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THE POLITICAL ECONOMY OF AGRI-ENVIRONMENTAL MEASURES: AN EMPIRICAL ASSESSMENT AT THE EU REGIONAL LEVEL

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Abstract: The paper deals with the political and economic determinants of EU agri-environmental measures (AEMs) applied by 59 regional/country units, during the 2001-2004 period. Five different groups of determinants, spanning from positive and negative externalities, to political institutions, are highlighted and tested using an econometric model. Main results show that AEMs implementation is mostly affected by the strength of the farm lobby, and the demand for positive externalities. At the same time it emerges a prominent role played by political institutions. On the contrary, AEMs do not seem implemented by the willingness to address negative externalities.

Keywords: Agri-environmental Measures, EU Regions, Institutions, Political Economy

1. Introduction

Agri-environmental measures (AEMs) are policy instruments targeted to support more environmental-friendly agriculture methods and protection of the European countryside. Started as ‘accompanying measure’ to the 1992 McSharry reform of the Common Agricultural Policy (CAP), they became one of the most important and innovative policy tools of the UE rural development policy. AEMs are the most important instrument in terms of both financial expenditure - about 44% of the Pillar II CAP money - and land coverage - 25% of EU utilized agricultural area, data referred to the 2000-2006 Rural Development Policies (RDP) Programming Period.

As an effect of this important and growing role and because of their particular nature, AEMs represent one of the most controversial instruments of the new CAP. On the one end the European Commission often emphasize the positive effects of AEMs, claiming for their future expansion (see Commission, 2010). On the other end, AEM like policies are often complained by many experts, who rise several concerns about their effectiveness, stressing that they are a form of disguising agriculture protection (see Anderson, 2000; Swinbank, 2001; Garzon, 2005).

The large literature on AEMs can broadly classified in three main research areas. A first topic is represented by studies that try to quantify the AEMs effects on production and commodities markets, with the aim to clarify their role from the point of view of World Trade Organization (WTO) rules (e.g. Glebe, 2007; Edwards and Fraser, 2001; Diakosavvas, 2003; Latacz-Lohmann and Hodge, 2003). A second line of research, is focalized on their optimal policy design (see Hodge, 2000; Latacz-Lohmann, 2004; Hart and Latacz-Lohmann, 2005). Last, but not least, an emerging research area is dedicated to farmers’ willingness to participate in agri-environmental schemes, starting from the assumption that such a participation is mainly the outcome of a farm-level utility maximization process, influenced by other factors like social capital and the farmer’s environmental attitude (e.g. Vanslembrouck et al., 2002; Dupraz et al., 2002).

Until now, less afford has been devoted to investigate the real motivations behind agri-environmental schemes, notwithstanding the large literature on the political economy of agricultural policy (see Swinnen, 2010, for a recent review). Only few papers have systematically investigated this issue (see Baylis et al., 2006; Salhofer and Glebe, 2004) and, more importantly, they have treated the problem only at the EU national level. However, it is important to stress that the EU rules allows member states to design AEM schemes at the national or regional level, in order to adapt this policy to the different farming systems and environmental conditions. Thus, since AEMs are established at the regional level, Regions not Member States should be the relevant decision-making units of the analysis.

Starting from this consideration, this paper adopt a political economy approach to empirically investigate the determinants of AEMs implementation, at regional level. The analysis covers all the 59 agri-environmental programs of the EU-15 members from 2001 to 2004. Making reference to the 2000-2006 RDP programming period is useful because of the lack of a minimum funding requirement for each RDP axis, giving full freedom to local political bodies.

Special emphasis is given to the characterization of some important dimensions of the AEMs political bargaining process, focusing on the role played by political institutions, a dimension rarely investigated before in the literature. Specifically, the analysis tests five main hypotheses about the driving forces leading to AEMs diffusion: i) agricultural political weight; ii) limitation of negative externalities;, iii) demand of positive externalities; iv) public budget constraints, and finally v) political institutions.

The main results can be summarized as follow. We find evidence that AEMs implementation is mainly affected by farmer political weight, political institutions and the demand for positive externalities. Differently, AEMs expenditure and diffusion do not appear particularly affected by the level of existing negative externalities, suggesting that regions where agriculture is more intensive, causing worse environmental damage, are only marginally affected by the potential environmental benefit due to the diffusion of agro-environmental measures.

The remainder of the paper is organized as follow. The next Section reviews the theoretical background of agri-environmental policies, while Section 3 reviews the evidences from previous literature. Section 4 puts forward our key testable hypotheses and the model specification. Section 5 presents the results. Finally, the last Section discusses the main implication and draws some concluding comments.

2. Background

In the last decades the link between agriculture and the environment has become a relevant subject for economic and political debate around the role the primary sector should play in the future. In many countries environmental issues have gained the top of agricultural policy agenda. Particularly, in the European Union these issues have been risen to a fundamental goal of the Common Agricultural Policy (CAP), in order to contribute of a sustainable development. As an effect, policy instruments like AEMs, have gained progressive interest in both the political and social communities.

