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RESEARCH IN ECONOMICS AND RURAL SOCIOLOGY

The effects of agri-environmental measures

Agri-environmental measures (AEM) aim to improve the environmental impacts of agriculture thanks to subsidies granted on the basis of farmers' voluntary commitments over at least 5 years. Within the second pillar of the CAP, they are the only mandatory applicable measures for Member States. In France, they represent nearly 6% of the overall direct aid paid to farmers over the period 2000-2006.

AEM were generalized in the European Union (EU) in the 1990s. They were used in many various ways by Member States. The AEM effects at the same time depend on their principles and modes of action, which are relatively original, but also on the evolution of other CAP tools.

The research carried out with the support of the European ITAES project attempted to analyse the environmental effectiveness determinants of agri-environmental measures. These determinants come under bio-physical processes linking agricultural practices to environmental impacts, farmers' economic behaviour and institutional aspects in relation to the elaboration and implementation of measures. Methodological tracks and tools for the improvement of AEM devices and agreements were tested. Investigations were carried out in 9 EU regions or countries. 2000 farmers were interviewed, 200 farmers committed to AEM were followed during one year and nearly 300 representatives from governmental and non-governmental organizations were questioned.

Rapid and heterogeneous growth of agri-environmental measures

These payments to farmers have been co-financed equally by European and National funds since 1993. The corresponding European contributions (figure 1) progressed rapidly before marking time from 2000 onwards. In 2002, areas subject to AEM reach 30 million ha, that is to say more than 25% of the agricultural surface area of the EU-15.

Over 2000-2004, second pillar Community contributions are 7.2 billion euros per year on average, that is to say 16% of the European agricultural budget. This share is quite variable according to Member States: 5% in the United Kingdom, Belgium, the Netherlands and Denmark, 10% in France and Greece, 20% in Germany, Italy, Ireland, Spain and Sweden, and as much as 40% in Finland, Austria, Portugal and Luxembourg. Within these community contributions to the second pillar, the proportion of agri-environmental aid is even more variable from one country to another: 85% in Sweden, 70% in Austria, 50% in Ireland, Germany and Denmark and 25% in France and Spain, for instance.

The overall annual agri-environmental payments related to overall utilised agricultural area on the one hand, and to the share of area benefiting from these payments on the other hand, give a synthetic indicator of the scale of AEM in the different countries of the EU-15 (figures 2 and 3, respectively).

Principle and action modes of agri-environmental measures

In reference to the Pigouvian approach to the internalization of externalities, AEM are in principle symmetrical to taxes on polluting activities, offering remuneration for agricultural amenities. In practice, their modes of action move significantly away from that principle, according to criteria that have evolved over time.

AEM were born in the 1980s. The MacSharry reform (regulation 2078/92) made them compulsory for Member States. The participation of eligible farmers in AEM is voluntary. Payment must be based on the area committed. The premium per hectare is calculated in order to compensate for the decrease in profit (or surplus cost) caused by the shift in practices specified by the measure. This mode of calculation allows AEM to be listed in the green box of the 1994 Uruguay Round agricultural agreement. On the other hand, they are intrinsically suboptimal from the viewpoint of the economic theory of internalisation of externalities, which advocates remuneration that takes social demand into account, that is to say the value given to the targeted externality by the community. This is not the case here since only reductions in profit are taken into account in the calculation. Theoretically, according to this rule AEM cannot remunerate the externalities, which are supplied without any additional cost or loss of profit. However, to take

social demand into account, public authorities may play on the farmers' eligibility and specifications by targeting certain geographical zones or certain particular production systems. In application of the subsidiary principle, the elaboration and implementation of the measures are under the responsibility of the States who themselves may decentralize them to lower territorial levels. This allows adaptation of the measures to specific local agricultural and environmental conditions. It results in a great variety of institutional devices of implementation, in spite of a unified European framework.

