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

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## 1. Introduction

The EU's agri-environmental programmes 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 programmes were defined as: i) reducing or stabilizing production levels, ii) safeguarding farm income, and iii) improving environmental quality. Most programmes 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 programmes is voluntary and the expenditures are co-financed. For objective 1 areas the EU takes over 75%, for all other areas 50%.

The number of agri-environmental programmes launched under EU Regulation 2078/92 and EU Regulation 1257/99 as well as the amount of agricultural land covered under these programmes varies significantly between EU member states. While more than two thirds of the total agricultural area was covered by at least one agri-environmental programme in Austria, Finland, Luxembourg, the share was less than 5 % in Belgium, Denmark, Greece, Netherlands and Spain (Figure 1). Payments per hectare varied between € 45 and € 328 in 1997 and between € 41 and € 348 in 1998. The objective of this paper is to analyse the spatial heterogeneity in the uptake of agri-environmental programmes across Europe, 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 develops a model which explains the influence of several economic, environmental and political factors on the implementation of agri-environmental policies. In section 4, we analyse the nationally optimal uptake of agri-environmental programmes, depending on whether a member country acts non-cooperatively to maximise national welfare or whether cooperative governmental behaviour among EU member countries is assumed. Section 5 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. Theoretical model

A common feature of most agri-environmental programmes in the EU is to offer farmers compensation payments for the implementation of environmentally favourable production technologies. Since participation in agri-environmental programmes is not compulsory, farmers only participate, if compensation payments exceed the costs involved with changing production methods. Private costs arise because participation in agri-environmental programmes, which often restrict the use of agro-chemical inputs, is 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". We assume that marginal private costs (*MPC*) increase as more land is covered under agri-environmental schemes. The rationale is that farmers may first reduce the intensity of unproductive land before highly productive land is included in agri-environmental schemes.

Figure 1 depicts the marginal private costs (*MPC*) associated with the change towards environmentally more friendly production methods, as well as the marginal social benefits of the environmental quality improvement (*MSB*). The marginal social benefits (*MSB*) associated with the implementation of agri-environmental programmes will be generally positive, whereas the slope of the MSB might be negative or positive. Assume that countries have to finance the agri-environmental compensations payments by themselves. The socially optimal payment rate $D_i^*$ and the optimal area covered by agri-environmental programmes ($A_i^*$) in country *i* is then determined by the intersection of the *MPC* and *MSB* curves, given that administrative and transactions costs are neglected. If taxes are mainly paid by *non-*farmers, which are also regarded to be the beneficiaries of environmental quality improvements, their welfare improvement is represented by area III, while farmers would gain from the participation in agri-environmental programmes by area II (Figure 1).

Let us now extend the model of Figure 1 to account for equity considerations and the costs of raising public funds. An important objective of the CAP, as specified with EC 2078/92 regulation, is to support farmers' income, which is also reflected in the current design of the EU's agricultural policy. Hence, we specify a country's political objective function so that it makes a provision for a different weight being attributed to farmers' welfare:

$$W_i = U_{i,N}(A_i) + \delta_i U_{i,F}(A_i) \quad (1)$$

Let the welfare of farmers and non-farmers be denoted by $U_{i,F}$ and $U_{i,N}$, respectively, while $\delta_i$ represents the political weight attributed to farmers' welfare. The welfare function thus captures equity considerations which have featured in many recent contributions to the literature on agricultural policy analysis, as has been discussed by Bullock and Salhofer (2003). If a government considers farmers as a social group which needs to be supported, $\delta_i$ will be greater than unity. Hence, within a normative analytical approach, $\delta_i$ may represent the objective to insure social justice, which would then need to be balanced against economic and environmental goals. In positive economics, $\delta_i$ would indicate the political weight given to farm income, which might be due to the lobbying pressure of interests groups (Becker, 1983).

