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- ITALY -

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COOPERATION

Table of content

1. Introduction

This document reports the outcome of task 5.3 of the SPARD project.

SPARD task 5.3 aims to understand the feasibility of using the SPARD tool for ex-ante analysis and to support task 5.4, through the pilot use of estimated models coming from 5.2 to simulate the impact of selected policy scenarios and measures at local level.

"The objective of Ex ante evaluation is to assist the preparation of proposal for new or renewed community actions. Its purpose is to gather information and to carry out analyses which help to ensure that the policy objectives will be delivered successfully, that the measures used are cost-effective and that reliable evaluation will be subsequently possible" (DG Budget, 2004).

Tasks 5.3 aims at using the information generated in 5.2 to support policy design. Task 5.3 is the second step of the process started in 5.2, in which a spatial econometric model was estimated. This was carried out in 6 case study areas at the main programming level (i.e. the level in which Rural development plans are designed). The selected case study areas were Brandenburg (NUTS 1, Germany), North Holland (NUTS 2, The Netherlands), Emilia Romagna (NUTS 2, Italy), Basse Normandie (NUTS 2, France), Scotland (NUTS 1, UK) and Eastern Slovenia (NUTS 2, Slovenia). The selected regions were chosen due to full availability of data required for an exemplary application of the model at the level of lowest disaggregation and to complementarity in revealing policy design issues in different environmental and institutional frameworks.

The results of 5.3 (together with the outcome of 5.2) will allow in task 5.4 the discussion with stakeholder/ end-user/ expert, to gather policy/stakeholders feedback about the tool and for identifying appropriate rural development measures that should be a part of a regional programme established through a Rural Development Programme document (RDP).

This document provides the outcome of an optimization model jointly aiming at optimal targeting and payment setting with a focus on incentive compatibility, building on participation functions generated from 5.2. Moreover, our objective on this task is to model the factors affecting participation that comes from participation model D5.2, to support ex-ante analysis and identify optimal policy parameter in order to improve the design solutions of the AEMs. Policy design related to connected payments or to explicit policy priorities

(CSA Emilia Romagna) are relevant when used. The complexity of factors affecting participation, which go far beyond environmental and structural determinants, including also personal attitudes, information and hidden transaction costs, farm specialisation or land use determinants. Moreover, factors related to remoteness (rural areas, share of natural areas etc.) also play a role usually in encouraging participation.

In this way, our works aims to develop an optimal targeting model with a focus on resource and incentive compatibility differentiated by zone. On one hand, this approach requires the determination of the total compliance costs of AEMs, which is known to be rather difficult to obtain. In order to avoid this problem, a function of marginal compliance costs of participation to measure 214.1 is taken from a previous study, which allows us to model farmers' economic behaviour in participating to scheme 214.1. On the other hand, through this analysis it is possible to highlight the territorial consequences of differentiated payments through zoning on farmers' participation to the programme. Also within an ex ante analysis and monitoring these objectives could help to increase, at policy design level, the efficiency of the measure and the flexibility of funding trough simplification and reduction of transaction costs. Moreover, at program level, it could help the design of alternative payment mechanism, that taking in consideration different farmers' compliance cost through space instead of the classical flat rate payments.

Due to time and data constraint, it was decided to carry out this exercise only for one single measure (214.1 Integrated Production) in one of the case study areas, namely Emilia Romagna.

Six main sections compose this document. First, section 2 reports the main implications of the decentralised design of RDP measures on the spatial distribution of participation which come from 5.2. Moreover, section 2 discusses the implication of farmers' decision-making behaviour on environmental incentive schemes and on the cost-effectiveness of the policy design. In section 3 an optimal targeting model with a focus on resource and incentive compatibility differentiated by zone is presented, in section 4 a summary of the results is provided, followed in section 5 by a discussion. The document ends in section 6 with some concluding remarks.

2. Background information

From SPARD WP5 and D3.2 we achieve that the decentralized design of RDP implies that each local administration is in charge of setting and identifying target and zoning policies, in order to better design the measures with focus on the main local concerns. The targeting concerns a set of different priority or eligibility criteria applying the measures, mainly based on population density or the amount of inhabitants of the municipalities. The results from the SPARD case study regions show different approaches to targeting mechanism, which range from relatively simple approaches based on eligibility criteria only, to more complex and selective targeting mechanism based on zoning policies, or scoring systems (Uthes et al., 2012). For instance the local administration of Emilia Romagna (ER) has set a mechanism of priority to incentive the participation to the measure 121 based on locations (e.g. LFA zone, plain, hill and mountain zone), the farm specialization and the farmers' age. The expected effect of this zoning is to prioritize the access to measure 121 to some farm sectors which are considered relevant for the area. Moreover, across the entire RDP of ER an identification of less favorable areas (LFA) is realized. This is a kind of zoning that follows the application of EU directives (NATURA 2000, WFD, NITRATE DIRECTIVE; etc.). Additional identification of the LFA are realized including to the above other areas with specific handicap, for example mountain areas in ER.

Many factors could influence the choice for a particular targeting approach, such as administration costs, spatial variability in terms of benefits and costs, but once identified the target areas, the regulation must be accompanied with the provision of an adequate system of incentives since the purpose is to encourage farmers' participation to the RDP. Again the administration is responsible to set up policy variables as payment schemes to support the production of goods, relatives or complementary to the commodities, with the characteristic of externalities such as those produced through agri-environmental measures (Falconer e Whitby, 1999; Vatn, 2001; McCann et al., 2005). For these reasons agri-environmental measures (AEMs) are adopted. AEMs are economic aids to farmers to reduce environmental risk or to preserve cultivated landscapes (Uthes, 2010). For example, measure 214 of RDP introduces compensatory payments targeting to farms in areas affected to nitrogen pollution to achieve the environmental objective of encouraging organic production and reduce nitrogen pollution. By this way farmers commit themselves to adopting organic farming or less resource-intensive farming practices. In return, they receive payments that compensate them for additional costs and loss of income (DG Agriculture and rural development, 2005). To incentive the farmers' participation to these measures the payments must be high enough to cover compliance costs but also should prevent as much as possible unneeded farmers' rents.

Indeed, while the payments are usually designed as uniforms between different areas and targets, the compliance costs are not uniform. Moreover, the presence of asymmetric information conditions, such as the farmer having information about compliance costs that are not disclosed to the regulator, causes a higher profitability to participate for those farmers who have to cover lower compliance cost. In economic terms the difference between payments and compliance costs generate an economic surplus for those farmers and consequently a deadweight loss from the perspective of cost effectiveness of the measures.

Figures 1 to 3 below try to explain this loss of effectiveness. It is assumed that there is a group of farms, who participate to one measure (e.g. scheme 1, integrated production) and that they belong to two different zones: zone 1 (hill) and zone 2 (plain). Also it is considered that farmers belong to zone 1 must support different compliance costs from farmers which belong to zone 2. In other word, it is hypothesized that the costs can be heterogeneous depending on the geographic zone (hill, plain). Marginal compliance costs are a linear function of the amount of goods and services produced, such costs are indicated in the figures with the orange line.