This on going process, often called the ‘greening’ of the CAP, can be included in the actual and more general debate around agriculture’s multifunctionality, with specific reference to its environmental function.[1] The concept of multifunctionality is not univocal, but lend itself to several interpretations, often depending on the perspective taken. For example, Van Huylenbroeck et al. (2007) distinguish between a supply vision, based on agricultural production characteristics, and a demand vision, focused on the role society assigns to multiple agriculture functions. A more detailed survey of heterogeneous viewpoints around multifunctionality issues is also given by Hagedorn (2004), who separates analytical and descriptive interpretations, the latter often merely finalized to policy instruments justification.

From an economic point of view, multifunctionality definition involves some key concepts as agriculture’s joint production of commodity and non-commodity outputs (NCOs), externality and public goods (OECD, 2001; Durand and Van Huylenbroeck, 2003). Following the OECD working definition the basic elements of multifunctionality are: *i*) *the existence of multiple commodity and non-commodity that are jointly produced by agriculture* and *ii*) *the fact that some of the commodity outputs exhibits the characteristics of externalities or public goods, with the result that markets for these goods do not exists or function poorly* (OECD, 2001).

Since many jointly-produced NCOs have externalities and public goods characteristics, market failures occurs and hence public intervention is required. Depending on the degree of jointness different policy instruments are established to solve market failures (OECD, 2003). To that purpose, it is fundamental to identify causes of jointness (see Boisvert, 2001): policy intervention is particularly needed in case of non-allocable inputs contemporary devoted to the realization of both commodities or NCOs. In this situation NCOs public good features lead to under-provision of positive externalities and over-provision of negative externalities, with respect to the social optimum.

Economic theory suggests that incentives or disincentives to correct market failures and to maximize social welfare should equate social marginal value of every public good in its optimal provision level. This implies that as many policy instruments are required as many goods are addressed (Tinbergen, 1952).

Following this criteria some authors claim for completely production-decoupled instruments to improve multifunctionality (see Anderson, 2000; Blandford and Boisvert, 2002). This could be justified by the fact that many multifunctional features are strictly site-specific and potentially separable from farming. On the other hand, Vatn (2002) and Rørstad et al. (2007) argue that in-depth instrument targeting involves higher transaction costs, often undoing potential benefits. Furthermore, targeting often conflicts with the difficulty to economically evaluate every public good, especially when they are spatially widespread (Randall, 2002). Thus, due to economies of scope, production-coupled tools become more sustainable under the strong assumption that overall non-trade agriculture effects are positive.[2]

The issue of handling NCOs by agricultural policy tools rise also concerns about the acceptability of the multifunctio-

[1]Other issues are represented, for example, by cultural heritage, food security, food safety, rural viability and so on.

[2]European widespread intensive agriculture’s management does not seem to confirm this assumption (Anderson, 2000)

nality approach, or 'non-trade' concerns, in the WTO system Detractors of multifunctionality, especially from US and Cairns Group and, more recently, also from several developing and emerging countries, highlight the trade-distorsive nature of production-coupled measures and charge their advocates with disguised protectionism. On the other hand 'multifunctionalists', as the EU and other high-costs production countries like Japan, appeal to the role of agriculture in preserving landscape amenities and rural viability.

As an effect of the strictly joint production regarding many NCOs, tools aimed to affect their supply seem to imply inevitable production effects (Diakosavvas, 2003; Latacz-Lohmann and Hodge, 2003)[3]. This issue is also valid with respect to AEMs which, in the Uruguay Round Agreement on Agriculture (URAA), were placed in the Green Box, among the minimal trade-distorting measures. Thus, a question arises whether current Green Box policies eligibility criteria will receive confirmation in the future (Josling and Tangermann, 1999; Glebe, 2007). Edwards and Fraser (2001) defends URAA decisions about AEMs, on the contrary Diakosavvas (2003) as well as Salhofer and Streicher (2005) reports evidence on the AEMs significant influences on production and trade.

Summarizing, agri-environmental schemes feasibility depends, from a normative perspective, to the capacity to solve market failures by minimizing market distortions (Latacz-Lohmann and Hodge, 2003). Thus, agri-environmental policies are argued to be sustainable if they are welfare-enhancing, despite possible negative production side effects (Hodge, 2000; Edwards and Fraser, 2001).

Pointing our attention to EU AEMs, many authors have added their contribution to design optimal schemes and to evaluate existing tools (e.g. Hodge, 2000; Lankoski and Ollikainen, 2003; Latacz-Lohman, 2004). Undoubtedly one of the most important limits of EU AEMs is represented by information asymmetry between farmers and policy makers. Because of limited information and lack of targeting, voluntary contributions are approached by only those farmers who easily accomplish to environmental prescriptions. So adverse selection problem involves farmers over-compensation and limited environmental effects. Other restrictions are represented by moral hazard, lack of incentives to ameliorate farming environmental quality and administrative costs for implementing and monitoring policies (see Falconer, 2000; Fraser, 2002; Latacz-Lohman, 2004; Hart and Latacz-Lohmann, 2005).

It is important to remark that the choice to subsidize less intensive farming practices and landscape amenities by contributes linked to extra costs or loss of income, involved in complying with the government program, does not approach the social optimum and it is not consistent with the "polluter pays principle". However, this question involves the hoary problem of externalities evaluation on the one hand and definition of property rights for land use on the other (Glebe, 2007; Schleyer et al., 2007).

