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Assessment of Collective implementation of Agri-Environmental Schemes

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Introduction. Subsidies and regulations targeting individual farms have been traditionally the most employed mechanisms to address the sustainability of the agricultural sector (Lefebvre et al. 2015). Yet a shift toward a collective approach, where public policy measures target groups of farms, has been often advocated for natural resource management in rural areas (Westerink et al. 2017). Several reasons underpin the potential inclusion of a collective approach in agri-environmental policies, for example: the difficulty (economical or technical) to monitor individual efforts (Suter et al. 2010), threshold effects in environmental processes (Kuhfuss et al. 2015), production of ecosystem services (Cong et al. 2014) and/or economies of configurations (Banerjee et al. 2017).

Focusing on the latter, the literature has developed the so-called "agglomeration bonus", whose distinct characteristic is the presence of a bonus, in addition to a standard payment, in case the allocation of land to biodiversity conservation is coordinated (e.g. the creation of a continuum) across landowners (Parkhurst et al. 2002). Several lab experimental analysis have suggested the elements that help players/farmers to coordinate (Banerjee et al. 2017). In addition, mathematical programming model have been employed to analyze the effectiveness of different types of payments (Wätzold and Drechsler 2014).

Collective payments have been introduced in mathematical programming model by assuming that farmers cooperate (e.g. the objective function being the aggregated gross margins of the farmers' population in a given area). This assumption leaves unexplained the choice of cooperating, or the formation of the group of people cooperating, the "coalition" hereinafter, and thus when and how to design policy schemes that promote cooperation. However, coalition formation models have been extensively used for the assessment of the ratification of international environmental agreements and voluntary participation in pollution control programs (e.g. Finus and Rübbelke 2013). However, the potential application of this methodology to an ex-ante assessment of collective conditionality constraints on actual policy schemes is challenged by the difficulties of dealing with 1) heterogeneous players, 2) spatially explicit considerations, and 3) potential emergence of a multitude of coalitions.

The objective of this paper is to assess the effectiveness of the inclusion of collective conditionality constraints in agri-environmental measures, in a setting characterized by the endogenous formation of farmers' coalition with respect to the enrollment in agri-environmental payments characterized by collective conditionality constraints (CCC). We formulate a theoretical model in which both rate of land contracted, cooperation decisions and the design of the policy schemes are endogenously determined. We model the group of farmers that cooperate as a club facing coordination costs. The characterization of farmers participating in this scheme as the contribution to a club is not a novelty, but actual studies that explicitly introduce a club/coalition framework for the analysis of policy schemes are rather limited (Ansink and Bouma 2013; Zavalloni et al. 2018). The model is analyzed in different scenarios that are differentiated along two dimensions. The first one is the presence or not of Ecosystem Services (ES), for example pollination, affecting the productivity of the agricultural sector, and at what scale these are determined. The second one is the type of access to the coalition, namely closed vs open access. The two access types represent different implementation of a collective approach.

Model. The basic structure of the analysis follows. In a given area there is a population of farmers F=$\{i...F\}$ where F is the size of the population. The player of the coalition formation game is a subset $G \subseteq F$ of size G. Call $S \subseteq G$ with size S one of the feasible coalitions of the game. We use the subscript "*s*" and "*n*" to indicate respectively members or not-members of the coalition. A regulator has the objective of maximizing the environmental quality of a a given area (E, say biodiversity) that depends on the land allocated to environmental protection: E=E$(e{\cdot}x_s{\cdot}S+(n\text{-}S){\cdot}x_n)$. The main motivation for the potential promotion of coalition formation is the fact the coordinated efforts deliver more environmental value: $e_s>1$. The profit function of a coalition member depends on i) the payment (p_s), ii) an ES (b) that could depend on the whole coordinated environmental effort ($e{\cdot}x_s{\cdot}S$), the average coordination costs t(S) and the costs of compliance K(x_s):

(1) $\pi_s = p_s \cdot x_s + b \cdot e \cdot x_s + \mathrm{B}\left(e \cdot x_s \cdot S\right) - \mathrm{t}\left(S\right) - \mathrm{K}\left(x_s\right)$

