# CONTRACT DESIGN AND TARGETING FOR THE PRODUCTION OF PUBLIC GOODS IN AGRICULTURE: THE IMPACT OF THE 2003 CAP REFORM

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## Abstract

The objective of this paper is to compare different ways of designing agri-environmental contracts and to set targeting under adverse selection, comparing conditions before and after CAP reform 2003. The results suggest that the present contract structure may be relevantly improved through a more accurate design and a clearer target. The reform, through the decoupling mechanism, will contribute to reduce the opportunity cost of the adoption of agri-environmental measures. This may increase the optimal amount of public goods produced by agriculture and will encourage participation by farmers. However, in order to properly exploit the new conditions brought by the 2003 reform, it is necessary to review the way agri-environmental payments are assigned and their structure, in terms of targeting, contract differentiation and payment allocation.

**Keywords**: Agri-environmental schemes, contracts, multifunctional agriculture, CAP Reform

**JEL classification:** Q1 – Agriculture; Q18 - Agricultural Policy; Food Policy; Q2 - Renewable Resources and Conservation

## 1. Objective

The development of the multifunctional role of agriculture is accompanied by the diffusion of innovative forms of contract aimed at creating incentives for the production of public goods by the sector. Some examples are the Agri-Environmental Schemes (AES) proposed under regulation 2078/92 and 1257/99.

In the perspective of an increasing relevance of public services produced by agriculture, contract efficiency represents a key issue. In fact, only the reduction of unjustified rents and the containment of policy transaction costs seem able to guarantee a sufficient efficiency of public expenditure, the maintenance of sector's credibility and the ability to allow economic reward for those farmers actually producing public goods appreciated by the whole society. Such need is perceived at all levels, including the EU that has explicitly inserted environmental and social efficiency criteria in the mechanism of allocation of agri-environmental payments in view of the reform of rural development programs (Commission of the European Communities, 2004).

Some of the issues connected to such contracts may also be extended to cross-compliance. In fact, the farmer is faced with the choice between benefiting of a payment with some restrictions and giving up the payment with no obligations. The experience from US, for example, shows also for cross compliance the importance to tailor farming constraints on compliance costs and actual environmental problems of each area (Claassen et al., 2004). These issues, together with non-compliance, are a common feature of most cases of agri-environmental regulation (with and without payments) and represent a key factor affecting policy effectiveness and efficiency (OECD, 2004).

The objective of this paper is to compare different ways of designing agri-environmental contracts under adverse selection with associated information and incentive costs. In particular, the interplay between contract design and targeting objectives is dealt with. The analysis is carried out before and after the CAP reform 2003, with the objective to analyse the interaction between the new CAP and the design of agri-environmental contracts.

The structure of this paper is the following. In section 2 the state of the art about AESs analysis using contract theory approach is illustrated. In section 3 the methodology is described, followed, in section 4, by the illustration of the results of a case study. Some discussion is provided in section 5.

## 2. Background

### *2.1. Delimitation of the object of the paper*

The economic literature about contract design under asymmetric information has developed widely in the last twenty years (Laffont and Tirole, 1993; Salanié, 1998; Laffont and Martimort, 2002).

Among the applications of this approach, AESs appear particularly pertinent. In fact, being based on public goods acquisition by numerous agents (farmers), diversified in terms of participations costs (transactions cost included) and the degree of compliance, and being this costs farm's private information, the contracts proposed by the public administration are most frequently designed based on partial knowledge of the relevant information.

The problem could be posed in two different perspectives. The first is adverse selection. The second is moral hazard. The adverse selection problem is relevant due to diversification of compliance cost among farmers, when the public decision maker is not able to discriminate farmers belonging to different types. The moral hazard problem emerges when the public decision maker is not able to control the degree of compliance of the contracts uptakedn and there are incentives for the farmers to be totally or partially non-compliant.

In the following section we discuss the argument in two parts. First, we highlight the relevance of this issue for the operational decisions concerning agriculture policy. Secondly, we briefly discuss the main contributions from agricultural economics literature.

### *2.2. Relevance of the problem*

For its own characteristics, the issue of contract design under asymmetric information and moral hazard can hardly benefit from precise and univocal data on the relevance of the problems under consideration.