Moreover, defining an efficient set of policy instruments represents only a partial aspect of the problem, in fact there is question whether AEMs are mostly implemented to solve market failures or, differently, are also driven by redistributive logics influenced by the rent-seeking activity and political support motives (Peterson et al., 2002; Baylis et al. 2006). Taking care the last perspective and before presenting our main hypotheses, in what follow we will focus the attention on the few existing evidences that have analyzed the economic and political determinants of the AEMs adoption in the EU.

3. Previous evidence

A small literature has investigated the determinants of AEMs from a political economy perspective. Indeed, to date, this approach has been adopted by Baylis et al. (2005, 2006) and Sahlofer and Glebe (2004, 2007). However, although related to local compensation payment for providing landscape amenities, Hackl et al. (2007) offer a convincing interpretation of the political bargaining process of agri-environmental policies[4].

Starting with the US and EU diverging attitudes towards agri-environmental policies[5], Baylis et al. analyze the economic and political determinants of AEM expenditure of EU countries, from 1993 to 2002. These authors investigated the extent to which AEMs are driven by genuine objectives to reduce negative externalities and by satisfying public demand for landscape amenities or, differently, they are a disguised attempt to support farmers' income. The paper proposes four plausible policy 'lenses' for which AEMs could be interpret. In the *pollution lens* AEMs aim at reducing agriculture environmental impact, while in the *green demand lens* they correspond to social request for positive externalities. Other scenarios are represented by the *budgetary lens* in which it is hypothesized a partial substitution of traditional farm income support with 'green' labeled instruments, and finally by the *cynical lens* in which the only purpose is to merely maintain traditional farm support. Note that these scenarios are not mutually excludable.

[3] Moreover the linkage between commodities and NCOs depends on production intensity, thus the relationship may be negative or positive, the last overall in case of extensive production practices (Romstad, 2004).

[4] Differently, there is an important and growing empirical literature dealing with the farmers' willingness to participate in the AEMs (e.g. Dupraz et al., 2002; Vanslembrouck et al., 2002; Mann, 2005; Defrancesco et al., 2007; Jongeneel et al., 2008). These papers study the relationship between AEMs implementation and farms and farmers' characteristics.

[5] For a comparison between EU and USA agri-environmental policies see also Baylis et al. (2007).

Analogies with the above mentioned approach can be found in Glebe and Sahlofer (2007), who aim to understand heterogeneities in the uptake of AEMs across EU countries. They empirically test a political preference function model on AEMs implementation between, focusing on factors like environmental benefits, agricultural lobby influence, private costs of adhesion, and both national and EU budget pressure. The latter determinant is strictly related to the so-called 'restaurant table effect', namely how a non-cooperative game across EU countries split co-financed policy costs among other contributors, determining total public-resource overspending (see Pokrivcak et al., 2001; Pokrivcak and Swinnen, 2004).

Hackl et al. (2007) modeled the political bargaining process related to Austrian local agri-environmental programs. Considering factors affecting this process, they stress the role of transaction costs existing within and among categories of involved stakeholders (farmers, beneficiaries and politicians). Environmental benefits, opportunity costs, structural differences and budget constraints have also been taken into account. A key advantage of the Hackl et al. study, over the previously mentioned papers, is its focus on the *local* actors responsible for the decision and implementation of the agri-environmental policies. Indeed, a national focus may mask several key details that could be very important in the analysis of AEMs, given their particular nature of site-specific policies.

4. Hypotheses, data and model specification

Starting from the previous discussion, in what follows we advance some hypotheses on the most plausible factors affecting AEMs implementation intensity across EU regions. To organize the discussion we focus on five broad determinants: *i*) agricultural political weight, *ii*) negative externalities limitation, *iii*) positive externalities demand, *iv*) budget constraints and, last but not least, *v*) political institutions. However, it is important to note that these hypotheses are not mutually excludable.

4.1 Hypotheses and explanatory variables

Hypothesis 1: *AEMs implementation should be positively affected by the agricultural group political weight.*

Generally speaking, the agricultural lobby strength is characterized by its ability to seek public transfers. Thus, we expect a positive relationship between Pillar I and AEMs expenditure. Our key proxy to capture the farmers' political weight is the total regional transfer to the agricultural sector of Pillar I support (price support plus direct and other payments) as a share of the regional agricultural gross value added at basic prices (EU Commission, 2001). Moreover, to better capture the strength of the farm lobby we also include the agricultural labor share, land inequality, and female and young farmers share.[6] The first two variables make it possible to control for traditional factors like relative group size and sector heterogeneity, both elements that affect the transaction costs of farm groups collective action. Differently, the female and young farmers share are indicators of higher environmental sensitivity and a better education level (Hackl et al., 2007; Dupraz et al., 2002; Vanslembrouck et al., 2002).