In figure 1, a flat rate payment corresponding to p0 is given to induce farmers to participate by covering compliance costs.

Due to the flat rate payment policy p0, the only participating farmers belong to zone 1 (hill), where they produce the quantity that corresponds to x1. On the contrary, farmers belonging to zone 2 (hill) do not participate because the payment is lower than their compliance cost. Moreover, the farmers of zone 1 will receive a payment higher than their compliance costs, which creates a surplus for those farmers. This surplus corresponds to the deadweight loss of effectiveness for this measure that is represented by the BCD blue area.

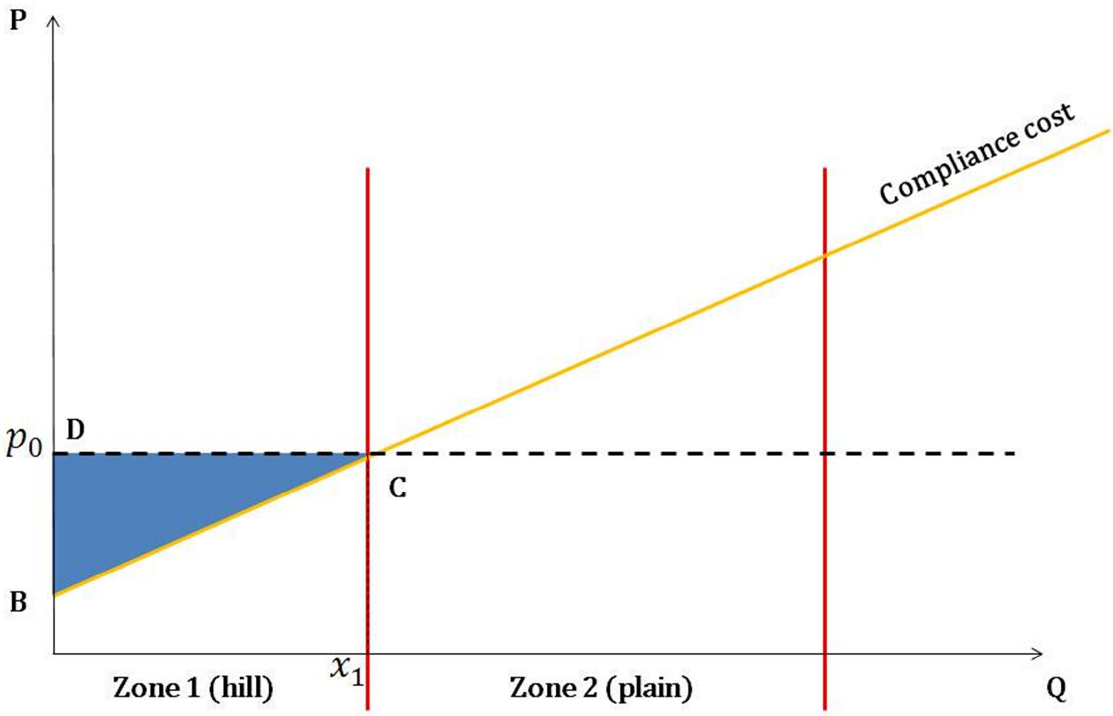

Figure 1. Deadweight loss and farmers surplus

In figure 2, it is hypothesized that a second flat rate payments, p1 higher than p0, is given by the regulator to induce the farmers of zone 2 to participate. In this new situation, both farmers of zone 1 and of zone 2 participate to the measure and the deadweight loss increases up to the area indicated by the triangle B'C'D'.

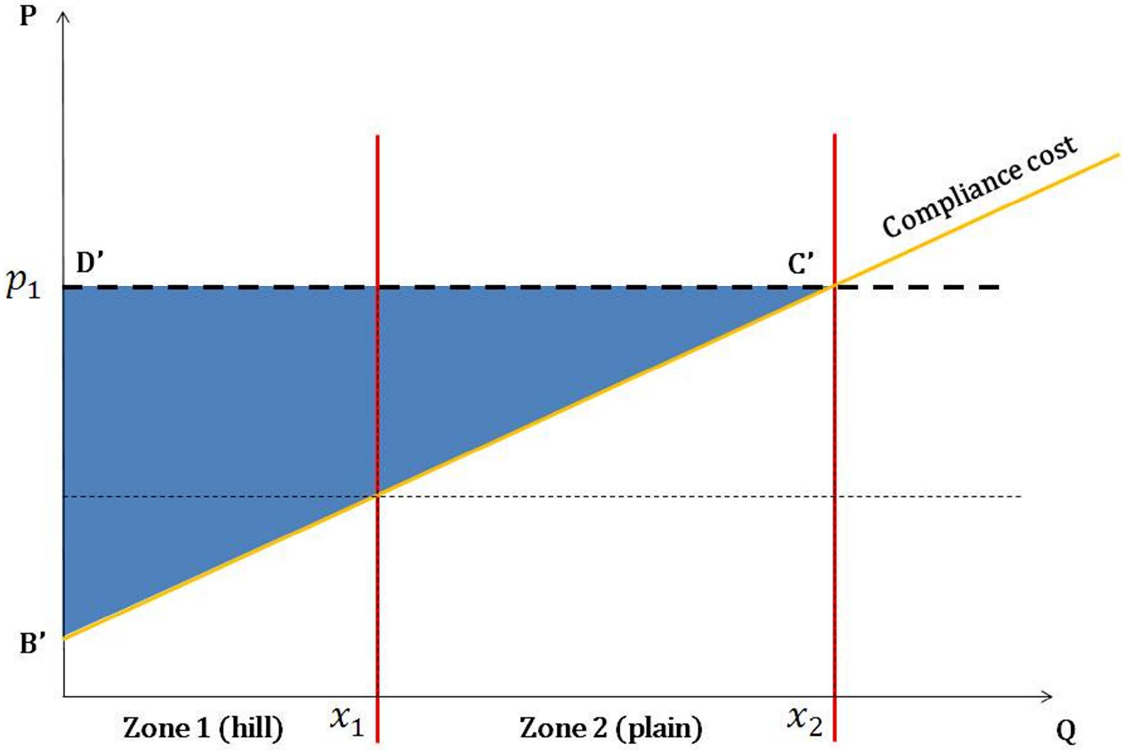

Figure 2. Deadweight loss and farmers surplus

In order to reduce the farmer's surplus and deadweight loss area in both zones, the regulator must set up a differentiate payment policy with lower payment in zone 1 and higher payments in zone 2. Within the differentiate payment policy, the farmers of both zones will produce the optimal quantity of goods and services corresponding to the equality between compliance costs and payments (figure 3). In this case the deadweight loss area is reduced by an amount corresponding to the yellow rectangle EFGH.