The data from mid term evaluations of the Rural development plans seem however to strengthen the idea that these problems are extremely relevant. For example, the economic impact evaluation of integrated production schemes in Emilia Romagna shows that, for peach and wheat, it would be on average profitable for farmers to participate in AESs even without any payment. For organic production this is true only for wheat, while it does not apply to peach (Emilia Romagna Region, 2003b). This result may be due to the little differentiation of payments, with respect to the variety of farmers' costs of compliance. Clearly, if the results correspond to reality, the actual incentive effectiveness would be very low, because it would have a minor effect on the cropping techniques.

The very high compliance cost differentiation among farmers is confirmed by results from monitoring carried out in Emilia Romagna. In fact it brings evidence of compliance costs ranging from less than zero to more that 500 euro/ha (data not published from Emilia Romagna Region, 2003b).

This evaluation, based on data reported by farmers, in most cases does not consider the non-compliance. For example, the results from Emila Romagna controls show that only 57% of the farmers are totally compliant (Emilia Romagna Region, 2003a). The remaining may be mostly concerned with small non compliance. On the other side, most of the controls are based on some self reporting, so the degree of non compliance may be relevantly larger than detected.

The problem is relevant both for the design and for the valuation of AESs. In fact, even ex post, without objective indicators about the change in the state of the environment, evaluation only based on uptake (the most frequent case) would supply an illusory measurement of the environmental effectiveness and efficiency.

The argument, applied so far about AESs, is likely going to assume a more general importance, in relation to CAP 2003 reform, that introduces environmental conditionality and constraints on the use of land benefiting of payment rights.

### *2.3. The contribution of the agricultural economics literature*

The agricultural economic literature has tackled the problem since the beginning of the 1990s. (Fraser, 1993). One recent literature review about this topic may be found in Latacz-Lohmann (2004).

Briefly, the literature could be divided, with respect to the problems dealt with, in works that refer mainly to adverse selection, moral hazard or both.

The adverse selection problem is treated by Moxey et al. (1999) and Gren (2004), through models that hypothezise the possibility to provide the farmers with a menu of contracts, able to induce farmer's self-identification through contract choice. These models are based on the maximization of social welfare; this function is composed by environmental improvement benefits, by the benefit derived from the possible farmer's income increase and by the cost of the distortionary effect of taxation, necessary to provide public funds. In alternative, the problem may be posed in terms of cost-effectiveness, so eliminating the need to attribute monetary values to externalities and to quantify the distortionary effects of public funds (Havlik et al., 2003).

One alternative way of facing the problem is through contract auctions. This instrument was studied by Latacz-Lohmann and Van der Hamsvoort (1997; 1998) and by Bazzani et al. (2000).

On this topic, a large literature existents concerning the Conservation Reserve Program application in the United-State, in which the contract assignments were based on auction mechanisms. In spite of the theoretical advantages of such mechanisms for contract allocation, practical experience showed a number of limits (on this issue see for example Viaggi and Taff, 2004).

The moral hazard problem is studied by different authors (for example Choe and Fraser, 1998; 1999). In general, the models used to deal with this problem try to identify the optimal monitoring level needed to ensure farmers compliance. The result is represented by the optimal mix of payments, sanctions and the level of monitoring, in relation to farmers compliance cost.

Less numerous are the contributions in which moral hazard and adverse selection are considered at the same time (for example White, 2002). In this case, the main thematic is represented by the interaction (synergy) between incentives aimed at self qualification and those aimed at compliance.

One issue unfrequently seen in the literature is the interplay between contract design and targeting objectives. Targeting is a key feature in policy design and is often used as a proxy for the social value of environmental improvements, assuming it is correlated to the location with respect to e.g. sensitive area or high natural value areas (OECD, 2004). Targeting may well be interpreted as an issue as long as it entails a trade-off between the precision of the AES and its cost, as it may be assumed that a higher targeting will imply a more than proportional increase in policy costs (Romstad, 2004).

## 3. Methodology

The methodology used in this paper is based on a principal agent model under adverse selection, where the public regulator does not explicitly know the monetary value of the externalities produced by the sector. As a consequence he has the aim of maximising the environmental improvement (or some proxy such as the uptake of some measure) given the budget available. The type of contract assumed is limited to input (in particular nitrogen use) reduction[1]. It is assumed that the area interested by the schemes has heterogeneous characteristics, as for both environmental sensitivity (and, as a consequence, priority in AES) and farm characteristics (compliance costs).

It is in the interest of the regulator not only to maximise the environmental improvement, but also pursue its concentration in priority areas.