Farmers' financial gain from participating in agri-environmental programmes is determined by the difference between compensation payments ($D_iA_i$) and private costs (*PC*). Consider a quadratic costs function leading to a linear *MPC* curve:

$$MPC = k_i + b_i A_i \qquad (k_i \geq 0;\ b_i \geq 0) \tag{2}$$

Assuming profit maximising behaviour ($D_i$=*MPC*), farmers' welfare function can then be written as:

$$U_{i,F} = b_i\, A_i^{\,2} \big/ 2 \tag{3}$$

We also consider a linear marginal social benefit function:

$$MSB = l_i + c_i A_i \qquad (l_i > k_i;\ c_i < b_i) \tag{4}$$

By making use of equation (4), the net welfare gain for non-farmers resulting from agri-environmental policies is obtained by deducting the costs of public funds ($U_{i,BD}$) which are associated with the implementation of agri-environmental programmes from the social benefit (*SB*), which results from environmental quality improvement:

$$U_{i,N} = l_i A_i + c_i \frac{A_i^2}{2} - U_{i,BD} \tag{5}$$

The costs of raising public funds for agri-environmental programmes ($U_{i,BD}$) in any of the *N* EU member countries are specified as follows:

$$U_{i,BD} = \lambda_i \left[ \left(s_i + (1 - s_i) t_i\right) D_i A_i + t_i \sum_{j=1}^{N} (1 - s_j) D_j A_j \right] \tag{6}$$

where $1 \geq s_i \geq 0$; $1 \geq t_i \geq 0$; $\lambda_i \geq 1$; $i = 1,2,...N$ and $j \neq i$.

Let $s_i$ denote the share of the programme cost that have to be financed nationally (e.g. 0.5 for 50%) by country *i*, while $t_i$ is the share the country contributes to the overall EU budget. The total national contribution to the agri-environmental payments is multiplied by the factor $\lambda_i$, which accounts for a country's administrative and/or political costs associated with the raising of public funds (Hagemann *et al*. 1988).

## 3. Non-cooperative governmental behaviour

The starting point of the analysis is to determine the socially optimal uptake of agri-environmental programmes if EU member countries maximise national (rather than EU) welfare and thereby act non-cooperatively. Later, in section 4, we will investigate the optimal agri-environmental policy based on cooperative governmental behaviour.

Given profit maximising behaviour ($D_i = MPC$), the optimisation problem for a non-cooperatively acting EU member country can be formulated by making use of equations (1), (3), (5) and (6):

$$\max_{A_i} W_i = l_i A_i + \frac{A_i^2}{2}(c_i + \delta_i b_i) - \lambda_i (s_i + t_i - s_i t_i)(k_i A_i + b_i A_i^2) - \lambda_i t_i \sum_{j=1}^{N-1} (1 - s_j)(k_j A_j + b_j A_j^2) \qquad (7)$$

Solving equation (7) yields:

$$A_i^* = \frac{-l_i + \lambda_i k_i (s_i + t_i(1 - s_i))}{c_i + \delta_i b_i - 2\lambda_i b_i (s_i + t_i (1 - s_i))} \qquad (8)$$

It is interesting to note, that the Cournot solution of equation (8) does not result from a strategic interaction between EU member countries. This is because country *i*'s optimal uptake of agri-environmental policy ($A_i^*$) is not dependent on the extent to which agri-environmental policies are implemented in other countries ($A_j$). Note further, that it is not clear whether $A_i^*$ maximises or minimises national welfare. This can be derived from the second derivative of country *i*'s welfare function:

$$\frac{\partial^2 W_i}{\partial A_i^{\,2}} = c_i + b_i\left(\delta_i - 2\lambda_i\left(s_i + t_i - s_i t_i\right)\right) \qquad (9)$$

Since the sign of equation (9) is ambiguous, we conclude that the second-order condition for an interior maximum ($\partial^2 W_i / \partial A_i^{\,2} < 0$) is not necessarily fulfilled. If equation takes a positive value, national welfare will continuously be enhanced if the agri-environmental area is increased beyond $A_i^*$. This scenario may occur, if farmers political weight is strong and programme participation leads to large environmental improvements (large $c_i$ and $\delta_i$), while the national contribution to programme expenditures and the costs of raising public funds are relatively small (small $t_i$, $s_i$ and $\lambda_i$). Given that national welfare is *maximised* at a positive $A_i^*$ ($\partial^2 W_i / \partial A_i^{\,2} < 0, A_i^* \geq 0$), the impact of different parameters on the optimal uptake of agri-environmental programmes can be calculated by taking the first derivatives of equation (8):[1]

