



## Analysis

# How do incentive-based environmental policies affect environment protection initiatives of farmers? An experimental economic analysis using the example of species richness



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## ABSTRACT

To address ongoing biodiversity losses, the use of incentive-based nature protection policies is increasingly recommended. In the present paper, we examine how action and result-oriented agricultural policy measures affect the species protection initiatives of real agricultural managers. To do so, we use a computer-based economic experiment involving a multi-period individual business simulation game. Our results indicate that action-oriented measures do not have any impacts on farmers' initiatives to protect species. In contrast to action-oriented policy measures, result-oriented measures with identical profit effect significantly increase these initiatives. Although risk-averse farmers are less willing to participate in result-oriented measures than non-risk-averse farmers, in general, risk aversion does not influence farmers' species protection initiatives. Furthermore, the species protection initiatives are influenced by the opportunity costs of species protection.

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## 1. Introduction

In 1992, the Convention on Biological Diversity (CBD) was signed in Rio de Janeiro, in which 168 member states committed to conserve biodiversity. Despite this agreement, biological diversity is still decreasing at an alarming rate (Zabel and Engel, 2010). Since a substantial amount of biodiversity losses may be due to agricultural activities (Hails, 2002; Tschamtko et al., 2005), agriculture plays an important role in conserving biodiversity. The provision of ecosystem services, such as biodiversity, partially depends on farm management (Dale and Polasky, 2007; Power, 2010; Hanley et al., 2012).

In order to preserve ecosystems and to address ongoing biodiversity losses, scientists increasingly recommend the use of incentive-based conservation policies (Kroeger and Casey, 2007; Ulber et al., 2011). A typical instrument of the European Union (EU) to remunerate ecological services in agriculture is agri-environmental programs, anchored in the Common Agricultural Policy (CAP) since 1992. Within such programs, farmers receive payments for implementing specific agri-environmental measures. The major part of the existing agri-

environmental measures aims to remunerate the provider of the ecological service, i.e. the farmer, for implementing specified land-use measures that are expected to lead to an improvement of ecological conditions (Engel et al., 2008; Gibbons et al., 2011; Hanley et al., 2012). This concept is also referred to as action-oriented remuneration (AOR).

However, many studies on systematic evaluation of agri-environmental measures reveal that agri-environmental measures do not have the expected effects, show only moderate effects, or even lead to negative effects (Kleijn et al., 2001; Kleijn and Sutherland, 2003; Whitfield, 2006; Whittingham, 2011). According to Matzdorf et al. (2008), the design of European agri-environmental measures still lacks the necessary effectiveness and efficiency.

The next financial period of the CAP from 2014 to 2020 has begun, and the question still arises how European concepts remunerating ecological services within the framework of the second pillar should be designed nationally in the future. As an alternative concept to the AOR, many scientists support the result-oriented remuneration (ROR) (see e.g., Ferraro and Kiss, 2003; Zabel and Engel, 2010; Kempa and von Haaren, 2012), also referred to as output or performance-based payments for ecological services and success-oriented remuneration. Here, premium payments are directly linked to ecological objectives, and the farmers are entirely flexible on how they achieve these objectives. In the meantime, in Europe, the concept of the ROR has

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been implemented into individual agri-environmental measures.<sup>1</sup> There are also some existing worldwide pilot projects that deal with the implementation of the ROR (see e.g., Nelson et al., 2009; Dinerstein et al., 2013).

In order to ascertain if the ROR is a promising alternative to the AOR, Wätzold and Schwerdtner (2005) recommend in-depth analyses of advantages and disadvantages of both concepts. Even though they have been intensely analyzed for some years (Matzdorf, 2004; Zabel and Roe, 2009; Burton and Schwarz, 2013), there are only a few studies that directly compare the actual effects of the two remuneration concepts. A comparison of the two concepts by means of existing environmental policies would be worthwhile, though impossible, because there are no existing action and result-oriented policies that would be comparable with *ceteris paribus* regarding economic, political, and regional framework. Kurkalova et al. (2004), Gibbons et al. (2011) and Derissen and Quaas (2013) analyze the practicability of the two concepts to remunerate several environmental services by means of different simulation models. The disadvantage of these models, however, is that the decision behavior of agents is simulated, and, thus, multidimensional objectives and bounded rationality of real decision-makers are not indicated.

The objective of this paper is the comparative analysis of the effects of different concepts to remunerate 'species richness', which is a measurement of species diversity, one of three hierarchical categories of biodiversity (World Resources Institute et al., 1992). For this purpose, we implemented a computer-based economic experiment with agricultural managers, who are the real decision-makers. In this experiment the participants were confronted with action and result-oriented policies with identical profit effect that promote species richness of herbaceous plants on farmland. This approach allows for a direct comparison of the effects of both concepts under controlled framework conditions. To the best of our knowledge, this is the first time that environmental policies for increasing biodiversity are experimentally analyzed, and that, furthermore, the effects of action and result-oriented remuneration concepts are directly compared by means of the behavior of real decision-makers in virtual land-use decisions.