The decision problem may be described as follows:

$$\min \; z = \sum_{i=1}^{2} \sum_{j=1}^{m} \lambda_{ij} q_{ij} \tag{1}$$

s.t.

$$\text{bc:} \; \sum_{i=1}^{2} \sum_{j=1}^{m} \lambda_{ij} p_{ij} \leq B \tag{2}$$

$$\text{tc:} \; \frac{\sum_{j=1}^{m} \lambda_{1j} q_{1j}}{\sum_{j=1}^{m} \lambda_{1j}} \leq \tau \frac{\sum_{j=1}^{m} \lambda_{2j} q_{2j}}{\sum_{j=1}^{m} \lambda_{2j}} \tag{3}$$

where:

$i$ = area type: 1=target, 2= non target;
$j$ = farm type, $j$ = (1, 2, …, m);
$\lambda_{ij}$ = percent of farms belonging to each combination of farm type and area type;
$q_{ij}$ = maximum input quota to be assigned to each combination of farm type and area type;
$p_{ij}$ = payment paid to each combination of farm type and area type;
$B$ = public budget available;
$\tau$ = ratio between the quota to be proposed in target areas and the quota to be proposed in non-target areas (degree of targeting).
*bc* is the budget constraint, while *tc* guarantees a certain concentration of AES impact (e.g. level of pollutant reduction) in target areas. This objective can be expressed in different ways. In the model adopted, the way chosen is that of a ratio between the degree of input of target areas and that of non target areas (roughly the same criteria applied in the nitrate directive).

The implementation of the regulator's program is constrained to the decision to participate by farmers, that is differentiated according to the information condition and to the form assumed for the payments.

In the case of perfect information (first best) it is assumed that the regulator knows the costs of compliance of each single farmer and that, as a consequence, it is sufficient to guarantee with equality that the payment are higher than the compliance costs (assuming reservation utility equal to zero):

$$\text{pc:} \; \pi_{ij}\left(q_{ij}\right) + p_{ij} \geq \pi_{ij}^{*}\left(q_{ij}^{*}\right) \tag{4}$$

[1] The problem is extended, in the same form, to others actions, characterized by input reduction (for example integrate production) and, with some variations, to the actions that provide a change in land use (for example wetlands).

where:

$\pi_{ij}(q_{ij})$ = farm profit as a consequence of the quota assigned $q$;
$\pi^*_{ij}(q^*_{ij})$ = unconstrained profit.

By maximising (1) constrained to (2), (3) and (4) we obtain the result, where the payment equals the compliance cost, calculated as the difference between the unconstrained and the constrained profit.

In the case of asymmetric information, equation (4) still holds, but the payment cannot be directly calculated on the compliance costs, as they are not known to the regulator. However, the regulator can be assumed to know the value of compliance costs for each type of farmer and have some prior expectation about the frequency of each type.

In this case, the best theoretical solution (revelation principle) is a menu of contracts built using mechanism design. The contracts are given by some combination of $p$ and $q$ for each farm type, such that:

$$\text{vi(i):}\quad \pi_{ij}(q_{ij}) + p_{ij} \geq \pi_{ij}(q_{ij'}) + p_{ij'} \qquad (5)$$

where:

$j'$ = each farm type different from $j$.

The constraint is active only for farms of the same area, given that, among areas, it is possible to discriminate according to farm location.

By maximising (1) constrained to (2), (3), (4) and (5), it is possible to obtain a contract different for each combination of farm and area type[2], each one such that its choice is profitable for the farm to which it is addressed.

One reference solution closer to the existing one is that of contract differentiated between target and non target areas, but not among different farm types. In this case the problem is solved by maximising (1) subject to (2), (3) and (4). In such a solution, the payment and the quota are indexed on $i$ only (target or non target area).

The hypothesis of proposing an input quota associated to a compensation payment may be substituted by the imposition of a reduction of input ($r$) compared with the private optimum, against a compensation. In such a case, the problem takes the following form:

$$\max \quad z = \sum_{i=1}^{2} \sum_{j=1}^{m} \lambda_{ij} r_{ij} \qquad (1a)$$

s.t.

$$\text{bc:} \quad \sum_{i=1}^{2} \sum_{j=1}^{m} p_{ij} \leq B \qquad (2a)$$

[2] This is not true in the pooling case, this last is not considered in this work (see Laffont and Martimort, 2002).

$$\text{tc: } \frac{\sum_{j=1}^{m} \lambda_{1j} r_{1j}}{\sum_{j=1}^{m} \lambda_{1j}} \leq \tau \frac{\sum_{j=1}^{m} \lambda_{2j} r_{2j}}{\sum_{j=1}^{m} \lambda_{2j}} \qquad (3a)$$

The problem is analogous to the previous one, with the difference that the input quota (*q*) is substituted by a reduction of inputs.