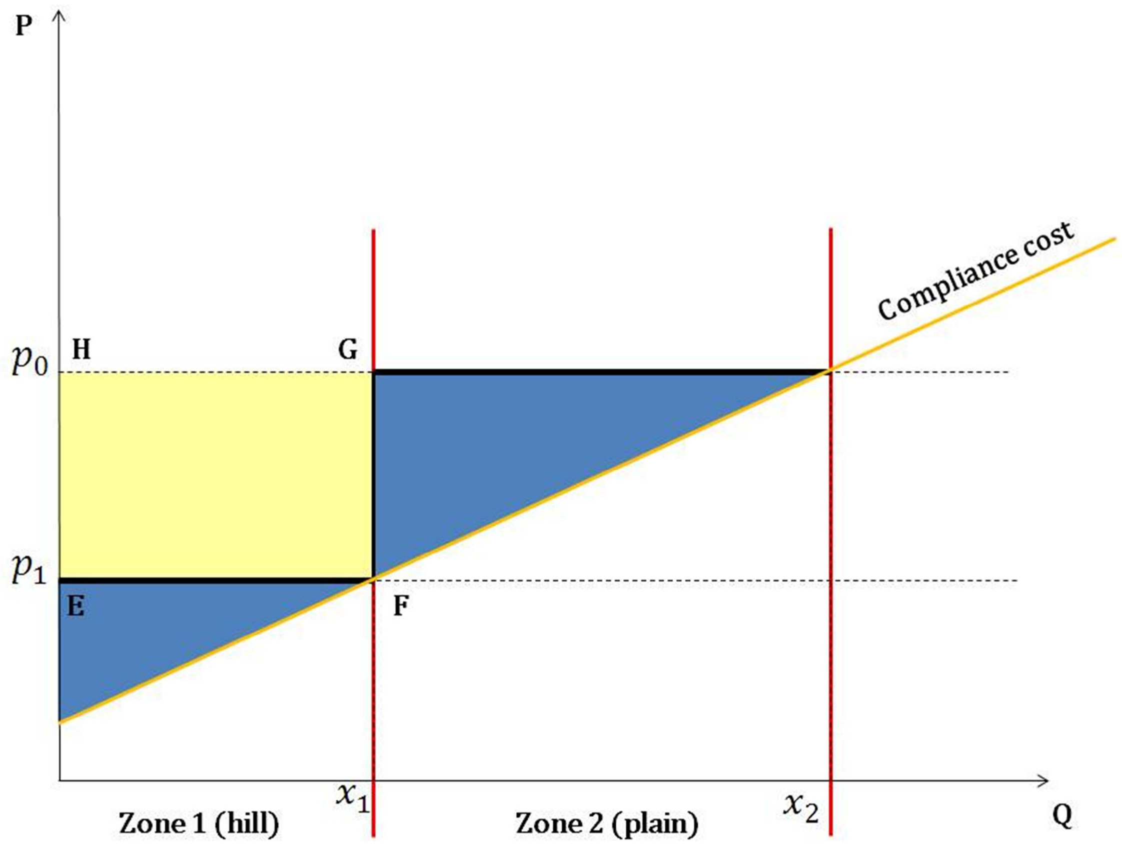

Figure 3. Deadweight loss and farmers surplus

Normally it is very difficult for the administration to know the different compliance costs.

In Italy, the instrument more frequently adopted up to now is a flat rate payment per hectare, with some level of weak differentiation based on zoning (Bazzani and Viaggi, 2004). Unfortunately, as in our example, the data at farm level suggest that public expenditure in many cases is not effective or even necessary, because it supports techniques that would be profitable for farmers even without public payments (Regione Emilia Romagna 2003b). In such cases the payment level does not correspond to the optimal (less expensive) first best situation where each farmer is remunerated with exactly the amount corresponding to his compliance costs. In effect, considering this flat payments, a surplus is kept by those farmers who have a compliance costs which is lower than the flat payments (Viaggi et al., 2008).

Various alternative payments mechanism can be applied with the aim of reducing information asymmetries leading to overcompensation and increasing the efficiency of the measures in terms of participation/expenditure ratios (Viaggi, Raggi, Gallerani, 2008).

A more cost-effective policy design requires a consistent combination of policy instruments, connected payments levels and differentiation, as well as monitoring (Bazzani and Viaggi, 2004). Indeed alternative ways setting the payments could be closer to the actual compliance costs of heterogeneous farmers differentiated by zone. Thus the payments should be able to provide incentives to participate, while reducing as much as possible farmers' rents.

Moreover, the payment should be defined ex ante for each crop and farmer by differentiated zone and the information about individual expected compliance cost must be collected.

With the objective of maximize participation in these specific zones, measured by the degree of uptake, the whole effect of this kind of policy instrument would be a screening, restricting participants to only those having cost below the resulting payment.

This implies a greater degree of information about compliance costs on the part of public decision maker but it is also not completely unrealistic if measures are targeted to some specific area (e.g. ER LFA areas, mountain, hill, plain) that also is characterised by compliance costs different from the average (Viaggi, Raggi, Gallerani, 2008).

3. Methodology

3.1. Overview

The main idea of this work is to use the concrete results of spatial regression model comes from SPARD D5.2 CSA E.R (participation model on measure 214) with an optimal targeting model focus on incentive compatibility illustrated in this document.

The methodology is based on mathematical programming through the maximisation of participation rate on AEMs (focusing on area-related measures, such as measure 214.1 “Integrated Production”) under resource and participation constraints at municipality level. Also the output of the model can be, at last, aggregated by the target zone of Plain, Hill and Mountain to reflect the spatial approach on targeting of the PSR Emilia Romagna. Participation rate is measured by the degree of uptake (DU) in UAA.

The type of instrument considered is spatial econometric analysis (following LeSage and Pace, 2009), that could be seen as a sptial extension of the standard linear regression model (see e.g. Breustedt and Habermann, 2011) and Spatial lag model:

$r = \rho W_1 r + X\beta + \varepsilon$

$\varepsilon = \lambda W_2 \varepsilon + \mu$

$E[\mu_i^2] = \sigma^2 h(z_i)$

$E[\mu_i \mu_j] = 0$ with $i \neq j$

Where r is the observed participation rate; X is the $n \times k$ matrix of the k determinants of the participation rate, β is the regression parameter to be estimated, ε is the error term, W_1 and W_2 are the $n \times n$ matrix of spatial weights; ρ are the spatial lag parameter; and λ spatial error coefficient. Where i the element of $W_1 r$ represent the spatial weighted average of the participation rate for municipality i and $W_2\varepsilon$ are the error lag and represent a specification of the error term.

Under several assumptions about of the ρ and λ the equation 1 could yield:

with $\rho = 0$; $\lambda = 0$ the equations return a standard linear regression model (model 1);

with $\lambda = 0$; the equations return a spatial lag model (model 2);

Moreover, it is assumed that the area targeted by the measures has different characteristics in term of farm compliance costs. As a consequence, we suppose the need for different payment levels differentiated by zoning. We define three hypothetical areas (mountain, hill, plain), where payments change taking into consideration the different compliance costs.

