
National Differences in the uptake of EU Agri-environmental Schemes: An Explanation

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Abstract

The number of agri-environmental programs, as well as the share of agricultural land covered under these programs, varies significantly between EU member states. We analyze national differences in the uptake of agri-environmental programs by developing a model of countries' political objective function. Based on this model we identify six factors which may explain the extent to which agri-environmental policies are implemented: environmental benefits, opportunity costs of participation, financial budget pressure, the share of program expenditures financed by the EU, contribution to the EU budget, and political weight attributed to farmers' income. The conceptual approach is then supplemented by an empirical analysis.

Keywords: agricultural policy, agri-environmental programs, EU

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1. Introduction

The number of agri-environmental programs launched under EU Regulation 2078/92 and EU Regulation 1257/99 as well as the amount of agricultural land covered under these programs varies significantly between EU member states. While more than two thirds of the total agricultural area is under agri-environmental agreements in Finland, Luxembourg and Austria, the share is less than 3% in Greece, Spain and Belgium. Similarly, the spending on agri-environmental schemes varies strongly between different countries. For example, the relatively small country Austria (2.7% of total agricultural land of the EU) spends 17% of the total EU expenditures for agri-environmental programs, while only 3% are spent by the relatively large country Spain (20% of agricultural land). The objective of this paper is to analyze these differences based on a conceptual framework which integrates environmental and political considerations into a standard economic welfare function.

The paper is structured as follows. The next section provides an overview of the design of agri-environmental programs in the EU and the spatial heterogeneity in the uptake of agri-environmental programs across Europe. In section 3, we develop a model explaining the influence of several economic, environmental and political factors on the implementation of agri-environmental policies. Section 4 then validates the model, based on the empirical evidence of the EU's agri-environmental scheme. The paper ends by discussing the main findings.

2. Agri-environmental Programs in the EU

The EU's agri-environmental programs were introduced as "Accompanying Measures" of the 1992 Mac Sharry Reform of the EU's Common Agricultural Policy (CAP). In Regulation EC 2078/92 the main objectives of agri-environmental programs were defined as: i) reducing or stabilizing production levels, ii) safeguarding farm income, and iii) improving environmental quality. Most programs aim to achieve these objectives by putting restrictions on environmentally harmful inputs (e.g. fertilizer), and thereby leading to less intensive agricultural production systems. Farmers are compensated for rising production costs by area-based direct compensation payments. Participation in these programs is voluntary and the expenditures are co-financed. For objective 1 areas the EU takes over 75%, for all other areas 50%.

As illustrated in Table 1 for 1998 the uptake of agri-environmental policies differs significantly between countries. While more than two thirds of the total agricultural area was covered by at least one agri-environmental program in Austria, Finland, Luxembourg, the share was less than 5 % in Belgium, Denmark, Greece, Netherlands and Spain. Payments per hectare varied between € 45 and € 328 in 1997 and between € 41 and € 348 in 1998.

3. Theoretical Model

Most agri-environmental programs in the EU try to internalize negative agri-environmental externalities by offering farmers direct payments (D) for the implementation of environmentally favorable production technologies. If efficient environmental policies are implemented, social welfare can be enhanced. However, participation in agri-environmental programs is not compulsory. Hence, farmers will only participate, if compensation payments exceed the costs involved with changing production methods. Moreover, an important objective of the CAP, as specified with EC 2078/92 regulation, is to support farmers' income. If we consider further that member states may aim for the maximization of national (rather than EU) welfare, the political objective function for a single national government can be written as (Bullock and Salhofer, 2003):

$$(1) W = U_N(D) + \delta U_F(D),$$

U_F denotes the welfare of farmers, whereas U_N represents the welfare of non-farmers. The political weighing factor δ can be interpreted in different ways, depending on whether a normative or a positive analysis is conducted. Normatively, δ may represent the objective to insure social justice, which would then need to be balanced against economic and environmental goals. For example, if farmers are considered as a disadvantaged social group within the society, δ would be greater than unity. Hence, if a government acts like a benevolent dictator, δ denotes the social or political weight that needs to be attributed for welfare benefits given to farmers. In positive economics, δ would indicate the political weight given to farm income, which might be due to the lobbying pressure of interests groups (Becker, 1983).