In the first best, the maximisation of the objective function is further constrained to an individual rationality constraint (assuming again zero reservation utility):

$$\text{pc: } p_{ij} - c_{ij}(r_{ij}) \geq 0 \qquad (4a)$$

where $c_{ij}(r_{ij})$ represents the compliance cost (with c'>0, c''>0) as a function of r.

By maximising (1a) constrained to (2a), (3a) and (4a) the optimal contract is found, that, in analogy with the previous case, is based on a payment equal to the total compliance cost.

In the case of asymmetric information, the (4a) still holds, but the payment cannot be calculated directly on the (unknown) cost of each farm. The menu of contracts is given, in this case, by a combination of *p* and *r* for each farm type such that:

$$\text{vi(i): } p_{ij} - c_{ij}(r_{ij}) \geq p_{ij'} - c_{ij}(r_{ij'}) \qquad (5a)$$

The constraint, as before, is active between farms of the same area. The structure of the menu of contracts is obtained by maximising (1a) constrained to (2a), (3a), (4a) and (5a).

Finally, the last solution among those considered here, is represented by an input reduction and an undifferentiated payment across farm types. In such a case the problem is solved by maximising (1a) constrained to (2a), (3a) and (4a), but using a payment and an input reduction indexed on *i* only (target or non target areas).

Compliance cost functions may be regarded as dependent upon the policy framework in place. In this paper, costs functions have been estimated assuming two possible conditions: the first under the Agenda 2000 rules and the second under 2003 CAP reform.

## 4. Results

### *4.1 The case study*

The model has been applied to an illustrative case study, using data from the Commune of Argenta (Ferrara, Emilia Romagna). Two farm typologies were assumed, distinguished for the different typology of technical-economic orientation: mainly cereal crops for farm 1 and mainly vegetables for farm 2. The gross margin (that substitutes the profit in this simulation) functions and the compliance cost functions, for the variation, respectively, of the quota on nitrogen use and the reduction of nitrogen use with respect to the private optimum are reported in table 1.

Table 1. Income and compliance cost functions.

| *Farm Typology* | *Gross Margin Function* | *Compliance cost function* |
|---|---|---|
| Type 1 Agenda 2000 | $\pi(q)$= 73,286+11,962 q -0,0445 $q^2$ | $c(r)$= -0,3937 r +0,0217 $r^2$ |

| | | |
|---|---|---|
| Type 1 2003 Reform | $\pi(q) = 286{,}9+9{,}1941\ q\ -0{,}0316\ q^2$ | $c(r) = 3775{,}8\ r\ -18{,}715\ r^2$ |
| Type 2 Agenda 2000 | $\pi(q) = 7{,}8893+15{,}491\ q\ -0{,}0449\ q^2$ | $c(r) = 1{,}0793\ r\ +0{,}0451 r^2$ |
| Type 2 2003Reform | $\pi(q) = 84{,}816+13{,}727\ q\ -0{,}0366\ q^2$ | $c(r) = 2866{,}3\ r\ -18{,}369\ r^2$ |

These functions are estimated using linear programming models, calibrated on structural data, derived to agricultural census and technical data derived to interviews to local experts. The gross margin and cost functions have been obtained by parametrising on a nitrogen use constraint (quota or reduction) and subsequently smoothing the response function obtained[3]. In order to carry out simulations it has been hypothesized an homogeneous farm distribution across the two typologies and across target and non target areas ($\lambda_{i,j}$ = 0,25 for all farm types/areas). The budget available to the regulator has been assumed equal to 300 euro/ha. We have besides hypothesized the objective to achieve a half use of nitrogen (respectively a twice reduction) in target areas with respect to non target areas.

## *4.2. Contracts based on input quota*

The optimal contracts structure for the Agenda 2000 scenario and using an instrument based on a payment associated to a quota on nitrogen input, show clear differences among different contract design solutions (table 2).