It is also assumed that the regulators knows of the existence and the characteristics of the different types of farmers, as compliance costs of each type, and the proportion of each type in the population, but cannot identify individual compliance costs (Bartolini et al., 2007).

As a reference, however, we also consider the possibility that the regulator is informed about which type each individual famer belongs to. By this way we build the theoretical reference point of first best solution.

With these hypotheses we set up a nonlinear programming model that allows an optimal allocation of the participation on measure 214, focusing into the scheme 1 “Integrated production”.

3.2. The Participation Model (Theoretical)

The optimal spatial distribution of participation to measure 214 (e.g. scheme 1, integrated production) is determined by a nonlinear programming model. In this model it is assumed that the Public Administration objective is to maximize participation, measured by the degree of uptake (DU), without consideration, for example, to the value of different environmental services produced by different farmers. The type of instrument considered is the classical rationality incentive constraint given by the payment level offered to farmers for participating to the RDP programme.

Let $i = 1, 2, \dots, I$ denote an index for various area type ($i = 1$ Mountain, $i = 2$ Hil, $i = 3$ Plain) and let $j = 1, 2, \dots, J$ denote an index for various agri-environmental measure (j=1 measure 214.1, j=2 measure 214.2 etc.), while it is also assumed that farmers participating just to one agri-environmental measure (214.1 "integrated production" on RDP E.R.) in various municipality of Emilia Romagna, so j=1.

Let $k = 1, 2, \dots, K$ denote an index for various variables representing farm characteristics and features included in the regression model (model 1 and 2) $r_{k,i}$ discussed in the previous section.

Since measure 214.1 provides to farms an annual premium per hectare of cultivated area, it is indicated in the model as "ρ_i" the marginal payments per hectare in each area type. Given a fixed value of the available budget (B), the public administration will maximize the area under contract x_i.

Max

$$DU = \sum_{i=1}^{I} x_i$$

Subject to:

$$\sum_{i=1}^{I} \rho_i x_i \leq B$$

Budget constraints

$\rho_i - \theta_i \geq 0$ *Rationality Constraints*

$$\theta_i = C(x_i)(1 - \sum_{k=1}^{K} r_{k,i})$$ $Marginal\ Cost\ function\ \theta(i)$

$x_i \leq S_i$ *Area constraints*

$x_i \geq 0\ , \rho_i \geq 0, \theta_i \geq 0$

Where S_i is the total surface per area zone i (ha), ρ_i the marginal payments for measure on area i (euro/ha) and B the total amount of Public funds available as budget for measure 214.1 (euro).

θ_i is the marginal cost function (euro/ha) which is composed by a component of marginal cost $C(x_i)$ calculated in a previous study and a parameter calculated based on the coefficients of the regression model $r_{k,i}$ derived from SPARD WP 5.2 CSA Emilia Romagna.

The variable $r_{k,i}$ introduce the spatial regression model $r_{k,i} = \rho W_1 r + X_{k,i}\beta_k + \varepsilon$ with $\varepsilon = \lambda W_2 \varepsilon + \mu$ (k = 1, 2 , ... , K) as it is described in the previous methodology section. The $X_{k,i}$ denote a vector of variables representing farm characteristics and features related to farm location (i) such as geographical, socio-economic (age, UAA, level of instructions) and institutional factors. In θ_i $\beta_1, \beta_2, \ldots, \beta_k$ are the estimated coefficients of the regression model come from CSA ER WP 5.2.

In this way the marginal cost function constrains the model to maximize the uptake in those areas where there are factors that influences the participation and where the corresponding payments cover such costs. This is the equality between the payments and the marginal compliance cost function, that minimizing the farmers rents, allows the model to select the surface of measure under area j where the compliance cost function is the maximum. By this way the model selects only those areas where farmers' surpluses the deadweight loss as previously explained is minimized.

3.3. The Participation Model (Empirical)

The participation model is designed in GAMS. The data input for this problem are taken from the concrete results of SPARD D5.2 E.R. CSA (results of the regression with only OLS, no spatial and data from 2000 CENSUS).

As it is mentioned in the previous section, θ_i is the marginal cost function (euro/ha) which is composed by a component of marginal cost C(x_i) calculated in a previous study on the basis of FADN data on measure 214.1, and the regression model $r_{k,i}$ derived from SPARD WP 5.2 CSA Emilia Romagna respectively considering the model 1 (linear regression) and model 2 (spatial lag model).

Moreover, to be able to adapt and homogenize the marginal cost function to the scope of the analysis it has been parameterized (0,1) the x_i variable of the FADN cost function (see figure 4. below). Than the variable obtained is expressed in range that vary between 0 and 1 instead of the cumulative UAA which vary from 0 (ha) to 180,000.00 (ha) in a different scale compared to the surface involved in our task analysis for SPARD project.

The marginal cost function $C(x_i)$ (euro/ha) used is:

$$C(x_i) = 1415.2x_i^3 - 1670x_i^2 + 701.9x_i \qquad Marginal\ Cost\ function\ C(i)$$

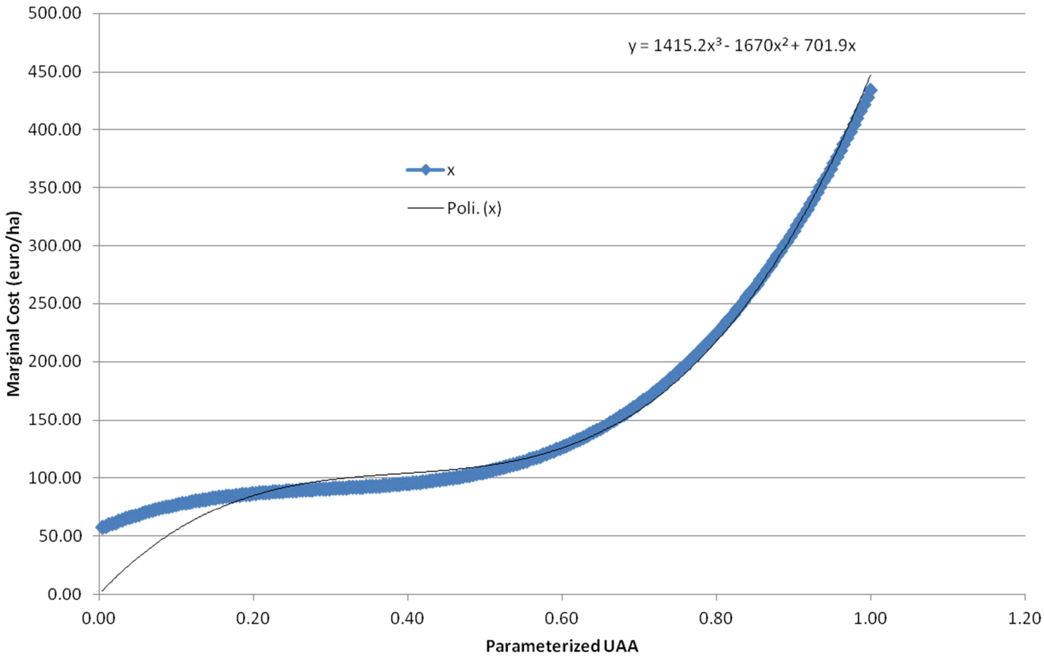

Figure 4. Marginal Cost as a function of Parameterized UAA - Integrated Production

The analysis was conducted at municipality level (i.e. considering the 341 municipality of E.R. as the units) and then the results were aggregate considering the target zoning of Plain, Hill and Mountain.

