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The role of multi-target policy instruments in agri-environmental policy mixes

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ABSTRACT

The Tinbergen Rule has been used to criticise multi-target policy instruments for being inefficient. The aim of this paper is to clarify the role of multi-target policy instruments using the case of agri-environmental policy. Employing an analytical linear optimisation model, this paper demonstrates that there is no general contradiction between multi-target policy instruments and the Tinbergen Rule, if multi-target policy instruments are embedded in a policy-mix with a sufficient number of targeted instruments. We show that the relation between cost-effectiveness of the instruments, related to all policy targets, is the key determinant for an economically sound choice of policy instruments. If economies of scope with respect to achieving policy targets are realised, a higher cost-effectiveness of multi-target policy instruments can be achieved. Using the example of organic farming support policy, we discuss several reasons why economies of scope could be realised by multi-target agri-environmental policy instruments.

1. Introduction

Agri-environmental measures have been introduced in the European Common Agricultural Policy (CAP) primarily for reducing negative environmental externalities of agriculture. The EU allows members states to choose from a portfolio of different instruments and to set payment levels according to region-specific opportunity costs and necessities. In the current programming period EU Member States allocate on average 30% of their rural development programme budgets towards these schemes (EC, 2012). In Switzerland, agri-environmental direct payments receive about 29% of the all direct payments and 14% of total spending for agriculture (FOAG, 2012).

There is a substantial body of literature analysing specific measures or instruments with respect to environmental effectiveness and economic efficiency (Bakam et al., 2012; Carey et al., 2003; Uthes and Matzdorf, 2013). The importance of targeting and tailoring of policies to achieve maximum effectiveness with a given budget or to minimize spending for achieving the targets set has been stressed by economists and policy makers (OECD, 2007b). It is therefore necessary to compare both environmental impacts and the societal costs of agri-environmental policy instruments with each other in order to provide a basis for economically sound policy design (Pearce, 2005; Primdahl et al., 2010).

The Tinbergen Rule (1956) has been a guiding principle for economists and policy makers for more than 50 years. It is applicable generally across all economic sectors and has been discussed with respect to agricultural policy, waste policy, health policy, energy policy and climate policy (Ahrens and Lippert, 1994; Braathen, 2007; Knudson, 2009). The main statement of the Tinbergen Rule is that efficient policy requires at least as many policy instruments as there are targets. The common interpretation of this rule is to favour single-target policy instruments over broader instruments. Tinbergen's thoughts have also substantially influenced agri-environmental policy (Mann, 2005b). Multi-target policy instruments, in particular cross-compliance (Mann, 2005a) and support for organic farming via direct payments (von Alvensleben, 1998) have been evaluated to be inefficient as their multi-target character seems to contradict Tinbergen's postulate. However, empirical data from evaluation studies is scarce due to methodological constraints (Viaggi et al., 2011) and does not permit the

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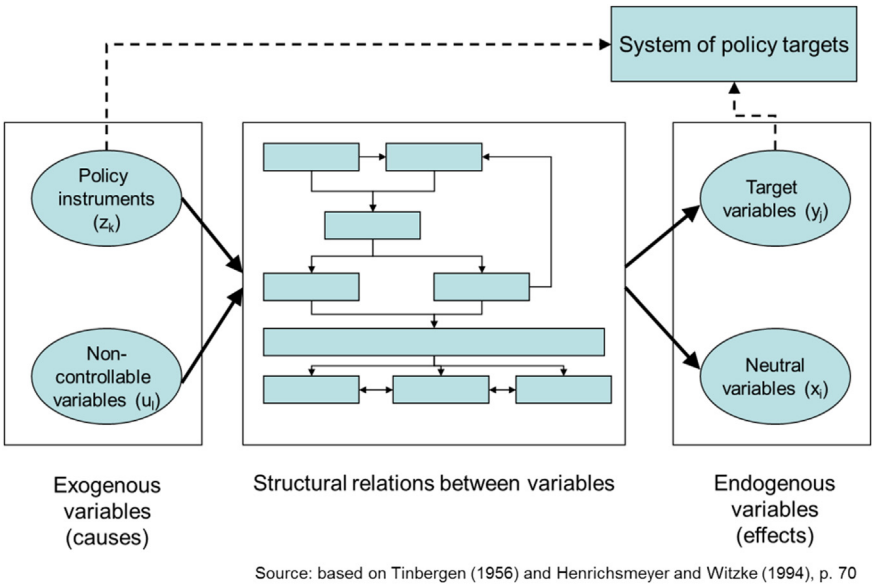

Fig. 1. Targets and instrument links in agricultural policy according to Tinbergen's model.

drawing of general conclusions on the efficiency of multi-target policy instruments.