Table 2. Results of different intervention options –Quota on nitrogen use – Agenda 2000 (B=300 euro/ha, $\lambda_{i,j}$ = 0,25, target = 0,5).

| | | *q* (kg N/ha) | | | | *p* (euro/ha) | | | | *average q* (kg N/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Type 1 | | Type 2 | | Type 1 | | Type 2 | | |
| | | t | nt | t | nt | t | nt | t | nt | |
| No target | First Best | 51 | 51 | 90 | 90 | 303 | 303 | 297 | 297 | 71 |
| | Second Best menu | 42 | 42 | 119 | 119 | 483 | 483 | 117 | 117 | 81 |
| | Second Best *q* uniform | 90 | 90 | 90 | 90 | 300 | 300 | 300 | 300 | 90 |
| Target | First Best | 30 | 80 | 69 | 118 | 479 | 127 | 471 | 122 | 74 |
| | Second Best menu | 18 | 76 | 96 | 152 | 789 | 147 | 255 | 9 | 86 |
| | Second Best *q* uniform | 64 | 128 | 64 | 128 | 520 | 80 | 520 | 80 | 96 |

t=target area; nt=not target area

Particularly, the contract menu shows the ability, with the same budget, to propose a nitrogen use quota 10% less than a uniform area payment. Targeting shows a relevant cost (in terms of increase of farm quota), but is apparently not prohibitive in presence of strong motivations for concentrating participation in target areas. However, the optimal contract structure (quota and payments by farm typology) result totally diversified among the different solutions, so denoting potential political limits in shifting from one form of contract to the other.

The introduction of 2003 CAP reform, has the consequence of lowering the quota for the first best and for the menu of contracts, while the quota increases (worsen) for the unified payment (table 3).

Table 3.Results of different intervention options – Input used quota – 2003 reform (B=300 euro/ha, $\lambda_{i,j}$ =0,25, target=0,5).

[3] We do not include further details, since the single farm modelling does not represent the main objective of this work.

| | | *q* (kg N/ha) | | | | *p* (euro/ha) | | | | average *q* (kg N/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Type 1 | | Type 2 | | Type 1 | | Type 2 | | |
| | | t | nt | t | nt | t | nt | t | nt | |
| No target | First Best | 35 | 35 | 92 | 92 | 303 | 303 | 297 | 297 | 63 |
| | Second Best menu | 28 | 28 | 130 | 130 | 516 | 516 | 84 | 84 | 79 |
| | Second Best *q* uniform | 92 | 92 | 92 | 92 | 300 | 300 | 300 | 300 | 92 |
| Target | First Best | 14 | 61 | 74 | 114 | 464 | 142 | 436 | 158 | 66 |
| | Second Best menu | 1 | 64 | 109 | 156 | 809 | 205 | 186 | 0 | 83 |
| | Second Best *q* uniform | 65 | 130 | 65 | 130 | 514 | 86 | 514 | 86 | 97 |

t=target area; nt=not target area

This depends on the fact that 2003 reform generally tends to induce a reduction of input use and so it has an effect in terms of higher ability to meet restrictions in input use.

However, it also increases the difference among opportunity cost in different farms, with respect to agri-environmental constraints, represented by the same nitrogen input quota. Therefore, only a higher payment differentiation is able to exploit the potential benefits of the new situation in terms of policy efficiency, while uniform contract solutions reach lower performances.

### *4.3. Contracts based on the reduction of input use with respect to the private optimum*

In the case in which the program proposes an input reduction with respect to the private optimum, in the Agenda 2000 situation, the comparison between different contract s brings to considerations analogous to the previous case, however with a stronger difference between the menu of contracts and the uniform payment (table 4).

Table 4. Results of different intervention options – Reduction of input use with respect to private optimum – Agenda 2000 (B=300 euro/ha, $\lambda_{i,j}$ =0,25, target=0,5).

| | | *r* (kg N/ha) | | | | *p* (euro/ha) | | | | average *r* (kg N/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Type 1 | | Type 2 | | Type 1 | | Type 2 | | |
| | | t | nt | t | nt | T | nt | t | nt | |
| No target | First Best | 147 | 147 | 54 | 54 | 408 | 408 | 191 | 191 | 100 |
| | Second Best menu | 157 | 157 | 28 | 28 | 534 | 534 | 66 | 66 | 93 |
| | Second Best *q* uniform | 70 | 70 | 70 | 70 | 300 | 300 | 300 | 300 | 70 |
| Target | First Best | 167 | 96 | 86 | 30 | 539 | 163 | 424 | 73 | 95 |
| | Second Best menu | 167 | 104 | 63 | 11 | 724 | 212 | 246 | 18 | 86 |
| | Second Best *q* uniform | 90 | 45 | 90 | 45 | 461 | 139 | 461 | 139 | 67 |

t=target area; nt=not target area

However, it should be noted that the solution proposed in this case may entail different control costs and have to be compared with the quota solution only after a cautious consideration of its actual implementability.