This first version of the AEM includes several ambiguities that the EU tried to clarify afterwards. The first one concerns measures such as the natural grass premium simply aiming to maintain production systems regarded as favourable to the environment. Although it is theoretically possible to calculate an opportunity cost for that maintenance over the commitment period, it was difficult to justify such a calculation *ex ante*. A second ambiguity concerns the measures aiming at reducing the negative externalities of agriculture, especially diffuse pollution. Though such measures contradict the polluter-payer principle, they remain the priority and absorb most of the payments (Bonnieux et al., 2006). This difficulty emphasizes the problem of competition distortion linked to the diversity of other modes of regulation for pollution, such as rules and taxes, and setting-off thresholds. Farmers from certain countries may thus get subsidies to improve practices forbidden or taxed in others. Last, the compensation principle for losses of profit seems to exclude the necessary incentive for the adoption of AEM by farmers. This is particularly striking for AEM, like the conversion of arable lands into extensive pastures, which implies the loss of direct compensatory aid for falling prices, which is indeed duly compensated for by agri-environmental payment but with much less guarantee for its existence. The result is a lack of clarity of the incentives granted by the CAP as a whole (Mollard et al., 2003). In fact, Member States benefited from plenty of room for manoeuvre in the calculation of premiums. They got out of these problems in various ways by negotiating AEM that were more or less marked by national priorities, especially as regards farm income support. This is especially the case for Finland, Sweden and Austria who used their agri-environmental payments in compensation for their drop in farm prices resulting from their accession to the EU in 1995.

Along with the 1999 reform, the 1257/99 regulation, called the rural development regulation, or CAP second pillar, provides several clarifications of previous ambiguities. From then on, compensations have been calculated in reference to the usual good farming practices (UFAP), which must be specified for every measure in their area of application. Moreover, these good practices must be observed by the contracting parties, even those agricultural activities that do not include the measures they have chosen. This reform allows remuneration of the maintenance of pre-existing practices situated above UFAP, even if surplus costs are not calculable in relation to the initial situation. Such AEM often aim at maintaining the existence of a jointness between environmental benefits and agricultural production, which would be threatened by the abandonment of farming activities in the areas of interest such as the marshlands, the environmental functions of which depend greatly on the maintenance of extensive cattle breeding. This issue is very close to that of less favoured areas. In this case, it may be that a system such as the compensatory allowance for natural handicaps, applied to protect this jointness by more simple conditioned subsidies, is better adapted than the AEM and more economical in terms of transaction costs, as much for the administration as for farmers.

Furthermore, the UFAP specification acknowledges a right to pollute. They are not necessarily compatible with environmental standards applying to close aquatic environments. However, they have the advantage of fixing tangible and verifiable limits. In 2003, the implementation of cross-compliance bound to the respect of directives and good agronomical and environmental conditions boosted a certain harmonisation of usual good practice within regions, States and EU, and most often increased their requirement level. The possibilities of subsidizing pollution reduction were lowered. In this way, some AEM remunerating modest adaptations of pollutant inputs or cultural successions became obsolete.

1257/99 Regulation also provides for the possibility to add an incentive supplement to the compensation for losses of profit in the calculation of payments, limited to 20% by the 445/2002 regulation. A 20% additional supplement may also be mobilized in the Natura 2000 areas. To a certain extent, these arrangements take into account community demand and the necessity to offer an incentive to favour participation in AEM. However, the true change in the structure of the incentives brought by the CAP comes from the decoupling of first pillar aid, with the establishment of single farm payments. The agricultural policy becomes more coherent and clearer towards the environment. The AEM aiming at a change in land-use become more attractive. This encouraging observation must be moderated because of the maintenance of a partial decoupling of certain first pillar aid and the 45€ premium per hectare dedicated to energy crops. This incentive, aiming to reduce greenhouse gas emissions, contrasts in certain large cropping areas with those provided by AEM, regarding water quality protection in particular.

The mid-term evaluation of the application of the rural-development regulation 1257/99 highlighted three difficulties linked together. One concerns the administrative and institutional complexity of their implementation, including at the community level. This complexity makes the rates of participation in measures difficult to anticipate, partly explaining the under-consumption of the budget. The second difficulty concerns the insufficient consideration of society's expectations in the choice and establishment of the measures offered to farmers. The third difficulty concerns the environmental effectiveness of AEM: this effectiveness is uncertain, except in some particular cases highlighted in national evaluations. This results from a lack of plan and method to allow a systematic and rigorous follow-up of the environmental effects of AEM.