Hypothesis 2: *AEMs implementation should be positively affected by the level of agriculture negative externalities.*

Agri-environmental schemes provide economic compensation for those farmers who choose to adopt more extensive agricultural methods, in order to reduce negative externalities.[7] In such a scenario, intensive farming areas represent the most suitable target for these measures (European Commission, 2005). Hence, to confirm the assumption that reducing agricultural pollution is an AEMs key objective, we have to expect a positive correlation between AEMs implementation and intensive farming proxies, like farm productivity. On the other hand, intensive farming incurs higher opportunity costs in complying with program commitments, thus discouraging adhesion. The intensity of agricultural production is measured by three proxies: regional average yield of wheat, regional nitrogen surplus,[8] and the share of pasture and permanent grassland over the whole agricultural area.

AEMs payments are calculated on the basis of the additional costs and the loss of income involved in complying with environmental standards beyond a reference baseline. These baseline requirements, called Good Farming Practice (GFP), represent the minimal environmental quality standard from which a farmer's efforts are compensated. As GFPs are not univocal, but are defined locally, it is conceivable that a high degree of environmental compliance might act as a deterrent to the farmer's involvement in AEMs. To quantify the GFPs level we use the European Environment Agency (EEA) IRENA project indicators and, particularly, IRENA 02 indicator 'Regional levels of good farming practices'.[9]

Hypothesis 3: *AEMs implementation should be positively affected by agriculture positive externalities social demand*

Social demand for agricultural positive externalities and, more generally, for environmental amenities is linked to

[6] Land inequality is measured by the Gini index of operational agricultural land holdings, while the share of female and young holders are respectively represented by female and 35 years old or less farm holders percentage. All these variable are based on Eurostat data.

[7] Reduction of intensive agriculture environmental impact is the most important objective of AEMs with 2/3 of public funds devoted to this aim (Diakosavvas, 2003).

[8] Source: CAPRI Modeling System

[9] IRENA 02 quantifies for each country percentage of relevant agricultural practices/environmental issues covered by GFPs (see EEA, 2005a).

individual economic welfare (Bimonte, 2002). Thus, our primary proxy for the demand of positive externality is the level of development, measured as regional real per-capita GDP. However, because this variable only imperfectly captures the social demand for environmental goods, other proxies have been included in the analysis, as well. Tourism intensity, which is captured by the rate of tourism arrivals per 1,000 inhabitants, should by proxy the direct landscape fruition. Moreover, access to an information network, measured as internet users per 1,000 inhabitants, might indirectly approach similar concerns.[10] Other relevant proxies used to disentangle the demand for positive externalities are the severity of environmental legislation and the green voters share. Clearly, the last variable also proxies for political pressure from environmentalist lobbies. Following Baylis et al. (2006), environmental legislation is measured by the EEA (2005b) ranking, that classifies countries with a score from 1 (worst) to 5 (best). The Regional Green voters share was built starting from the 1999 European Parliament Elections. Among environmentalist parties we include political movements enrolled in the European subgroup 'Greens' and other environmentalist parties without representation in the EU parliament.[11]

Hypothesis 4: *AEMs implementation should be affected by public budget constraints*

Following Glebe and Sahlofer (2007) concern about the AEMs co-financing system, we tested the 'restaurant table effect'[12] by taking into account the 'regional contribution' to the whole EU budget, proxied by the share of regional GDP on EU-15 GDP. In order to smooth the strong regional/national size differences we express such variable in a logarithmic form.

The regional/national budgetary pressure linked to the adhesion to agri-environmental measure is closely related to the public budget deficit, configuring itself like a public administration opportunity cost (Glebe and Sahlofer, 2007). Due to the lack of data on regional deficits, the budgetary pressure variable is indirectly proxy by the previous five years average regional growth rate. An analogous meaning is attributable to the variable indicating the share of farms located in less favoured areas (LFA).

Hypothesis 5: *AEMs implementation should be affected by political institutions*

AEMs regional implementation has many points in common with EU Structural (or Regional) policies. First, the policy is applied at the regional level, thus involving local political bargaining, in addition to national and EU bargaining. Kemmerling and Bodenstein (2006) point to a strong influence of political partisanship and competition in regional funding allocations. These authors refer to a positive effect of left and euro-sceptic partisan ideology in the regional redistribution of EU structural/cohesions funds. These effects are respectively motivated by left-wing parties' traditional preference for redistribution and by the attempt to compensate loser of the EU integration process, like voters who gain little from the common market or monetary policy. Moreover, Hackl et al. (2007) find a positive relationship between AEMs intensity and left parties' share. In their opinion, such results could reveal discontinuity in innovative agri-environmental contracts from long-established income support instruments, put forward by political groups to whom farmers traditionally refer, like conservatives.

To test this hypothesis we collect data from the 1999 European Parliament Election referred to each of the AEMs territorial units considered.[13] Specifically, following Kemmerling and Bodenstein (2006), we point our attention to left ideology and euro-sceptics, including in these categories those parties enrolled in specific European Political Groups. Using EU parliament and national election websites, 1999 EU Parliament elections results have been collected for every EU-15 regions and countries. Then every party has been linked to the respective European Political Group. In the analysis we consider only parties represented with at least one elected candidate at the European Parliament.[14]

A second important political institution dimensions is the degree of political competition. Comparative politics literature (see Persson and Tabellini, 2000) capture this dimension or by using differences in electoral rules (e.g. majoritarian vs. proportional election), or by using the mean electoral district magnitude, i.e. the average number of members of the lower house elected in each constituency. On the one hand, the larger the district magnitude, the greater the

[10] Internet users and environmental legislation variables are gathered at national level.