Thus, the first aim of this paper is to explore how the economically optimal mix between single and multi-target policies can be determined. The second aim is to illustrate advantageous and disadvantageous conditions for multi-target policy instruments in policy mixes and to analyse how multi-target policies integrated in a policy-mix impact cost-effectiveness. We have chosen to use support for organic farming as an example of a multi-target policy, as the organic production standards that are supported by such policies have been developed to address a range of environmental, food and social goals (Schader et al., 2012).

In order to pursue these aims, an analytical linear optimisation model was used. The model simulates the decision-making process from the viewpoint of a rational policy maker, with specified policy targets and a set of instruments to reach these targets, subject to minimisation of public expenditure as the objective function.

In this paper, we provide a brief summary of the theory behind the Tinbergen Rule and clarify its implications for policy mixes and multi-target policies (Section 2). We explain the analytical model to systematically analyse the problem (Section 3). The results of the modelling exercise are presented in Section 4, while Section 5 discusses the model assumptions and results against their degree of realism. Finally, conclusions for science and policy are drawn in Section 6.

2. Tinbergen Rule and agri-environmental policy

In this section, we review the Tinbergen Rule and discuss its relevance for policy mixes and multi-target policies under consideration of economies of scope.

2.1. Review of Tinbergen's model for quantitative policy analysis

Criticising standard policy making for (a) its trial and error approach, (b) the isolated view of single measures (widely ignoring the effects of measures on other aims), and (c) qualitative arguments for changing policies, Tinbergen introduced a quantitative approach to policy making taking into account several policy instruments and targets at once (Tinbergen, 1956, p. 53ff).

With this model, he demonstrated that efficient economic policy needs at least as many independent policy instruments as there are targets. He defined four types of variables: (a) policy-instrument variables which are determinable by a policy maker (with respect to agri-environmental policy this could be taxes on fertilizer or public expenditure for the policy instrument "organic farming area support payments"); (b) target variables which are relevant for the system of policy targets (e.g. protection of natural resources like soil, water, air and biodiversity), (c) variables which are not (or not fully) controllable by the policy maker (e.g. agri-environmental policy does not control inflation or national unemployment rates); and (d) neutral variables which are irrelevant to the system of policy targets. Both policy instrument variables and target variables feed into the system of policy targets (Fig. 1).

Tinbergen modelled the structural relations between these four types of variables as a linear equation system. Each policy target y_j, $j = 1,\ldots,J$ is described by a linear equation of the non-controllable variables, the irrelevant variables and the unknown policy instrument variables z_k, $k = 1,\ldots,K$ that should be determined by solving the equation system. Thus, by the basic properties of linear equation systems, Tinbergen concluded that if the number of independent policy instrument variables equals the number of policy targets, i.e. if the number of unknown variables equals the number of equations in the equation system, his model will have one solution. However, if the number of target variables (i.e. equations) does not match the number of policy instrument variables, the equation system is either over- or underdetermined. If there are more policy instrument variables than policy targets (i.e. equations), the equation system has an infinite number of solutions. In the opposite case, if there are fewer policy instrument variables than policy targets, the equation system only has a solution in accidental cases.[2] Furthermore, Tinbergen argues that even if in this latter case there is an optimal solution, this solution will be inflexible with respect to changes in variables over time that are not directly controlled by the policy maker. This means, if we use a mix of policy instruments for achieving a set of given policy targets, the number of independent policy instruments should

[2] Note that this is only the case for Tinbergen's fixed-target model. Assuming flexible targets, there will be a solution, irrespective of the number of instruments.