The 1698/2005 regulation attempts to make changes to these inadequacies: the compulsory introduction of the LEADER approach within the second pillar, the obligation

for States to organize a public consultation during the AEM elaboration phase and to implement a continuous evaluation system, the possibility for local action groups to elaborate and implement the AEM, independently from national programmes, the possibility to use auction mechanisms to conclude agreements with a view to improving the cost-benefit ratio. Because of the resumption of agricultural talks at the World Trade Organization (WTO), the extra 20% incentives are withdrawn to guarantee AEM is kept in the green box. On the other hand, the calculation of premiums may include private transaction costs, that is to say administrative costs the AEM contracting party is charged for. To be validated by the European Commission, this calculation of private administration costs must be based on the comparison between farmers involved in AEM and those who are not. Investigations were carried out within the ITAES project on the institutional innovations of this new regulation. Whatever the country, with a view to taking into account the social demand better, a major part of institutional actors and stakeholders wish to reduce the influence of the Ministries of agriculture and of the farmers' unions in the elaboration of AEM. The latter are not favourable to it. Local action groups and auctions chiefly appeal to non-governmental organizations, including agricultural ones, sometimes, which in the main doubt the effectiveness of AEM. On the other hand, government representatives, particularly those from regional institutions, agricultural and environmental services together, are reticent because they are more aware of administrative costs that these innovations imply (Eggers et al., 2007).

The effects of agri-environmental measures

Agri-environmental measures are based on the obligations to use all reasonable means to achieve a desired result, from which the calculation and justification of payments ensue, and not on obligations to achieve a particular result in terms of environmental impact. The latter depend on the following factors: a) causality between specified practices and environmental effect, b) localisation of contractual areas, c) participation rate in the areas of interest, d) respect of specifications by contracting parties, e) continuity of practices, with or without contract renewal.

As a rule, the conditions for the environmental effectiveness of measures are neither well-informed nor quantified in the implemented programmes. The same goes for the expected environmental effects. This double gap is a great handicap in evaluating and improving measures, be it in cost-effectiveness or in a cost-profit perspective. Within the ITAES programme, a method of quick assessment was tested in 9 case studies (Finn et al., 2007). It combines on the one hand the information available on the implementation of the environmental programme in these regions, in terms of geography of environmental stakes and in terms of areas concerned by the different measures offered, and on the other hand, the experts' experience and knowledge from various horizons (scientists, facilitators and experimented monitors). The method remains limited by its qualitative and comparative approach. In practice, it is also difficult to take interactions between measures into account. However, the method allows clarification of the contribution of each measure to each objective, intentional or not, and pinpoints the factors which limit the effectiveness of a given measure, or the set of measures, towards a given objective, at a lesser cost. Frame 2 shows the aggregated results per objective for the Lower Normandy region. The rate of participation in measures is the main limit of the system, especially for the water-quality objective.

Causality between specified practices and environmental effect

Here, the difficulty lies in the gap existing between very precisely specified farming practices, but often contributing at the same time to several environmental objectives. Conversely, several measures contribute to the same objective. In certain cases, their effects reciprocally intensify (superadditivity). In other cases the opposite happens, the effects of a measure being reduced by the implementation of another measure (sub-additivity). These causal relationships between measures and objectives vary in space and time. For instance, the diminution of transfers of polluting inputs by the setting of grass-strips depends on the soil type, the biodiversity of unfertilized meadows may decrease over several years before increasing again. This causality also depends on the existence of threshold and scale effects, for areas wider than the plot or the farm. Although well-known, these non-linear effects are rarely taken into account. Not taking threshold effects into account in the implementation of AEM leads to large wastes of public funds linked to the geographical sprinkling of heterogeneous measures (Dupraz et al., 2007). So it is crucial to identify the relevant territory for every environmental objective and examine what precisely localized areas must be submitted to what practices. This requires an institutional system of production of and capitalization on locally specific knowledge, which is able to investigate the feasibility and compatibility of the pursued environmental objectives. According to the analysis of farmers' behaviour, sharing this knowledge is decisive in their attitude towards the AEM.