[11] 'Greens' is a subgroup into Greens/European Free Alliance (Greens/EFA) political group. For our analysis we exclude EFA regionalist parties.

[12] By 'restaurant table effect' we mean that group members will order expensive meals, if the bill is split among group (see Glebe and Salhofer, 2007; Pokrivcak et al., 2001). In this case we refer to agri-environmental budget.

[13] The choice of utilizing EU Parliament Elections 1999 dataset, rather than national or local elections, is useful because EU results reveal electoral behaviour of every voters at the same point in time. Moreover different national and regional electoral results become comparable with respect to the classification of every local party into an European Political Group (and so to an ideology). Finally 1999-2004 EU legislation covers exactly our dataset on AEMs implementation.

In every case Kemmerling and Bodenstein (2006) demonstrate that regional results of national elections preceding the 1999 European Parliament Elections are not statistically different from the latter.

[14] Focusing on left ideology, we include in this category parties enrolled in the following groups: the Party of European Socialists Group (PES), the Confederal Group of the European United Left / Nordic Green Left (EUL/NGL) and the group of Greens / European Free Alliance (Greens/EFA). Among eurosceptics we assign the Confederal Group of the European United Left / Nordic Green Left (EUL/NGL), Union for Europe of the Nations (UEN), the Group for a Europe of Democracies and Diversities (EDD), Independent Members and also European Democrats (ED) subgroup. For every region the variables left and eurosceptics represent the percentage obtained by parties that are members of above mentioned EU political groups.

probability for minority parties without territorial concentration, like environmentalists, to obtain political representation. On the other hand, the literature suggests that majoritarian elections, characterized by small district magnitude, tend to be associated with political incentives directed towards narrow and concentrated geographical interest and local public goods. Thus, the a-priori effect of the district magnitude variable on AEMs expenditure is unclear. This variable, collected at the national level, comes from the World Bank Database on Political Institutions (see Beck et al., 2001).

4.2 The dependent variable

The basic data to measure AEMs intensity are extracted from the Common Monitoring Indicators collected by the UE Commission for the programmes' evaluation process. For each European country, AEMs have been drawn up at the most appropriated geographical level.[15] Following this logic, some Member States have implemented schemes at the national level, while others realized regional programs. At the former level we find France, Ireland, Sweden, Austria, the Netherlands, Greece, Denmark and Luxembourg. Instead Germany, Italy, Belgium and the United Kingdom, in relation to their institutional differences, chose to apply AEMs regionally. Germany and Italy with their respective 16 länders and 21 regions, worked out a programme for each of them. Diffenrently, the United Kingdom arranged 4 programmes, respectively for England, Scotland, Wales and Northern Ireland, and Belgium 2 programmes, one for the Flemish Region and the other for the Walloon Region. In a few cases, the Member States have simultaneously presented national and regional programmes for particular regions that prefer autonomy. This is the situation of Spain, Portugal and Finland.[16] Overall, to explain the economic and political drivers of the implementation of agri-environmental measures, we use data from 59 EU territorial units observed for the years from 2001 to 2004. Thus, pooling these observation, we work with a total number of 236 observations.

The AEMs implementation intensity is expressed as the ratio between agri-environmental payments and agricultural gross value added.[17] This choice is motivated by two main considerations. First, the heterogeneous nature of agri-environmental measures, where, for example, several schemes could cover the same surface, have generated problems of double counting in quantifying the physical share of the total utilized agricultural area under agri-environmental commitments (see EEA 2005a). Thus, a measure based on the effective expenditure overcomes such problems. Moreover, by measuring AEMs intensity in terms of expenditure on agriculture value added, we stay close to the literature that has investigated the determinants of agricultural support using endogenous variables, like producer subsidy equivalent. Figure 1 displays the AEMs expenditure intensity across the EU-15. Table 1 shows summary statistics of the explanatory variables described above. Finally, in Appendix A data sources and calculation details of the above described variables are reported.