The 2003 CAP reform has in this case a negative effect for all intervention hypotheses, with one decrease close to 20% of obtainable pollution reduction with the same budget level (table 5).

Table 5. Results of different intervention options – Reduction of input use with respect to private optimum –2003 Reform (B=300 euro/ha, $\lambda_{i,j}$ =0,25, target=0,5).

| | | r (kg N/ha) | | | | p (euro/ha) | | | | average r (kg N/ha) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Type 1 | | Type 2 | | Type 1 | | Type 2 | | |
| | | t | nt | t | nt | t | nt | t | nt | |
| No target | First Best | 98 | 98 | 64 | 64 | 331 | 331 | 269 | 269 | 81 |
| | Second Best menu | 105 | 105 | 42 | 42 | 456 | 456 | 144 | 144 | 73 |
| | Second Best *q* uniform | 68 | 68 | 68 | 68 | 300 | 300 | 300 | 300 | 68 |
| Target | First Best | 121 | 67 | 85 | 36 | 505 | 157 | 422 | 116 | 77 |
| | Second Best menu | 128 | 75 | 60 | 19 | 674 | 230 | 247 | 48 | 70 |
| | Second Best *q* uniform | 88 | 44 | 88 | 44 | 448 | 152 | 448 | 152 | 66 |

t=target area; nt=not target area

Besides, the reduction is more clear in the first best and in the case of the menu of contracts, while it is almost irrelevant in the case of a fixed payment. As we saw before, the quota instrument seems to benefit of the fact that, under 2003 reform, farms show an autonomous reduction of pollution. This benefit do not extend to the further reduction of pollution. On the contrary, the cost of such further reduction appears increasing even for the farms with lower compliance costs.

Again, both in the case of Agenda 2000 and in case of the post 2003 reform, the cost of targeting appears relatively low and worth strongest targeting policies.

## 5. Conclusion

The paper add further evidence to the literature on AES contract design highlighting the potential benefits from the adoption of menus of contracts as compared to flat rate payments. Also, targeting policies, timidly promoted in Italy, may be pursued at a relatively low cost.

In perspective, it should be expected that the 2003 CAP reform will have an impact on AESs compliance cost. Particularly, we should hypothesize that the mid term review through decoupling, will tend to reduce the opportunity cost of uptaking AESs contracts (at least for the schemes not competitive for land use) and then to increase the optimal production of AESs service.

Using interventions typology of the same type now existent (flat rate and more often based on constraints on input use), the result could be an apparent improvement of effectiveness/cost ratio of AESs. However this result is reverse if we hypothesize schemes that produce an effective environmental improvement with respect to the optimal private result.

For a better exploitation of the new context set by 2003 CAP reform, it is necessary to review the way AESs payment are assigned and they structure. In particular, a more courageous territorial policy tailoring is needed. However, at least for voluntary instruments, targeting does not appear to be able to solve present problems in AES implementation, if it is not accompany by a sufficient contract diversification (in both constraints and payments). Besides, the targeting of measures, because of the additional incentive costs, need to be correlate to the public willingness to pay, in relation to the effective benefits derived by society.

The possibility and the strategy for contract improvement, is a function, both of the variability of the cost for the production of environmental services among farms, and of the effective degree of asymmetric information among actors, also in relation to the growing investment for the collection and processing of farming data. In perspective, the higher complexity of the menu of contracts may be justified in some cases, while the use of fixed payment could remain the best solution in other cases.

The modelling approach adopted in this paper could be developed in different directions. A first issue concerns the connection of linear programming models and principal-agent models, that appear promising in interpreting, in the same framework, crop choices and farmers' constraints, as well as their reaction to policy incentives.

A second major issue for a deeper analysis may be found in the interplay between target areas and contract design. For example the optimal contracts structure could be studied in different hypothesis of correlation among priority areas and compliance costs.

Besides, transaction costs that are additional with respect to incentive and information cost could be taken into account. Finally, the externality value and the opportunity cost of public funds should be included for moving from the cost/effectiveness approach towards a more complete social cost and benefit analysis.

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