In the following section, we develop the hypotheses underlying this paper. Thereafter, we describe the design of the experiment (Section 3) and explain the socio-demographic characteristics of the participants in the experiment (Section 4). Subsequently, we analyze and discuss our results (Section 5). The paper ends with final conclusions (Section 6).

## 2. Generation of Hypotheses

European agri-environmental programs for the preservation and restoration of farmland biodiversity are continuously growing in relevance (Kleijn et al., 2006). Action and result-oriented policy measures are used to remunerate ecological services (Derissen and Quaas, 2013).

From the farmer's point of view, action-oriented policy measures can be quite interesting. They feature a high practicability (Osterburg, 2006) and are easy to understand for farmers (Hampicke, 2001). The client, e.g. the state, instead of the contractor, i.e. the farmer, bears the risk that the specified environmental measures do not lead to the desired success (Gerowitt et al., 2006). Moreover, action-oriented policy measures can lead to information asymmetries between the client and contractor that allow the contractor to work against the client's interests (Ferraro, 2008).

Result-oriented policy measures have many characteristics that can influence the species protection initiatives of farmers. For instance, result-oriented environmental policies grant farmers the autonomy to provide the requested ecological result by the means they choose (Zabel and Roe, 2009; Matzdorf and Lorenz, 2010). According to

Klimek et al. (2008), this flexibility increases the acceptance rate of this remuneration concept. By the use of result-oriented incentives, farmers are directly motivated to achieve ecological results (Hampicke, 2001; Klimek et al., 2008). The ROR increases the farmers' interest in ecological matters and their intrinsic motivation to achieve ecological objectives (Matzdorf and Lorenz, 2010). It encourages the farmers to develop innovative methods to implement the ecological objectives (Jack et al., 2008; Matzdorf et al., 2008). Lastly, the ROR induces the understanding of environmental services as income sources (Hampicke, 2006). Thereby, farmers respect environmental services as agricultural products and incorporate them into their economic calculations (Matzdorf et al., 2008).<sup>2</sup>

As described above, action and result-oriented policy measures can be advantageous for farmers. Thus, we formulate the following hypothesis:

**Hypothesis 1.** Action and result-oriented environmental policies that promote species richness on farmland significantly increase the species protection initiatives of farmers in terms of an extensified agricultural production (implementation of flowering fields, low input of pesticides).

If hypothesis 1 is true and both policy measures have the same profit effect, the question arises whether one of the two policy measures will increase the species protection initiatives of farmers more than the other. Compared to action-oriented policy measures, result-oriented policy measures have a distinct disadvantage for farmers. They bear the risk that the implemented environmental measure does not lead to the desired success (Burton and Schwarz, 2013; Derissen and Quaas, 2013). This means that the species protection initiatives of farmers are not financially remunerated in case of absent ecological success and that they additionally need to bear the costs of the implemented measures for an ecological condition improvement. However, if an environmental service is remunerated according to the concept of the AOR, farmers essentially do not need to worry about its ecological objective because the implementation of a defined measure is remunerated in any case.

As farmers are considered to be risk averse (Serra et al., 2008), it is expected that the risk of non-remuneration described above will significantly decrease the impact of result-oriented policy measures. Therefore, our second hypothesis is formulated as follows:

**Hypothesis 2.** Action-oriented policy measures have a significantly higher impact on the farmers' species protection initiatives than result-oriented policy measures with identical profit effect.

Besides agricultural policies, further factors can influence the species protection initiatives of farmers. An important aspect that should not be neglected in land-use decisions is the farmers' objective to earn money. Farmers are entrepreneurs and pursue multiple objectives (Sumpsi et al., 1996). As farmers are certainly motivated by financial considerations (Benz, 2009), we assume that they try to find economically advantageous solutions in operational decision-making situations. Thus, our third hypothesis is:

**Hypothesis 3.** Farmers practice significantly lower species protection initiatives, when the opportunity costs of species protection rise.

## 3. Experimental Design

The experiment consists of four parts that were performed by the participants in the following order: (1) the business simulation game,

<sup>1</sup> For an extensive overview of result-oriented agri-environmental measures in Europe, see Burton and Schwarz (2013).

<sup>2</sup> In the scientific literature, many other characteristics of the ROR are mentioned, such as its high cost effectiveness (Wätzold and Drechsler, 2005). Here, we limit ourselves to the consideration of characteristics which can affect the action of farmers in real land-use decisions. We do not consider advantages and disadvantages for the client or the society.

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