Localization of contracted areas

This factor requires the examination of the geographic targeting mechanism. In some cases, auto-selection works well. For a given premium per hectare, this is the case when there is a reverse correlation between agricultural profitability and amenities of the targeted areas. The late use of meadows to make nesting-birds reproduction easier is exemplary of the situation. However, there are many cases of adverse selection: The relevance of the upkeep and cleaning of hedgerows, very much contractualized in Lower Normandy, relies on the maintenance of the Bocage network (farmland criss-crossed by hedgerows and trees). Yet it clearly appears that farmers only apply this measure on the hedges that they did not intend to destroy before the agreement deadline. The same fact is acknowledged for measures aiming at reducing aquatic pollutions: these measures are often selected in zones where the respect for specifications is the least costly for farmers, and also the least necessary. To deal with this problem, the best and most common solution is to restrict the eligibility to certain measures to priority zones of interest. The zoning principle is often questioned by farmers' union representatives who consider there is discrimination in terms of redistributive effects: as for the measures aiming

at reducing pollutions, the most polluting farmers are the main beneficiaries.

Participation rate

The participation rate is the share of enrolled area in the total area targeted by the AEM. This factor depends on the one hand on the economic behaviour of farmers and on the other hand on the remuneration and form of the contracts offered. The form of the agreements includes different attributes: length of time, flexibility in the choice of areas to formalize in the choice of specifications, as well as in the monitoring, penalty and renegotiation modes.

The first empirical surveys relied on models of profit maximization where remuneration of the agreement is compared with the additional costs associated with the implementation of specifications. Most of them also integrated elements of context accounting for farmers' behaviour towards the environment and their insertion in professional or associative networks. Due to the statistical importance of these context variables, it was necessary to adapt the model of behaviour. The farm household model allows the necessary consideration of personal farmers' preferences in their behaviour as a producer. Actually, farmers enjoy the environmental goods they produce and the payments associated to this production in an unrivalled way. The theory of transaction cost allows us to integrate context variables into the analysis. It chiefly allows us to build them more rigorously as determinants of a cost transaction function, integrated into the representation of farmer behaviour (Ducos & Dupraz, 2006).

The monitoring of 200 contracting farmers over a year allowed an assessment of the transaction costs, which represent about 20% of the payments, ranging from 5 to 35% according to the AEM (Mettepenningen et al., 2007). This survey identifies the main determinants of transaction costs. Results are consistent with those of the analysis on the AEM adoption conducted on 2000 farmers and allow refinement of their interpretation (Arnaud et al., 2006). Access to information, the farmer's confidence in the reliability of administrative procedures and his confidence in State goodwill lower the transaction costs and increase the probability of AEM adoption. They quite clearly affect the probability of AEM adoption. So it appears that transaction costs constitute barriers to formalization.

The theory of transaction costs shows that they increase with asset specificity that is to say with the difficulty in using the means engaged in the transaction to other ends. The analysis of the farmers' choice between the different combinations of measures characterized by different levels of asset specificities illustrates this result for the AEM (Ducos & Dupraz, 2007). This explains why the measures offering the highest payments per hectare, which are then the most restrictive and often the most ambitious as far as the environment (biodiversity protection and certain actions of landscape restoration) is concerned, are also the ones that are contracted the least. This stems mainly from not taking transaction costs into account in the calculation of payments. The result is that the most attractive measures for farmers are also the least ambitious.

An examination of the real adoption of contracts does not describe how transaction costs vary with the characteristics of the contracts, since all the real contracts have the same duration, the same possibilities of choice in measures and surface areas to engage, as well as the same monitoring modalities. This is the reason why the choice experiments method was implemented. Interviewed farmers were faced with alternative agreements, the characteristics and payments of which differ from real agreements. The analysis of their trade-offs between these fictive agreements allow measurement of the variation of their minimal willingness to pay for the modifications of these characteristics, that is to say the modification of the necessary premium in order that they maintain the same area under agreement, taking these modifications into account. For example, in Lower Normandy, all things being equal, the extension of the duration of the agreements from 5 to 10 years would require a 10% increase in annual payments. This method gave remarkably consistent results in the nine countries where it was tested (Ruto & Garrod, 2007). It is thus a good tool to adapt premiums, including for technical modifications regarding specifications of measures.