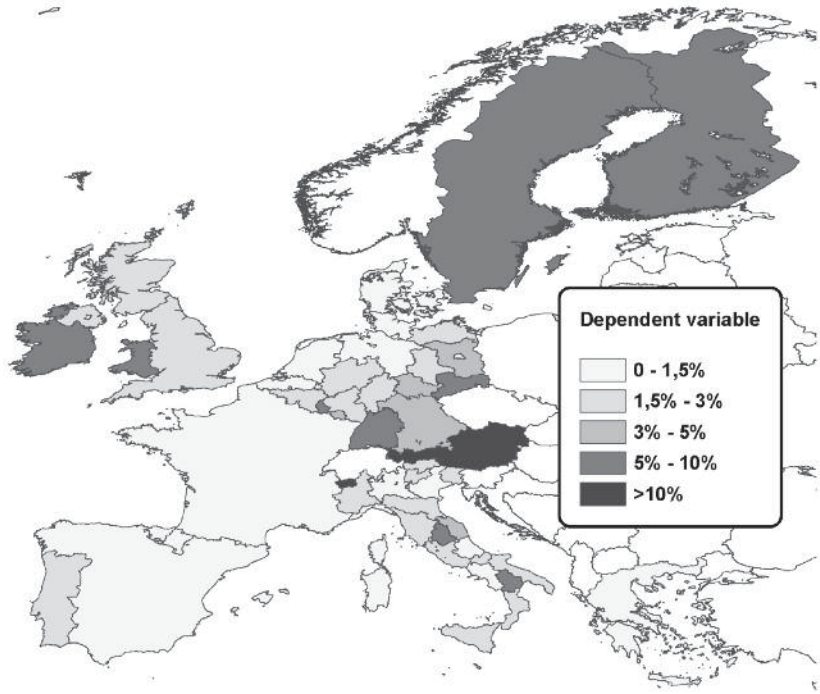

Figure 1. Agri-environmental expenditure on agricultural value added

5. Regression Results

Table 2 displays the regression results of the model specification described in the previous section. In particular, we report the results of two different specifications. Model I is a pooled regression specification where we do not control for country fixed effects, whereas in Model II we control for

[15] Council Regulation (EEC) No 1257/99 of 17 May 1999, article 41.

[16] Spain has a national agri-environmental programme, with the exception of Navarra and the Basque Country that have their own. In Finland and Portugal there is a programme for the continental portion of the country and specific plans for the Aland Islands, Madeira and the Azores Islands.

[17] Agri-environmental payments include financial funds under the old commitments of Council Regulation (EEC) No 2078/92 and under more recent Council Regulation (EEC) No 1257/99.

Table 1. Descriptive statistics (Number of observations = 236)

	Mean	Maximum	Minimum	Std. Dev.
Dependent variable				
AEMs Intensity	3.12	20.14	0.16	3.34
Agricultural political weight				
Pillar I expenditure	36.46	88.94	2.80	17.61
Agricultural labor share	4.61	14.95	0.36	3.41
Agricultural labor share squared	21.28	223.59	0.13	11.60
Land inequality	58.69	82.03	2.72	12.59
Female	20.46	41.88	7.65	9.95
Young	10.77	18.63	3.89	4.06
Negative externalities limitation				
Nitrogen surplus	56.36	202.00	9.00	44.92
Yield	5.14	9.81	0.84	2.45
Pasture	37.91	99.13	0.92	24.73
Level of good farming practices	59.12	82.00	33.00	9.50
Positive externalities demand				
GDP per capita	24,385.00	59,778.79	10,5636.31	7,873.91
Tourism intensity	1,895.72	10,000.40	504.00	1,745.01
Green voters share	4.71	22.61	0.00	4.60
Environmental legislation	2.85	5.00	1.00	1.46
Internet	25.86	45.60	9.20	7.02
Budget constraints				
Region GDP/EU GDP	1.69	16.85	0.01	3.01
Region 5 year avg GDP growth	4.24	14.96	-0.51	2.39
Less favoured area	55.79	100.00	0.00	26.79
Political institutions				
Left	38.83	64.03	11.64	13.42
Left * land inequality	2,276.34	4,938.82	91.57	948.08
District magnitude	9.17	150.00	1.00	19.14
Eurosceptics	20.45	46.55	0.00	13.31

unobserved country heterogeneities by including a set of country fixed effects. The key differences between the two models, other than fixed effects, come from some variables that lack regional variation. Indeed, we are forced to omit them from Model II due to their perfect collinearity with the country fixed effects.

As a general rule, we include an explanatory variable by means of its significant level and robustness especially with respect to Model II, as it represents a more conservative specification to problems of omitted variables bias.

Following the previous discussion, we organized the results presentation by grouping the set of explanatory variables into five categories, that should represent the main driving forces affecting the level of AEMs implementation. However, it is important to bear in mind that the borders across these groups are not always so sharp. Finally, for each model, we report the estimated coefficients, and their respective *p*-value. Moreover, we also report the standardized β coefficients, with the aim to address which variable contributes the most to the regression.[18]

At the general level, the explanatory power of the models, measured by the adjusted R^2, appears quite high, also taking into account the cross-sectional nature of the data set. Model I accounts for about 72% of the variation in AEMs expenditure, while in Model II the overall explanatory power reaches 89%. The proxies related to farmer political weight are all significant at the 5 or 10 percent level, with the exclusion of the agricultural employment share squared and

[18] The β coefficients have been calculated by dividing the standardized estimated coefficients by the standard deviation of the dependent variables, so as to 'purge' the estimated coefficients of their dependence on measurement units.