Social optimization could be achieved by maximising equation (1) subject to economic and environmental constraints. The economic and environmental constraints government faces are presented in equations (2) - (4) and illustrated in Figure 1. The horizontal axis in Figure 1 represents the agricultural area (A) covered under agri-environmental programs. Participation in agri-environmental programs, which often restrict the use of agro-chemical inputs, is usually linked to higher private production costs and/or lower physical yields and thereby reduces profits. The profit reductions linked to the participation in agri-environmental schemes will be referred to as "private costs" (PC). We assume that marginal private costs (MPC) increase as more land is covered under agri-environmental schemes (Figure 1). The rationale is that farmers may first reduce the intensity of unproductive land before highly productive land is included in agri-environmental schemes. For simplicity, we further assume the MPC function to be linear and to start from the origin:

$$(2) MPC = bA \quad b > 0,$$

where b is the slope of MPC.

We now turn to the environmental benefits of agri-environmental programs. The marginal social benefits (MSB) associated with the implementation of agri-environmental programs will be generally positive, since they aim to internalise externalities associated with farming (Figure 1). However, it is difficult to predict whether the MSP may decline, increase or remain constant as more land is used for agri-environmental schemes. For simplicity, we assume the marginal social benefits to be constant:

$$(3) MSB = c \quad c > 0,$$

where c is defined as the environmental benefit per hectare.

We characterise a country's taxpayer cost for agri-environmental programs as follows:

$$(4) BD = \lambda [sDA + (1-s)tDA] = \lambda(s+t-st)DA \quad 0 \leq s, t \leq 1,$$

where s is the share of the program cost that have to be financed nationally (e.g. 0.5 for 50%), t is the share a country contributes to the overall EU budget, and λ is a factor representing a country's "additional" cost for raising public funds. From an economic point of view, λ might represent the cost for public funds, i.e. the deadweight losses created through taxation (Hagemann, Jones and Montador, 1988). In a political economic context, λ might include political costs of budget deficits. In both cases, λ will increase with increasing budget deficits and therefore differ between nations.

Let D denote direct payments per hectare which are received by farmers participating in agri-environmental schemes. Hence, given direct payments of D_1 , the area A_1 to be covered under agri-environmental programs can be derived from the MSP curve (Figure 1). Farmers' welfare improvement is represented by area II, while the welfare gain for non-

farmers from environmental quality improvement is represented by the area I +II + III. However, non-farmers also face expenditures in form of taxes, given by $\lambda(s+t-st)(I + II)$.

The expenses for the programs are co-financed from the EU budget, but also include, administrative and political costs associated with the raising of funds. Hence, the socially optimal area (A^*) to be covered under agri-environmental schemes can usually not be found at the intersection of the MPC and MSB curve. The optima area A^* can be calculated by maximizing equation (1) subject to equations (2)-(4):

$$(5) \quad A^* = \frac{-c}{b[\delta - 2\lambda(s+t-st)]}$$

A positive A^* requires $\delta < -2\lambda(s+t-st)$.

Comparative static analysis suggests that A^* will be positively related to program benefits (increases with increasing c) and the political weight given to farmers (δ). On the other hand, the size of A^* is negatively related to the program participation costs (b), the economic and/or political cost of budget expenditures (λ), the share of program expenditures covered by national budgets (s) and the extent to which a country has to finance the overall EU budget (t).

$$(6) \quad \frac{\partial A^*}{\partial c} = \frac{-1}{b[\delta - 2\lambda(s+t-st)b]} > 0.$$

$$(7) \quad \frac{\partial A^*}{\partial \delta} = \frac{c}{b[\delta - 2\lambda(s+t-st)b]^2} > 0.$$

$$(8) \quad \frac{\partial A^*}{\partial b} = \frac{c[\delta - 2\lambda(s+t-st)]}{b^2[\delta - 2\lambda(s+t-st)b]^2} < 0.$$

$$(9) \quad \frac{\partial A^*}{\partial \lambda} = \frac{-2c\lambda(s+t-st)}{b[\delta - 2\lambda(s+t-st)b]^2} < 0.$$

$$(10) \quad \frac{\partial A^*}{\partial s} = \frac{-2c\lambda(1-t)}{b[\delta - 2\lambda(s+t-st)b]^2} < 0.$$

$$(11) \quad \frac{\partial A^*}{\partial t} = \frac{-2c\lambda(1-s)}{b[\delta - 2\lambda(s+t-st)b]^2} < 0.$$

4. Empirical Test

For testing the theoretical results we simplify the model by explaining the farm area covered by agri-environmental programs, expressed as a percentage of the total area ($A^{\%}$), by the variables c , b , λ , δ , and t .¹ A limitation of the empirical analysis is that the number of observations is constrained to 15 member states. Hence, it is only possible to use a simple linear specification:²

$$(12) \quad A^{\%} = \alpha + \beta_c c + \beta_\delta \delta + \beta_b b + \beta_\lambda \lambda + \beta_t t + \varepsilon,$$