The adaptation of the level of payments is not the only means to mobilize in order to improve the participation rate. It is also possible to play on the institutional quality of design and implementation of measures. The environmental sensitivity of farmers in interaction with their understanding of the objectives and processes plays a significant role that it is possible to exploit, and the same goes for the administrative and technical support of non-governmental and private organizations. Lastly, the lack of confidence in the public authorities' will and procedures can probably not be completely compensated for by the premium level.

Respect of specifications by contracting parties

The European Court of Auditors pointed out several inadequacies in the AEM monitoring procedures, although validated by the General Directorate for Agriculture of the European Commission. This is particularly the case of the excessive weight given to the statements of contracting parties in these procedures, and of the gap between the specifications and monitoring points, considered as inadequate or non-adapted.

Penalties are often insufficient to be truly deterrent. Furthermore, they seem to be inequitable when non-conformity rates are high: in such a situation, the administration has neither the means to increase the monitoring rate up to the adequate level nor the penalties dependent on the general legal corpus.

However, based on the principles of good governance, these difficulties and criticisms come within a view of agreements more based on the text than on the quality of relationship between parties (Polman & Slangen, 2007). In the case of AEM, such a view may fuel bureaucracy without improving the contracts' impact on farmers' real practices. As for the participation rate, the improvement in the respect of specifications may also be found in the improvement in the relationship between public authorities and farmers by relying on the existing networks or by strengthening them.

The durability of practices and impacts, with or without renewal of contracts

Generally based on five-year contracts, the AEM are well adapted to the introduction of innovations which appear to be durable in the *ex post* economic context, like the conversion to organic farming or the introduction of intermediate crops, beneficial in agronomical terms. It is not always the case, especially for slow agro-environmental processes and flows of environmental services requiring permanent support. In this case, other instruments must be used, for instance adequate conditioned supports.

The decoupling of first pillar aid, the increase in the AEM budget and co-funding and in the compensation allowance for natural handicap, all go the same way. Decoupling reduces contradictory incentives as regards land use and cross compliance of aid increases the attractive nature of the environmental payments because of cost complementarities between the different environmental productions. However, big efforts must be made for better targeting of the environmental services for which AEM may prove to be effective. This presupposes respect of the polluter-payer principle, even if transitory aid supporting the adaptation of production systems must not be excluded.

From an institutional point of view, stakeholders would like less influence from the Agricultural Ministry and Farmers' Unions. This is consistent with the fact that targeting environmental goods is seldom compatible with targeting criteria for income support. Moreover, private or public transaction costs are particularly high in relation to payments made within the AEM. They make it one of the worst instruments for income support.

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For further information

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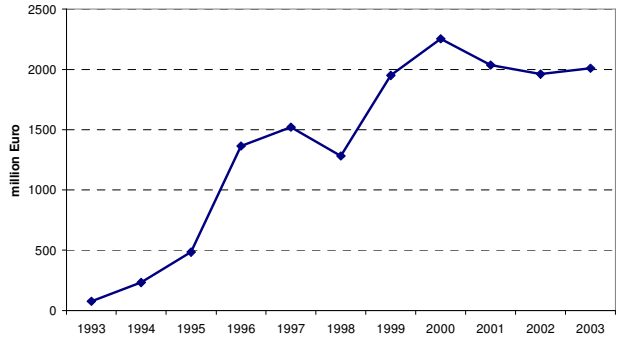
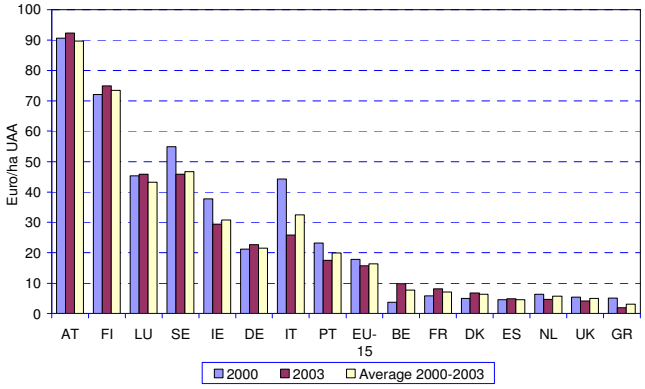
Figure 1: Evolution of the annual Community expenditure granted to AEM (1993-2003)