Table 2. Determinants of agri-environmental expenditure

	Model I			Model II		
	Coefficient	P-value	*B* coeff.	Coefficient	P-value	*B* coeff.
Agricultural political weight						
Pillar I expenditure	0.045	0.000	0.239	0.069	0.000	0.362
Agricultural labor share	0.574	0.006	0.585	-0.368	0.011	-0.376
Agricultural labor share squared	-0.007	0.532	-0.106	0.024	0.007	0.346
Land inequality	-0.073	0.088	-0.274	-0.031	0.376	-0.118
Female	0.177	0.000	0.528	0.099	0.000	0.294
Young	0.144	0.020	0.175	-0.046	0.379	-0.056
Negative externalities limitation						
Nitrogen surplus	-0.015	0.000	-0.202	-0.009	0.043	-0.127
Yield	0.025	0.843	0.018	-0.081	0.480	-0.059
Pasture	0.001	0.909	0.006	-0.013	0.095	-0.094
Level of good farming practices	0.009	0.685	0.024			
Positive externalities demand						
GDP per capita	0.0002	0.000	0.523	0.0001	0.000	0.304
Tourism intensity	0.0005	0.000	0.255	0.0003	0.000	0.153
Green voters share	0.068	0.060	0.094	-0,130	0.002	-0.179
Environmental legislation	0.922	0.000	0.404			
Internet	0.292	0.000	0.614			
Budget constraints						
Log (Region GDP/EU GDP)	-0.227	0.117	-0.099	-0.504	0.000	-0.220
Region 5 year avg GDP growth	0.586	0.000	0.418	-0.050	0.572	-0.036
Less favoured areas	-0.022	0.028	-0.178	-0.012	0.058	-0.098
Political institutions						
Left	-0.184	0.004	-0.741	-0.184	0.000	-0.738
Left * land inequality	0.004	0.000	1,078	0.003	0.000	0.825
District magnitude	-0.036	0.000	-0.205			
Eurosceptics	-0.009	0.493	-0.035	-0.048	0.003	-0.190
Year fixed effects	Yes			Yes		
Country fixed effects	No			Yes		
Nr. observations (Nr. Regions)	236 (59)			236 (59)		
Adjusted R-squared	0.72			0.89		
F-statistic	25.4			53.3		

Notes: OLS regressions, p-values based on cluster standard errors at the country/region level. b coefficient reported in columns 3 and 6 are calculated by dividing the standardized estimated coefficients by the standard deviation of the dependent variables. Country and year fixed effects, included as indicated.

land inequality in Model I and Model II, respectively. The signs of the estimated coefficients are, generally speaking, in line with *a priori* expectations, suggesting that the relationship between the power of the farm lobby and the agro-environmental measures are substantially in line with the vast literature on the determinants of agricultural protection and support (see, e.g., Olper, 2007). AEMs expenditure is strongly, and positively, related to the level of Pillar I expenditure, suggesting that the two policies tend to be complementary.[19] In model II the agricultural labor share displays a U-shaped relationship with agro-environmental expenditure. This means that the relationship is negative for a low level of agricultural labour share but, beyond the threshold of about 8%, any further increase in the size of the farm group tends to increase AEMs expenditure. The proxy finalized to capture heterogeneity in the farm group, land distribution inequality, affects the level of AEMs expenditure negatively, a result in line with recent literature on inequality and collective action problems (see Bardhan et al. 2001; Olper 2007). Finally, an increase in the share of females and young farmers affects AEMs implementation positively, although the latter variable is only significant in Model I.

AEMs expenditure is not particularly affected by the level of existing negative externalities, namely regions where agriculture is more intensive, causing environmental damage, have not a higher level of agro-environmental

[19] In some, more parsimonious, specification the share of Pillar I expenditure display an inverted U-shaped relationship with AEMs expenditure, suggesting some degree of substitution between the two policies. However, this result is not robust to the inclusion of country fixed effects.

Appendix A: Data sources and variables definition

Variable name	Definition	Source
Dependent variable		
AEMs Intensity	The regional ratio between AEMs payments and the agricultural gross value added	Authors' calculation from EUROSTAT Database and EU Commission sources
Agricultural political weight		
Pillar I expenditure	The total public transfers to the agricultural sector of Pillar I support (price support plus direct and other payments) as a share of the regional agricultural gross value added at basic prices	Authors' calculation from EU Commission (2001) and EUROSTAT Databases
Agricultural labor share	The share of agricultural employment on the total regional employment	Authors' calculation from EUROSTAT Database
Land inequality	The Gini index of agricultural land concentration (2000)	Authors' calculation from EUROSTAT Database
Female	The share of female farm holders on total farm holders (2000)	Authors' calculation from EUROSTAT Database
Young	The share of 35 yers old or less farmer holders on total farm holders (2000)	Authors' calculation from EUROSTAT Database
Negative externalities limitation		
Nitrogen surplus	The regional nitrogen surplus (Kg per hectare)	CAPRI Modeling System
Yield	The regional yield of wheat (tons per hectare)	EUROSTAT database
Pasture	The share of pasture and permanent grassland over the whole agricultural area	Authors' calculation from EUROSTAT Database
Level of good farming practices	The percentage of relevant agricultural practices/environmental issues covered by Good Farming Practices in each country (IRENA 02 indicator 'Regional levels of good farming practices')	EEA (2005a)
Positive externalities demand		
GDP per capita	The Gross Domestic Product per capita in real terms at regional level	Authors' calculation from EUROSTAT Database
Tourism intensity	The rate of tourism arrivals per 1,000 inhabitants at regional level	EUROSTAT database
Green voters share	The regional share in the 1999 European Parliament Elections of parties enrolled in the EU Parliament subgroup 'Greens' and other environmentalist parties withouth representation in EU Parliament	Authors' calculation from national and EU sources
Environmental legislation	The environmental policy integration degree in national legislation from 1 (worst) to 5 (best)	EEA (2005b)
Internet	The number of internet users per 1,000 inhabitants at national level	EUROSTAT database
Budget constraints		
Region GDP/EU GDP	The regional Gross Domestic Product as a share of the EU one (expressed in a logarithmic form)	Authors' calculation from EUROSTAT Database
Region 5 year avg GDP growth	The regional Gross Domestic Product growth rate of the previuos five years	Authors' calculation from EUROSTAT Database
Less favoured area	The share of farms located in the Less Favoured Areas	Authors' calculation from EUROSTAT Database
Political institutions		
Left	The regional share in the 1999 European Parliament Elections of parties enrolled in the following EU Parliament political groups: the Party of European Socialists Group (PES), the Confederal Group of the European United Left / Nordic Green Left (EUL/NGL) and the group of Greens / European Free Alliance (Greens/EFA)	Authors' calculation from national and EU sources
District magnitude	The average number of Members of the Lower House elected in each costituency	World Bank Database of Political Institutions
Eurosceptics	The regional share in the 1999 European Parliament Elections of parties enrolled in the following EU Parliament political groups: Confederal Group of the European United Left / Nordic Green Left (EUL/NGL), Union for Europe of the Nations (UEN), the Group for a Europe of Democracies and Diversities (EDD), Independent Members and European Democrats (ED) subgroup	Authors' calculation from national and EU sources