The total UAA considered in the analysis is 1,111,997.52 (ha) which can be divided into 649,047.53 (ha) for Plain, 218,617.47 (ha) for Hill and 244,332.52 (ha) for Mountain. It is also supposed that the amount of Public funds to invest in measure 214.1 varies in the range from 0 to 27,500,000.00 (euro), which is in the order of magnitude of the regional annual commitments for this measure.

3.4. Participation to Measure 214: issue and result from spatial analysis (5.2)

The optimization model is based on participation functions generated from 5.2. In this section the results of the participation functions are reported to highlight the main issue concerning participation to AEMs. The models developed in task 5.2, for each measure (121 farm modernization, 311 farm diversification, 214 agri-environment) of the Rural Development Program (RDP) Emilia Romagna, provide information about the distribution of participation and in some cases support the expert expectations about spatial spillovers within municipalities. Information about participation to RDP and for land based measure (e.g. 214) about payments was delivered by the Regional administration (Agricultural directorate). Data concerning participation and dependent variables are aggregated at municipality level. Such level allows having enough information to conduct spatial analysis. Measure 214 covers a substantial part of the RDP budget and it is organized in several sub-measures which target different environmental objectives and areas. The distribution of the participation (percent of participating farms per municipality) is mainly differentiated in the plain area and in the hill-mountain area and it is different between the aggregate and the specific sub-measures. The participation map of the whole measure 214 (Figure 5) shows a spatial agglomeration, rather different across municipalities, in areas where a zoning system is applied. In particular, sub-measure 1 (integrated production) is mainly located in the plain areas (Figure 6) characterised by large share of fruit production (eastern part of the region). This is largely connect to a deliberate strategy of valorisation and targeting to the sector.

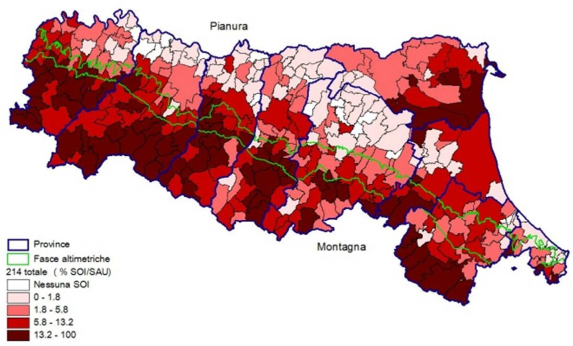

Figure 5: Spatial distribution for measure 214 (all sub-measures)

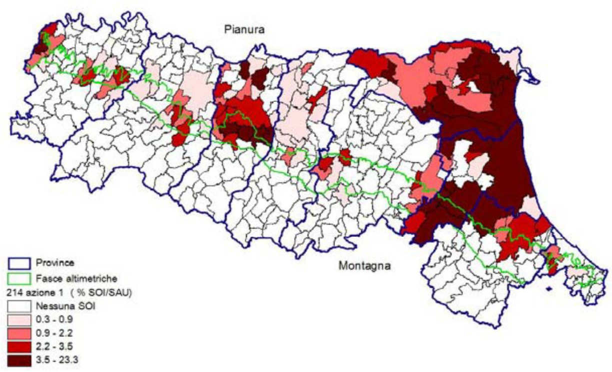

Figure 6: Spatial distribution for measure 214 (sub-measure 1: Integrated production)

The explanatory variables for participation are: a territorial proxy for plain, hill and mountain, the density of inhabitants, the percentage of farms that are conducted directly by the farmer, the percentage of farms which use only household labor, the percentage of farms with arable crops, with fruit crops, with forest, with pigs and with livestock, the percentage of farmers with age less than forty and more than sixty-five, the percentage of part-time farmers and five variables related to different preferential areas. Ordinary least squares highlight that no variable is significant for all sub-measures and the aggregate, but several variables are consistently relevant to account for participation across several measures. The variables that are significant for the measure as a whole are: density of inhabitants, household labor, farms with arable crops, forest, livestock and the variable related to the preferential area.

From 5.2 we outline that it is possible to estimate models for measure 214, with a relevant ability to explain participation; Within this models the spatial component was highly significant and important; The explanatory variables are sharply differentiated by sub-measures; The regional priorities affect the results probably as a mixed effect of environmental characterization and of priority in awarding of the funding. Socio-economic indicators appear as less often significant and less stable across models.

4. Results

The results are summarized in the two tables below and in eight figures considering the two hypotheses about the regression model (model 1, the linear regression and model 2, the spatial lag model). Table 1 shows the results considering model 1 (linear regression model) as the econometrically-derived component of the cost function. As expected, an increase in the available budget reflects a growth in the degree of uptake. Also the share of UAA on the different zones is growing, but at different ratios depending on marginal costs and payment in combination with the variables which influence more the participation from the regression model.

Budget (euro)	Marginal Costs (euro/ha)			Average Marginal Payment (euro/ha)	Plain (ha)	Hill (ha)	Mountain (ha)	DU Tot (ha)
	Plain	Hill	Mountain					
0	0	0	0	0	0	0	0	0
1000000	39.82254	38.00299	37.99287	38.60613	24803.13617	178.3477	144.7193	25126.2
2500000	61.17331	56.53922	56.516752	58.07643	40422.9977	265.5903	215.4272	40904.02
5000000	83.48898	74.03123	73.992612	77.17094	59329.38195	348.0708	282.2243	59959.68
8000000	101.9253	86.53259	86.479727	91.64589	77863.19374	407.11	330.0066	78600.31
10000000	111.5193	92.10997	92.050021	98.55975	89022.56856	433.4744	351.3359	89807.38
12500000	121.5126	97.04259	96.976001	105.1771	102209.7415	456.8037	370.2055	103036.75
14500000	128.2864	99.75506	99.684666	109.2421	112367.4012	469.6377	380.5843	113217.62
15000000	129.8379	100.2916	100.220471	110.1167	114868.5531	472.1768	382.6376	115723.37
15500000	131.3378	100.7772	100.705376	110.9401	117357.4404	474.475	384.4959	118216.41
18000000	138.1325	102.5226	102.448243	114.3678	129661.2458	482.736	391.1757	130535.16
20000000	142.8232	103.2204	103.144983	116.3962	139397.5502	486.039	393.8463	140277.44
24000000	150.5609	103.207	103.131622	118.9665	158801.0587	485.9757	393.7951	159680.83
27500000	155.8423	102.1352	102.061334	120.0129	175890.0745	480.902	389.6927	176760.67

Table 1. Results of Participation Model 1

Table 2 shows the results using model 2 (spatial lag model) as the econometrically-derived component of the cost function. Also in this case is highlighted the concentration of participation to the plain area which has the main share on the total of DU (ha) for each budget level. Moreover the marginal costs (and consequently the payments) are higher than the value of marginal costs obtained from the previous model and therefore the share of uptake is lower.