$$\frac{\partial A_i^*}{\partial l_i} = \frac{-1}{c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)} > 0 \qquad (10)$$

$$\frac{\partial A_i^*}{\partial c_i} = \frac{l_i - \lambda_i k_i\left(s_i + t_i\left(1 - s_i\right)\right)}{\left[c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right]^2} > 0 \qquad (11)$$

$$\frac{\partial A_i^*}{\partial \delta_i} = \frac{b_i\left(l_i - \lambda_i k_i\left(s_i + t_i\left(1 - s_i\right)\right)\right)}{\left[c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right]^2} > 0 \qquad (12)$$

$$\frac{\partial A_i^*}{\partial b_i} = \frac{\left(l_i - \lambda_i k_i\left(s_i + t_i\left(1 - s_i\right)\right)\right)\left(\delta_i - 2\lambda_i\left(s_i + t_i\left(1 - s_i\right)\right)\right)}{\left[c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right]^2} < 0 \qquad (13)$$

$$\frac{\partial A_i^*}{\partial \lambda_i} = \frac{\left(s_i + t_i\left(1 - s_i\right)\right)\left[-2b_i\left(l_i - \lambda_i k_i\left(s_i + t_i\left(1 - s_i\right)\right)\right) + k_i\left(c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right)\right]}{\left[c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right]^2} < 0 \qquad (14)$$

$$\frac{\partial A_i^*}{\partial k_i} = \frac{\lambda_i\left(s_i + t_i\left(1 - s_i\right)\right)}{c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)} < 0 \qquad (15)$$

$$\frac{\partial A_i^*}{\partial s_i} = \frac{\left(1 - t_i\right)\lambda_i\left[k_i\left(c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right) + 2b_i\left(-l_i + \lambda_i k_i\left(s_i + t_i\left(1 - s_i\right)\right)\right)\right]}{\left[c_i + \delta_i b_i - 2\lambda_i b_i\left(s_i + t_i\left(1 - s_i\right)\right)\right]^2} < 0 \qquad (16)$$

$$\frac{\partial A_i^*}{\partial t_i} = \frac{\lambda_i (1-s_i)[k_i(c_i + \delta_i b_i - 2\lambda_i b_i (s_i + t_i(1-s_i))) + 2b_i(-l_i + \lambda_i k_i (s_i + t_i(1-s_i)))]}{[c_i + \delta_i b_i - 2\lambda_i b_i (s_i + t_i(1-s_i))]^2} < 0 \qquad (17)$$

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

## 4. Cooperative governmental behaviour

Next, we analyse the optimal uptake of agri-environmental policy in country *i*, if it coordinates its domestic policy with other EU member countries to maximise EU welfare. To simplify the analysis, we consider a bilateral model ($i$ = 0,1). The optimisations problem can then be written as:

$$\begin{aligned} \max_{A_i, A_j} W = {} & p_i\left( l_i A_i + \frac{A_i^2}{2}(c_i + \delta_i b_i) - \lambda_i (s + t_i - st_i)(k_i A_i + b_i A_i^2) - \lambda_i t_i (1-s)(k_j A_j + b_j A_j^2) \right) + \\ & p_j\left( l_j A_j + \frac{A_j^2}{2}(c_j + \delta_j b_j) - \lambda_j (s + t_j - st_j)(k_j A_j + b_j A_j^2) - \lambda_j t_j (1-s)(k_i A_i + b_i A_i^2) \right) \end{aligned} \qquad (18)$$

where $p_i, p_j \geq 0$; $s_i = s_j = s$; $t_0 + t_1 = 1$; $i, j = 1,2$ and $j \neq i$.

