tag{3}$$