Budget (euro)	Marginal Costs (euro/ha)			Average marginal Payment (euro/ha)	Plain (ha)	Hill (ha)	Mountain (ha)	DU Tot (ha)
	Plain	Hill	Mountain					
0	0	0	0	0	0	0	0	0
1000000	174.0862	173.3431	173.325677	173.585	4327.937707	681.3897	741.0997	5750.43
2500000	274.3135	272.427	272.383361	273.0413	6884.264448	1075.492	1169.529	9129.28
5000000	386.4269	382.5871	382.499667	383.8379	9803.13975	1517.7	1650.068	12970.91
8000000	487.0534	480.8103	480.670015	482.8446	12479.12414	1915.668	2082.358	16477.15
10000000	543.4377	535.5623	535.386696	538.1289	14002.85394	2139.04	2324.92	18466.81
12500000	606.1947	596.2486	596.028807	599.4907	15720.0871	2387.927	2595.125	20703.14
14500000	651.7966	640.1718	639.916539	643.9616	16982.38308	2568.93	2791.589	22342.9
15000000	662.6724	650.6249	650.360829	654.5527	17285.27108	2612.114	2838.456	22735.84
15500000	673.3595	660.8881	660.615174	664.9542	17583.59895	2654.554	2884.514	23122.67
18000000	724.2564	709.6492	709.331956	714.4125	19014.00008	2856.743	3103.911	24974.65
20000000	762.3391	746.0037	745.651031	751.3313	20094.85262	3008.087	3268.104	26371.04
24000000	832.8604	813.0196	812.596023	819.492	22121.00002	3288.428	3572.178	28981.61
27500000	889.574	866.6146	866.129085	874.1059	23774.36631	3513.908	3816.679	31104.95

Table 2. Results of Participation Model 2

In the following page, four figures (Figures 7, 8, 9 and 10) related to the model 1 (linear regression model) are presented. The first three figures provide the Total Payment and Total Cost as function of participating UAA, respectively in plain, hill and mountain zone. The estimation of the total cost function for measure 214.1 is achieved by calculating the integral of the marginal cost function, which is a 3rd degree cost function derived from a previous study, combined with the regression model. Moreover the Total Payment function is obtained multiplying the share of UAA (ha) participating to the measure with marginal payment value obtained from the model.

Figure 7 shows the results of the maximisation problem in terms of payments and costs and it representing the maximum UAA participating in the 214.1 sub measure for the target plain zone. The difference increases between payment and cost to the increase of the budget. Also the participating UAA increases with the budget.

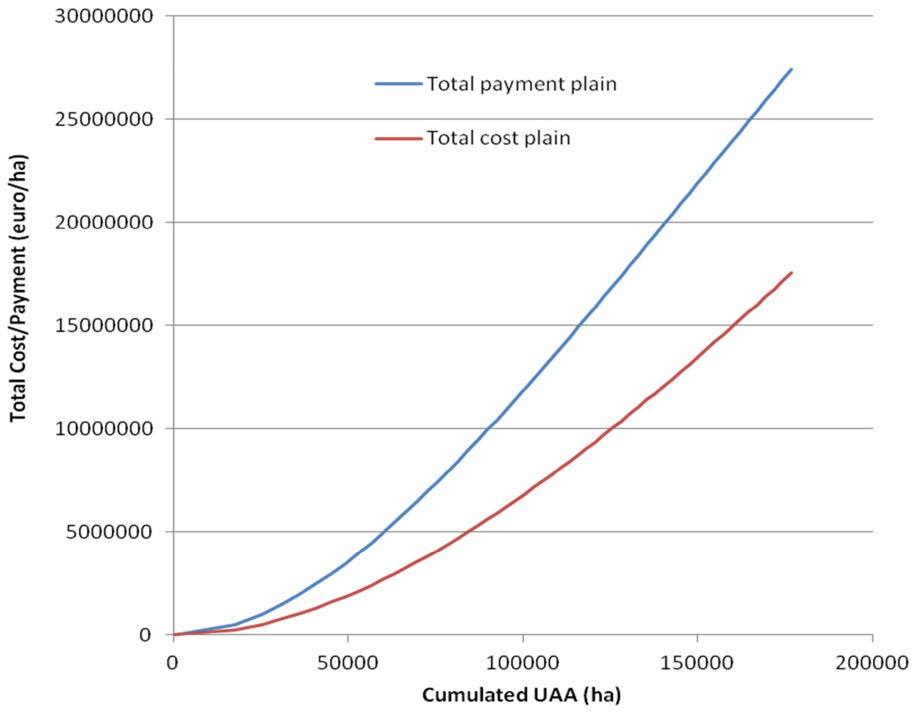

Figure 7. Total Cost and Total payment as a function of participating UAA (Plain) - Integrated Production

The figures 8 and 9 show a different degree of participation in the measure for the target hill and mountain zone. The data indicate a different convenience of farm to participate beyond a certain level of budget depending of the different compliance costs and characteristic of farms from each zone. Also as in the previous case the difference increases between payment and cost to the increasing of the budget.

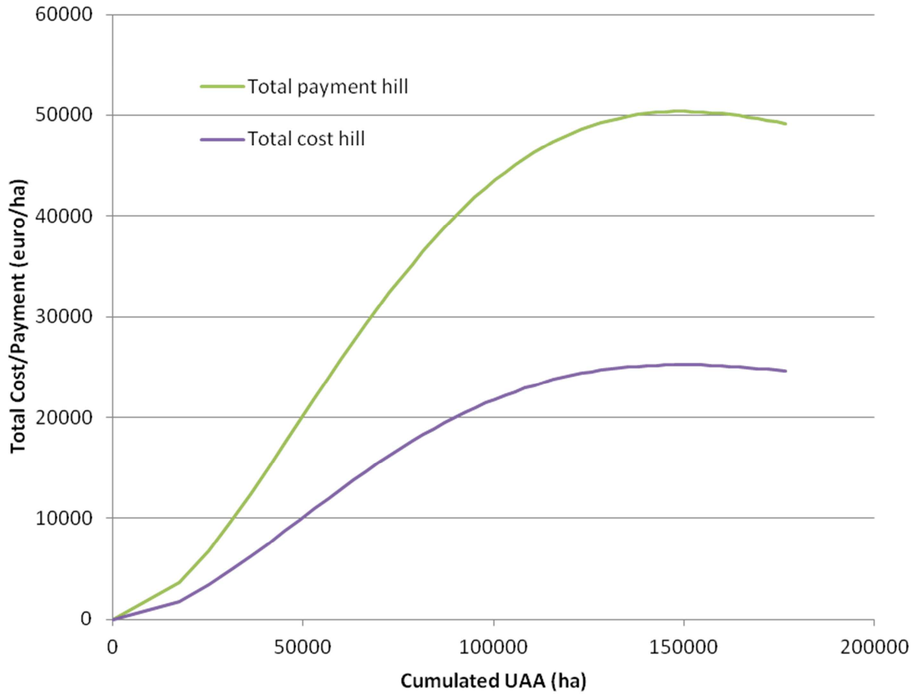

Figure 8. Total Cost and Total payment as a function of participating UAA (Hill) - Integrated Production