Hence, the cooperative solution becomes:

$$A_i^* = \frac{p_i(-l_i + \lambda_i k_i (s + t_i - st_i)) + p_j \lambda_j k_i (1-t_i)(1-s)}{(p_i(c_i + \delta_i b_i - 2\lambda_i b_i (s + t_i - st_i)) - p_j \lambda_j (1-t_i)(1-s)2b_i)} \qquad (19)$$

Analogously to the previous section, we calculate the partial derivatives of equation (19) in order to analyse how the different parameters influence the optimal agri-environmental area:[2]

$$\frac{\partial A_i^*}{\partial l_i}=\frac{-p_i}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)}>0 \tag{20}$$

$$\frac{\partial A_i^*}{\partial c_i}=-\frac{p_i\left(p_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)+p_j\lambda_j k_i\left(1-t_i\right)\left(1-s\right)\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2}>0 \tag{21}$$

$$\frac{\partial A_i^*}{\partial \delta_i}=\frac{-p_i b_i\left(p_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)+p_j\lambda_j k_i\left(1-t_i\right)\left(1-s\right)\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2}>0 \tag{22}$$

$$\frac{\partial A_i^*}{\partial p_i}=\frac{-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)\left(2b_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)+k_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)}>0 \tag{23}$$

$$\frac{\partial A_i^*}{\partial b_i}=\frac{\begin{pmatrix}p_i\left(\delta_i-2\lambda_i\left(s+t_i-st_i\right)\right)\\-2p_j\lambda_j\left(1-t_i\right)\left(1-s\right)\end{pmatrix}\begin{pmatrix}-p_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)\\-p_j\lambda_j k_i\left(1-t_i\right)\left(1-s\right)\end{pmatrix}}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2}<0 \tag{24}$$

$$\frac{\partial A_i^*}{\partial \lambda_i}=\frac{p_i^2\left(s+t_i-st_i\right)\left(k_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)+2b_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2}<0 \tag{25}$$

$$\frac{\partial A_i^*}{\partial k_i}=\frac{p_i\lambda_i\left(s+t_i-st_i\right)+p_j\lambda_j\left(1-t_i\right)\left(1-s\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)}<0 \tag{26}$$

$$\frac{\partial A_i^*}{\partial s}=\frac{p_i\left(p_i\lambda_i-p_j\lambda_j\right)\left(1-t_i\right)\left(k_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)+2b_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2} \tag{27}$$

$$\frac{\partial A_i^*}{\partial t_i}=\frac{p_i\left(k_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)+2b_i\left(-l_i+\lambda_i k_i\left(s+t_i-st_i\right)\right)\right)\left(1-s\right)\left(p_i\lambda_i-p_j\lambda_j\right)}{\left(p_i\left(c_i+\delta_i b_i-2\lambda_i b_i\left(s+t_i-st_i\right)\right)-p_j\lambda_j\left(1-t_i\right)\left(1-s\right)2b_i\right)^2} \tag{28}$$

Equations (20)-(26) show that, similar to the cooperative solution of the previous section, the optimal area $A_i^*$ is large if environmental benefits from agri-environmental programmes are highly valued by the society (large $l$ and $c$) and a high political weight is given to the country ($p$) and its farmers ($\delta$). On the other hand, high programme participation costs ($k$ and $b$) as well as high cost of public expenses ($\lambda$) lead to a small size of $A_i^*$. Note, that the direction of how the optimal area is affected by the share of programme expenditures covered by national budgets ($s$) and the extent to which a country has to finance the overall EU budget ($t$) crucially depends on the political weight given to the country ($p$) and the administrative costs of raising public expenses ($\lambda$). Equation (27) and (28) demonstrate that $s$ and $t$ are positively related to $A_i^*$, if $p_j\lambda_j > p_i\lambda_i$, whereas both parameters have a negative effect on value if $A_i^*$ if $p_j\lambda_j < p_i\lambda_i$.