Non-members have a similar function with potential spillovers from the coalition (α) and the lack of coordination costs:

(2) $\pi_s = p_n \cdot x_n + \alpha \mathrm{B}\left(e \cdot x_s \cdot S\right) - \mathrm{K}\left(x_s\right)$

The model characterized by equations (1) and (2) is introduced in a three-stage game, which is subsequently solved by backward induction. In the third stage, coalition members and non-members decide on the land allocated to biodiversity, assuming coalition members behave cooperatively with respect to the other members. In the second stage, farmers decide on whether being a member or not of the coalition. In an open access scenario, the equilibrium condition is the solution S^O that equalizes: $\pi_s(S)= \pi_s(S)$. In the case of closed access, members of the coalition can prevent the entrance of non-members. The coalition that emerges S^C is thus resulting from the maximization of the average coalition member profits: $\partial\pi_s(S)/\,\partial S=0$. In the first stage, observing the effects of the payment on E, a regulator chooses the payment levels.

Results and discussion. The results of the model suggest that in a closed access, linear subsidy cannot be used to directly affect the size of the coalition, but either non-linear premium based on the coalition size, or minimum participation rules, are to be linked to the standard payments. On the contrary, in the open access case, linear subsidy directly affects the coalition size, even though the extent of their effect on the coalition size depends on the spillovers. A simple numerical example is then used to determine payment levels and the budget effectiveness of assuming a collective approach toward agri-environmental schemes.

Reference:

Ansink E, Bouma J (2013) Effective support for community resource management. Forest Policy and Economics 37:94–103

Banerjee S, Cason TN, de Vries FP, Hanley N (2017) Transaction costs, communication and spatial coordination in Payment for Ecosystem Services Schemes. Journal of Environmental Economics and Management 83:68–89. doi: 10.1016/j.jeem.2016.12.005

Cong R-G, Smith HG, Olsson O, Brady M (2014) Managing ecosystem services for agriculture: Will landscape-scale management pay? Ecological Economics 99:53–62. doi: 10.1016/j.ecolecon.2014.01.007

Finus M, Rübbelke DG (2013) Public Good Provision and Ancillary Benefits: The Case of Climate Agreements. Environ Resource Econ 56:211–226. doi: 10.1007/s10640-012-9570-6

Kuhfuss L, Préget R, Thoyer S, Hanley N (2015) Nudging farmers to enrol land into agri-environmental schemes: the role of a collective bonus. European Review of Agricultural Economics

Lefebvre M, Espinosa M, Gomez y Paloma S, et al (2015) Agricultural landscapes as multi-scale public good and the role of the Common Agricultural Policy. Journal of Environmental Planning and Management 58:2088–2112. doi: 10.1080/09640568.2014.891975

Parkhurst GM, Shogren JF, Bastian C, et al (2002) Agglomeration bonus: an incentive mechanism to reunite fragmented habitat for biodiversity conservation. Ecological Economics 41:305–328. doi: 10.1016/S0921-8009(02)00036-8

Suter JF, Segerson K, Vossler CA, Poe GL (2010) Voluntary-Threat Approaches to Reduce Ambient Water Pollution. American Journal of Agricultural Economics 92:1195–1213. doi: 10.1093/ajae/aaq042

Wätzold F, Drechsler M (2014) Agglomeration payment, agglomeration bonus or homogeneous payment? Resource and Energy Economics 37:85–101. doi: 10.1016/j.reseneeco.2013.11.011

Westerink J, Jongeneel R, Polman N, et al (2017) Collaborative governance arrangements to deliver spatially coordinated agri-environmental management. Land Use Policy 69:176–192. doi: 10.1016/j.landusepol.2017.09.002

Zavalloni M, Raggi M, Viaggi D (2018) Agri-environmental Policies and Public Goods: An Assessment of Coalition Incentives and Minimum Participation Rules. Environ Resource Econ 1–18. doi: 10.1007/s10640-018-0237-9