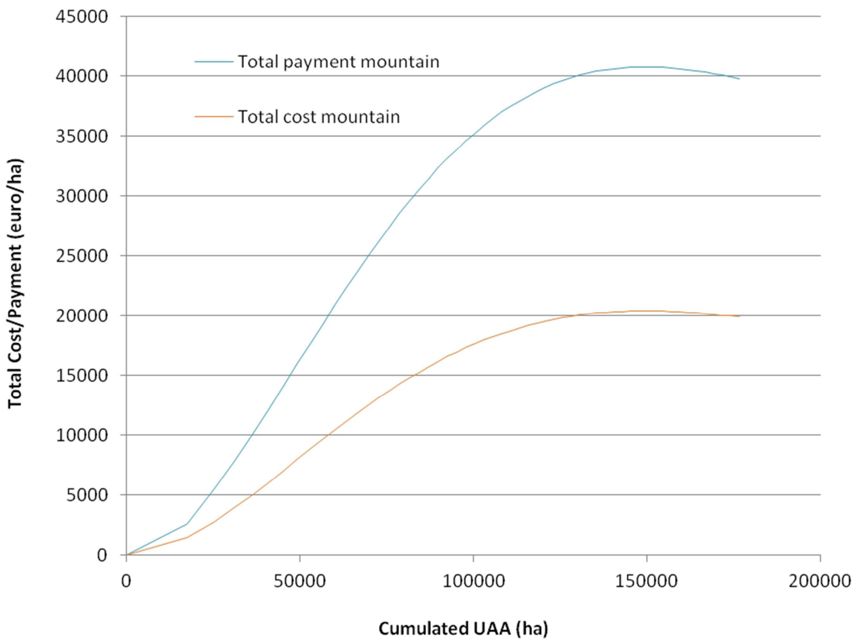

Figure 9. Total Cost and Total payment as a function of participating UAA (Mountain) - Integrated Production

These graphs confirm that an increase of the budget determines an increase of the uptake surface in all the zones and also an increase of the difference between cost and payment.

In this page the last figures is presented. These charts display the trend of marginal cost plotted on the Total participating UAA of plain zone.

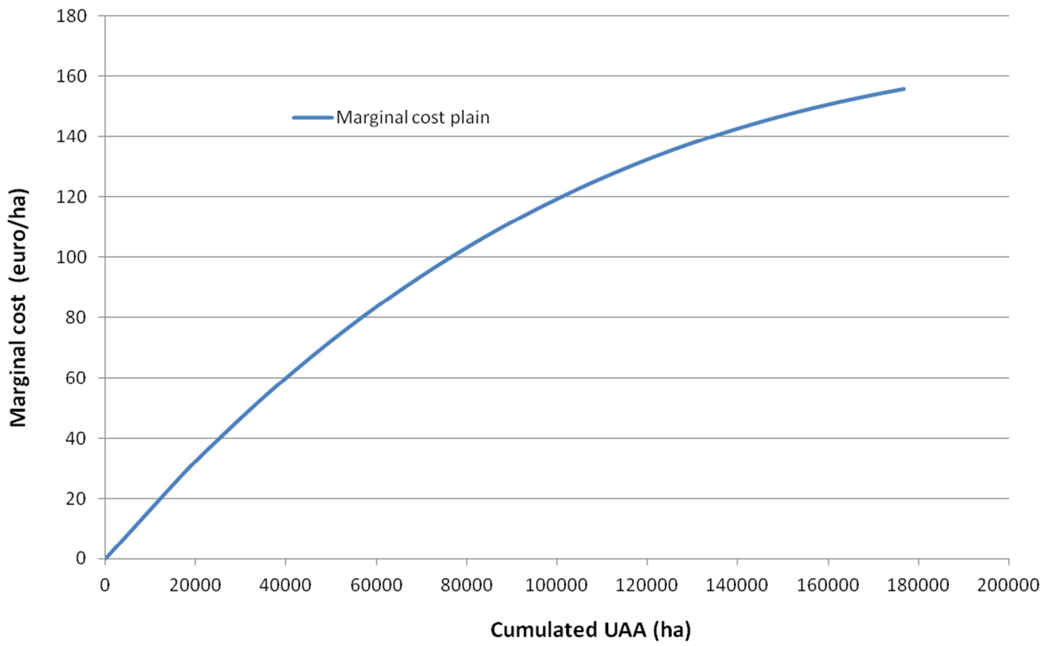

Figure 10. Marginal Cost as a function of participating UAA (Plain) - Integrated Production

In the next page are presented the three figures (Figures 11, 12 and 13) related to the model 2 (spatial lag model) .The figures show for all areas a change in the order of magnitude of payments and costs, which is higher than in the previous case (model 1) as it is showed in table 2.

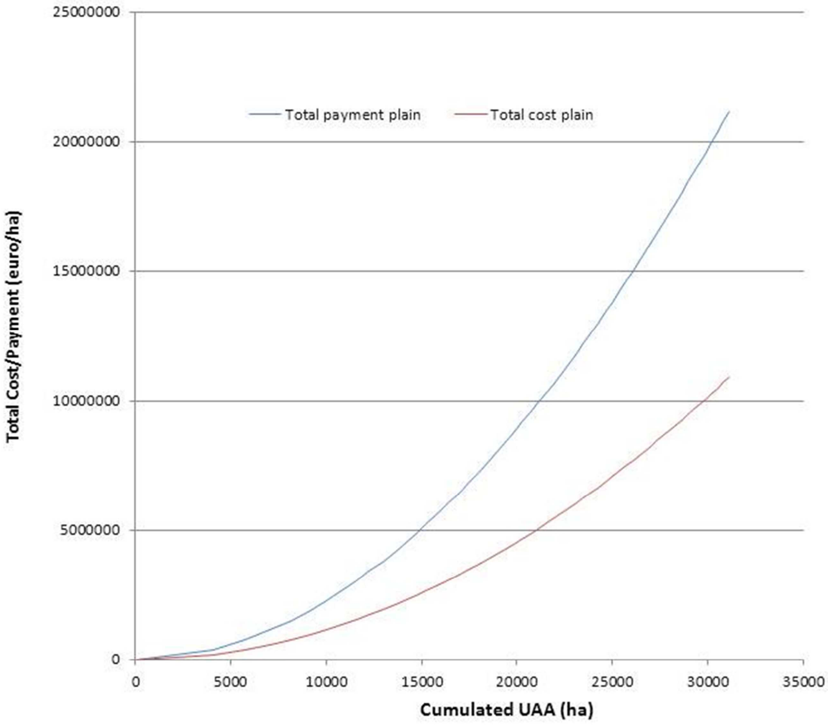

Figure 11. Total Cost and Total payment as a function of participating UAA (Plain) - Integrated Production

Regarding the hill and the mountain areas, the figures 12 and 13 show a significantly change in the trend for payment and cost functions compared to figures 8 and 9. In that case the graphs display an increasing trend, unlike the previous case. This could be due to some neighbourhood effects and as a result the participation of a certain municipality is influenced by the neighbour municipalities.