## 5. Empirical Test

For testing the theoretical results of the previous sections, we simplify the model by explaining the farm area covered by agri-environmental programmes, expressed as a percentage of the total area ($A^{\%}$), by the variables $c$, $b$, $\lambda$, $\delta$, and $t$.[3] 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:[4]

$$A^{\%} = \alpha + \beta_c c + \beta_\delta \delta + \beta_b b + \beta_\lambda \lambda + \beta_t t + \varepsilon \tag{29}$$

Data about the area covered under agri-environmental programmes 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 programmes ($b$) 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 ($\lambda$) is approximated by budget deficits as a percentage of countries' total national budget. We assume the political weight for farmers ($\delta$) 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 programmes 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' GDP in relation to the aggregate GDP of the EU. Table 2 presents the results of the regression analysis. All parameters are significant and besides of $t$, all parameters show the right sign.

## 6. Discussion

The extent to which co-financed agri-environmental programmes are implemented varies considerably between EU member states. Based on a theoretical model, we analysed the influence of economic, environmental and political factors on the uptake of agri-environmental programmes. The area under agri-environmental programmes increases as more political weight is given to farmers' income. Under the current design of most agri-environmental programmes, 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 programmes 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 programmes 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 programmes increase. Hence, regions where the productivity of agricultural land is rather low are likely to implement agri-environmental programmes to a comparatively large extent.

Given the co-financing rule for the EU's agri-environmental programmes, 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, if nations act non-cooperatively. 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, it might be also that EU member countries act cooperatively to maximise EU (rather than national) welfare.

## 7. References

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## Endnotes

[1] Considering that $c_i$ may take a positive value, $\delta_i - 2\lambda_i(s_i + t_i(1 - s_i)) < 0$ becomes a necessary condition which ensures that the second-order condition for a maximum at $A_i^*$ holds (negative value of equation 9).

[2] We still assume that equation (9) takes a negative value and thereby that $\delta_i - 2\lambda_i(s_i + t_i(1 - s_i)) < 0$.

[3] Since the share of programme 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.

[4] 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 in 1997 and 1998.**

| | 1997 | | 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 |

**Figure 1. The socially optimal uptake of agri-environmental programmes**

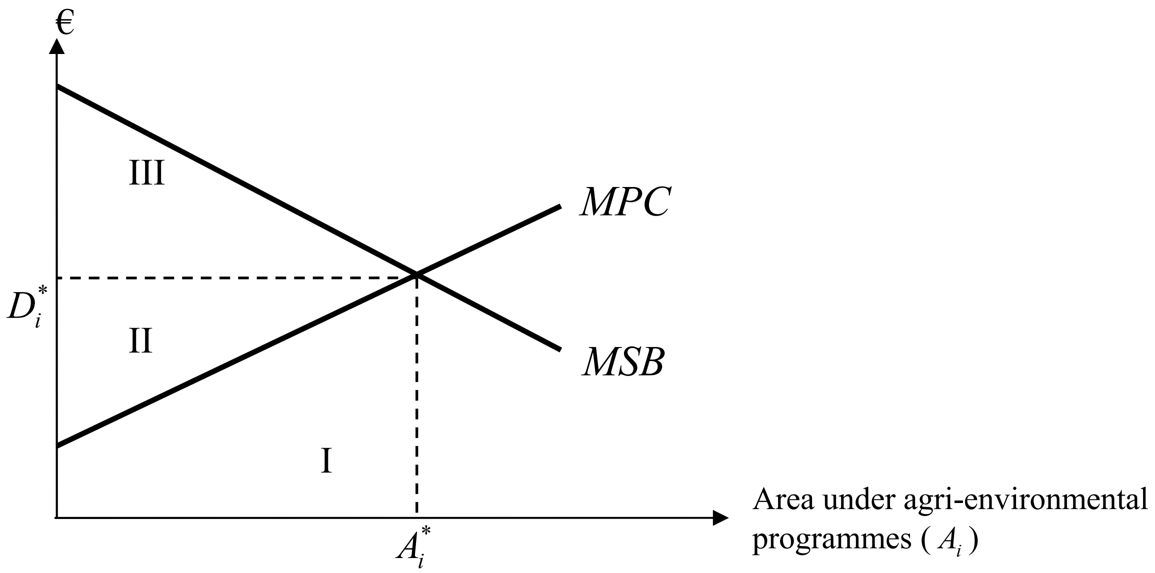

**Table 2. OLS Regression Results**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| α | 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.R2 | 0.90 | | | |