Data about the area covered under agri-environmental programs for each country are only available for the period between 1993 and 1998. However, the data for the years 1993 -1996 are incomplete and not available for all countries. Hence, the analysis is based on data of 1997 and 1998. The costs associated with the participation in agri-

environmental programs (b) are approximated by yields per hectare, assuming that opportunity costs for keeping environmental obligations are positively correlated to the productivity of agricultural land. Budgetary pressure (λ) is approximated by budget deficits as a percentage of countries' total national budget. We assume the political weight for farmers (δ) to be indicated by the overall national expenditures for agricultural support as a percentage of the agricultural net added value in factor cost. Finding an appropriate approximation for benefits of agri-environmental programs is difficult. Given the lack of data for more suitable indicators, we assume environmental benefits to be linked to the tourism industry, which is represented by the number of beds offered to tourists per 100 inhabitants. Countries' contribution to the overall EU budget can be calculated based on each nations' share in the aggregate GDP of the EU.

Table 1 presents the results of the regression analysis. All parameters are significant and besides of t , all parameters show the right sign.

5. Discussion

The extent to which co-financed agri-environmental programs are implemented varies considerably between EU member states. Based on a theoretical model, we analyzed the influence of economic, environmental and political factors on the uptake of agri-environmental programs. The area under agri-environmental programs increases as more political weight is given to farmers' income. Under the current design of most agri-environmental programs, farmers are compensated for using environmentally friendly production practices. Since participation in agri-environmental schemes is voluntary and a fixed area based direct payment is offered, farmers participating in agri-environmental programs will be generally better off. Moreover, offering compensation payments for environmental quality improvements means that property right for the use of natural resources like water or soil are *de facto* conferred to farmers.

We further showed that the area covered under agri-environmental programs is larger the higher the social benefits associated with environmental quality improvements. Social benefits from environmental quality improvements are likely to be higher in countries with a big tourism industry, as well as in countries where water and/or soil resources are scarce. We also showed that farmers' demand for agri-environmental schemes is expected to decline as the production costs involved with the participation in agri-environmental programs increase. Hence, regions where the productivity of agricultural land is rather low are likely to implement agri-environmental programs to a comparatively large extent. Given the co-financing rule for the EU's agri-environmental programs, adoption rates for agri-environmental policies are likely to be lower in countries with budgetary problems and in nations which contribute a relatively large share to the overall EU budget. Nevertheless, the supposition that high net contributions to the EU budget would reduce the attraction for agri-environmental policies cannot be supported by the empirical analysis. This might be due to the limitations of data, notably the small number of observations. However, the definition of countries' political objective function does not take into account game theoretic considerations which may cause governments to act in a different manner.

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¹ Since the share of program expenditures financed by the EU is 0.75 for objective 1 areas (instead of 0.5 for all other areas), the average share financed nationally (s) is not exactly the same for all countries. However, due to lack of information on this, we do not include s in the empirical model.

² A second order approximation in form of a quadratic polynomial might have been a more appropriate model, but could not be conducted. A quadratic polynomial specification would have to estimate 26 parameters for five independent variables.

Table 1: Percentage of agricultural area under agri-environmental programs and payments per hectare (1998)

country	% of program area	payments/ha	% of program area	payments/ha
Austria	73.0	144	67.8	140
Belgium	1.3	80	1.7	348
Denmark	3.4	142	3.9	142
Finland	91.3	125	86.9	125
France	20.3	45	22.9	45
Germany	37.0	59	38.9	83
Greece	0.3	328	0.6	328
Ireland	18.5	135	24.1	129
Italy	6.7	266	13.6	266
Luxembourg	76.4	88	76.1	82
Netherlands	1.6	278	1.9	268
Portugal	15.4	109	16.8	105
Spain	2.1	78	2.9	82
Sweden	51.0	81	51.6	68
UK	8.0	49	14.6	41
EU 15	16.5	91	19.5	99

Table 2: OLS Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.91	9.17	1.84	0.08
t	1.04	0.34	3.11	0.00
b	-0.33	0.12	-2.76	0.01
λ	-5.88	1.32	-4.46	0.00
c	1.23	0.67	1.83	0.08
δ	1.03	0.09	11.54	0.00
Adj.R ²	0.87			

Figure 1: Marginal Private Cost and Marginal Social Benefits of Agri-environmental Programs