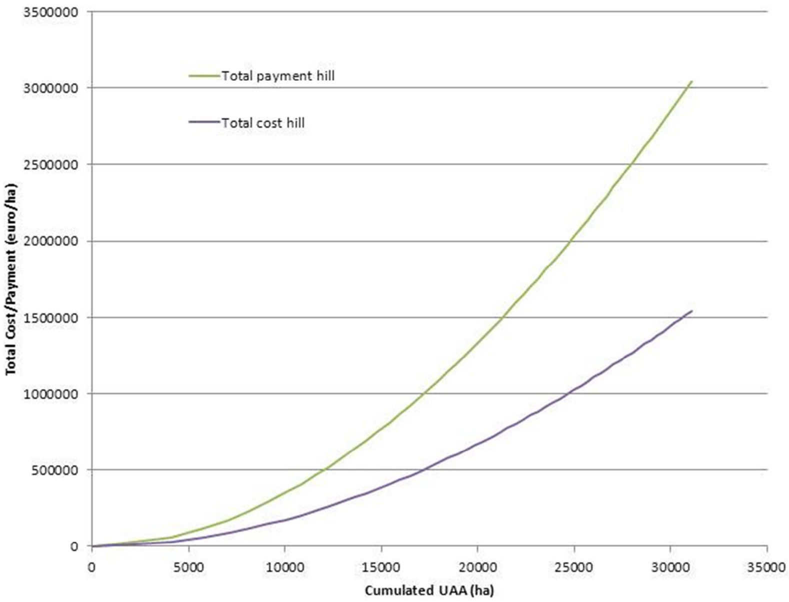

Figure 12. Total Cost and Total payment as a function of participating UAA (Hill) - Integrated Production

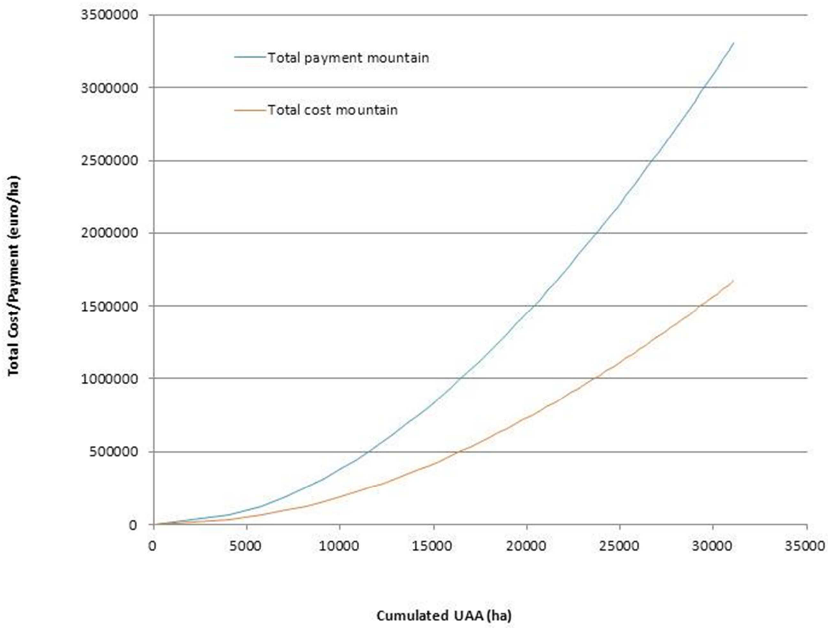

Figure 13. Total Cost and Total payment as a function of participating UAA (Mountain) - Integrated Production

5. Discussion

The modelling exercise provides an exploratory attempt to use econometric estimated information within an optimal targeting model.

The results of the model itself highlights the possibility to improve the targeting of AEMs by modelling farmer's economic behaviour in participating to scheme 214.1 and it offers an alternative approach to the design of payment mechanism, based on differentiated payments instead of the classical flat rate payments.

The optimization problem shows that the differentiate payment scheme gives a significant cost saving over flat rate mechanism by reducing farmers' rents and consequently the deadweight loss for cost effectiveness of the measures.

The method used, which improves the acknowledgement of AEMs, may have a potential for support the ex-ante analysis of RDPs.

The main weakness of the approach rests in the fact that the econometric information was particularly poor in terms of effect of policy design parameters (in particular payments), due to the limited range of payment observation. Also prioritisation was only tentatively modelled. Due to this, a participation cost function, the ideal input one would expected for this type of model, was not available. Hence, in this paper we used an approximate coefficient derived from spatial econometrics to correct an exogenously derived cost function. This remains was not completely satisfactory and remains a weakness of the approach.

In addition, while the spatial correlation term was used in the econometric analysis, it was not in not in the optimisation model, which hence used somehow more limited information than potentially available from the models.

A third point was that a meaningful empirical functional form for compliance costs in the area was not “well behaving” in terms of sought economic properties for a cost function. Hence difficulties in managing the model from a numerical point of view.

Facing the complexity of factor which affects participation, and the difficulties to model hidden transaction costs, the results can still be improved on several other grounds.

As a result, while the work on the task 5.3 of the SPARD project emphasize the relevance of mathematical programming combined with spatial econometrics for the interpretation and the support of RDPs results, it also warns that this may be very likely a useful support, but without the expectation to get to a totally satisfactory ability to provide normative results.

6. Concluding remarks

This work focused on the application of outcomes form spatial econometrics from SPARD task 5.2 with mathematical programming methods to test the feasibility of using the SPARD tool for supporting ex-ante analysis.

The study highlighted the importance of spatial differentiation to explain the determinants of farmers’ participation to AEMs schemes and the relevance of considering this differentiation in optimisation tools searching for optimal incentive-compatible targeting. It also showed the weaknesses of these approach, and the need for further improvement, which is rather common with any new methodologies aiming to explain complex factors as the dynamics and the RDP effects.

Despite this limitation, due mainly to data availability, the analysis could help the design process of an alternative incentive scheme based on the different farmers’ compliance cost through space instead of the classical flat rate payments.

At last, related to task 5.4, the alternative policy parameters derived from the SPARD D5.3 analysis could support the discussion with decision-makers. By this way it could be possible identifying better policy design option that could help the definition of appropriate RDMs.

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