expenditure. Furthermore AEMs expenditure is lower in regions where the nitrogen surplus is higher. Thus, from this perspective, even at the regional level we find confirmation of the evidence of Baylis et al. (2006), who show how countries systematically having the largest production of negative externalities are investing the least amount of money in AEMs measures.

In contrast, AEMs expenditure is strongly and positive related to the social demand of positive externalities. More specifically, the level of GDP per capita, tourism intensity, the strength of environmental legislation, the diffusion of internet and, finally, the share of regional votes going to Green parties, all exert a significant positive effect on AEMs intensity. However, the strength of Green parties is not robust to specification changes, e.g. the inclusion of country fixed effects induces a change in the sign of the estimated coefficient from positive to negative. Thus, while these results are broadly consistent with the previous evidence, it also appears that working at the regional level can lead to more complex relationships than previously suggested.

The 'regional contribution' to the EU budget negatively affects the AEMs intensity. Thus, the result tends to give some support to the so-called 'restaurant table effect', namely the tendency of the CAP decision-making process to overprotect agriculture, a result in line with the Glebe and Salhofer (2007) evidence obtained at the national level. The positive coefficient of the real GDP growth of the previous five years (although becoming insignificantly negative in Model II) and the negative coefficient referred to LFAs, give a substantial confirmation to the role played by public opportunity costs in co-financing policies.

The last group of considered variables are political institutions. Both left ideology orientation and the average district magnitude negatively affect agri-environmental expenditure. Moreover, and this is quite interesting, the effect of left-wing ideology orientation is conditional to the level of land inequality, namely an interaction effect between these variables has a significant positive effect on AEMs expenditure. The negative effect of the left-wing orientation on AEMs expenditure contrasts with the hypothesis and results obtained by Kemmerling and Bodestein (2006), who find a positive effect of left orientation on EU structural funds expenditure. However, this result is in line with the notion that farmers are traditionally represented by political conservatives (see Hackl et al. 2007; Olper 2007). Moreover, a possible interpretation of the interaction effect between left-wing orientation and land inequality is that in regions with a strong unequal land distribution, the resulting large fraction of small farmers tends to be affiliated with left oriented farm groups. Examples in this direction exist in some European countries, like France and Italy, where small farmers have their ad hoc organization related to left-wing parties.

On the other hand, the negative relationship between average district magnitude and AEMs expenditure appears in line with the prediction of the recent political economy model about the effect of electoral rules on policy outcomes (see Persson and Tabellini, 2000). Indeed, these models predict that majoritarian electoral rules (*vis-à-vis* proportional ones), characterized by small district magnitude, tend to benefit especially narrow, and not broad, interests, and the production of local public goods.

Finally, columns 3 and 6 of the table display the coefficients, with the purpose of addressing which group of determinants contributes the most to the regression. By taking into account the less than perfect categorization of our proxies in each category, what emerges from the analysis of the coefficients is that proxies related to farmer political weight, political institutions and, to a lower extent, to positive externalities demand, are the most important explanatory variables affecting AEMs expenditure.

6. Summary and conclusions

In order to better understand the real motivation behind agri-environmental schemes, this paper proposes a political economy analysis of their implementation determinants. To this end we exploit the rich information of 59 agri-environmental programs implemented at both national and regional level, over the 2001-2004 period. Using this information, we test five main hypotheses about the underline driving forces of AEMs diffusion...

Our findings point the central role played by variable proxies related to farmer political weight, political institutions, budget constraints, and the demand for positive externalities. By contrast, AEMs expenditure and diffusion do not appear particularly affected by the level of existing negative externalities, suggesting that regions where agriculture is more intensive, causing worse environmental damage, are only marginally affected by the potential environmental benefit due to the diffusion of agro-environmental measures. This is quite a notable finding, and subsequent policy implications become evident if we observe that 2/3 of the AEMs public funds are devoted to minimizing negative externalities.

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