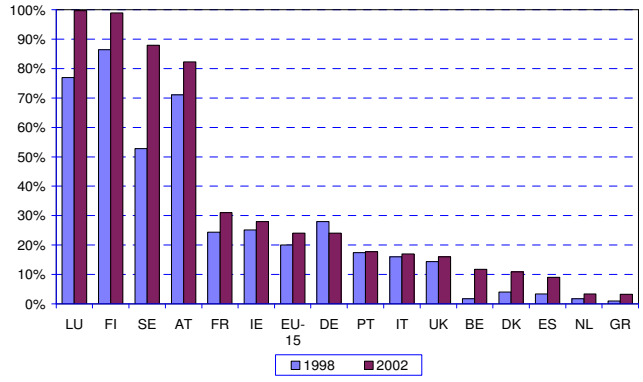
Source: DG AGRI, EAGGF-Guarantee budget execution 1993-2003.

Figure 2: Annual agri-environmental payments in relation to the utilised agricultural area (UAA)



Source: DG AGRI, EAGGF-Guarantee section, budget execution Heading 1(b)-2000-2003; ESTAT, FSS (UAA)

Figure 3: Share of the utilised agricultural area enjoying agri-environmental payments



Source: DG Agriculture and Rural development (DG AGRI), Common indicators for monitoring of implementation of Rural Development Programmes, 2002, and DG AGRI - Working document VI/7655/98.

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Frame 1: Heterogeneousness of agri-environmental programmes:
In spite of a common European framework, agri-environmental measures are extremely various in their environmental and non-environmental objectives and political structures: generally, unitary countries have a single rural development programme, while federal countries have regional ones.
With the exception of the Netherlands and Denmark who adopted more coercive regulation policies against agricultural pollutions, because of their acuteness, other countries' programmes are dominated by AEM aiming at improving water quality and the battle against erosion.
The Finnish programme benefits virtually the whole agricultural area. It works like a direct aid conditioned by barely restrictive good farming practices for fertilization and phytosanitary protection. Besides income support, the objective is the maintenance of arable lands faced with forest expansion.
In France grass-premium is more targeted on the support to extensive farmers' incomes, disadvantaged by the 1992 CAP reform, than to the environmental grass benefits, unequal according to the areas considered. This is all the more true that this measure does not distinguish meadows according to their age. France's characteristic is that it changed its institutional system three times in 10 years, while most of the countries maintained a certain continuity.
The Irish programme chiefly aims at bringing small breeding into compliance with standards. The highly decreasing form of payment according to area allows farms under 40 ha to be targeted, frequently multi-active ones. The objective is to maintain these small multi-active farmers, more for social and cultural reasons of country-planning than for well-targeted environmental objectives.
Some German Länder and Italian regions favour the support to differentiated agricultural products, associating quality attributes and environmental benefits (organic farming and integrated fruit production.

Frame 2: Appreciation of the AEM efficiency factors in Lower Normandy according to environmental objectives

On the basis of the specifications of different measures, the expert panel assesses the performance of causality between each measure and each environmental objective of the European Environmental Agency (EEA) list, on a 1-5 scale. Then, for each of the measure-objective pair, which got a non null mark, the panel gives a mark for every other factor: localisation of contract-based areas, density of these areas in the zones of interest, respect of specifications for contracting parties. As far as possible, marks are unanimously given after dialogue. Otherwise, the standard deviation shows the range of the estimations.

Objective	Causality	Respect of specifications	Good localization	Adequate rate of participation
Quality of soil	2.9 (0.9)	4.0 (0.5)	2.9 (0.9)	2.2 (1.1)
Quality of water	3.4 (1.1)	4.1 (0.6)	3.3 (1.0)	1.9 (1.3)
Diversity of species	4.5 (1.0)	3.5 (1.0)	3.8 (1.3)	2.3 (1.0)
Quality of habitats	3.8 (1.7)	3.6 (0.5)	3.9 (0.6)	2.5 (1.3)
Landscape	3.6 (1.2)	4.3 (0.5)	3.9 (0.4)	3.3 (1.6)

Source: Finn et al., 2007 (1 to 5-point scores, Standard deviation shown in parentheses)

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