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On the Choice of Farm Management Practices after the Reform of the Common Agricultural Policy in 2003

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Abstract

The Common Agricultural Policy (CAP) was fundamentally reformed in 2003. From 2005 on, farmers will receive decoupled income support payments instead of production premiums if basic standards for environment, food safety, animal health and welfare are met. Farmers will likely adjust production and management practices to the new policy framework.

We describe how this reform fits into the EU strategy of making agricultural production more environmentally friendly by concentrating on financial aspects. Using an agricultural sector model for Austria, we show that the reform will further decrease agricultural outputs, reduce farm inputs, lessen nitrogen surpluses and make environmentally friendly management practices more attractive for farmers.

JEL classification: Q12, Q18, Q24, Q28

Keywords: Common Agricultural Policy, farm management practices, agri-environmental measures, agricultural sector model, Austria

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1. Introduction

Ecological impacts of farming have deteriorated in recent decades. The effects of changes in land use, farm management and input use are often externalised, being greater for the society than for the agricultural sector (Stoate *et al.,* 2001). In many OECD countries, agri-environmental programmes have been implemented to reverse this trend by promoting environmentally sound farm management.

In the EU, community legislation requires member states to implement such programmes which are co-financed by funds of the Common Agricultural Policy (CAP). The Rural Development Regulation (1257/1999) provides the legal framework of agri-environmental measures in the EU. It is widely seen as an opportunity to implement measures for alleviating ecological impacts of farm management through a combination of cross-compliance and agri-environmental schemes (Baldock *et al.*, 2002; Parris, 2001).

A significant amount of public funds is used for this programme, which raises questions of how to choose cost-effective measures. This problem has two aspects: (i) identification of a set of economically viable measures which farmer would voluntarily accept and implement, and (ii) the selection of agri-environmental indicators to facilitate monitoring (Zalidas *et al.*, 2004).

Recent OECD work in the field of environment has focused on these challenges by providing a forum for comparisons of environmental and farm policies, and by developing a set of internationally accepted environmental indicators. In the field of agriculture, the work on indicators has been fruitful and recent publications allow sound country comparisons. The OECD publication goes beyond an exclusive description of land use change, farm input usage, and effects on biodiversity by including farm management indicators (OECD, 2001).

A major reform of the CAP was decided by the Council of Ministers in 2003. Among the objectives of this reform was to better align EU farm policy with "the demands of [...] citizens for healthy food, better quality, and environmentally-sound production methods which respect animal welfare principles" (Fischler, 2003).

From 2005 on, farmers will receive decoupled income support payments instead of production premiums if basic standards for environment, food safety, animal health, and welfare are met. The programme for rural development, established in 1999, was not modified and therefore existing agri-environmental measures will be maintained until the end of 2006. Farmers are likely to adjust production and management practices according to the new farm policy framework. Several studies show that the anticipated effects on farm incomes will be moderate and that some farm outputs (*e.g.*, beef) will decline (FAPRI Ireland Partnership, 2003; LEI, IAP and IAM, 2003).

How this reform will affect the choice of farm inputs and management practices – given that current agri-environmental programmes are in place – is relatively unknown. This paper makes an attempt to measure possible outcomes on agri-environmental indicators which are consistent with the OECD methodology. The approach employed in this paper is to model the effects of policy adjustments by the Positive Agricultural Sector Model Austria (PASMA). Austria is chosen as a case study, because it has a broad spectrum of agri-environmental measures, and detailed management data are available.

The topic of the paper is to analyse whether the recent CAP reform will (i) reduce or boost the output of agricultural commodities, (ii) provide incentives for using less or more environmentally relevant inputs, and (iii) induce farmers to adopt more extensive or intensive farming practices.

The remainder of the paper is structured such that financial aspects of agri-environmental programmes of EU-15 are presented next. After summarizing core elements of the recent CAP reform, the model, underlying assumptions, and scenario results are presented. Special attention is attributed to the modelling of management practices and data requirements. Finally, some remarks for improvements of the presented approach are discussed and tentative policy conclusions are derived.

2. Agri-environmental policy and the CAP reform – a financial perspective

In 1992, the CAP was reformed in order to control farm budgets and to gear for the Uruguay Round trade talks. Many farm commodity prices that had been kept at high levels via government intervention were significantly reduced to control surplus production. In order to retain farm incomes, direct payments were introduced which have been coupled to the crop acreages and livestock heads since then. Accompanying measures, among them agri-environmental programmes (Reg. No. 2078/1992), were established to facilitate the adjustment of the agricultural sector. These payments have been financed by the European Agricultural Guidance and Guarantee Fund (EAGGF), which has a large share of the general budget of the EU.

The environmental commitment of the EU farm policy was further reinforced by the establishment of the Second Pillar of the CAP and was introduced by the Agenda 2000 reform in 1999. Budgets for the period 2000-2006 were established and agri-environmental programmes had been integrated in the rural development framework. Compared to the previous legislation, the new regulation is more specific on goals and programme performance indicators.

In many cases agri-environmental programmes are designed such that farmers may choose whether to continue their farming practices or to join – usually by contract – particular schemes. The schemes are grouped into five broad categories (OECD, 2003):

- ways of using agricultural land which are compatible with the protection and improvement of environment, landscape and its features, natural resources, soil and genetic diversities;
- environmentally favourable extensification of farming and management of low-intensity pasture systems;
- conservation of high nature-value farmed environments which are under threat;
- the upkeep of landscape and historical features on agricultural land; and
- the use of environmental planning in farming practice.

Agri-environmental programmes are required to achieve benefits that go beyond those obtained through application of 'good farming practices'. This term defines the level of environmental quality that farmers are obliged to achieve due to environmental restrictions without compensation. For efforts that go beyond legal requirements, compensation payments are calculated based on the costs incurred or income foregone by farmers as a consequence of adopting such activities. Payments are given to farmers

in relation to the environmental obligations taken on. The Integrated Administration and Control System (IACS) is used to control contract compliance.

In general, the programmes are for a minimum duration of five years (apart for long-term set aside). The EU co-funds up to 75% of the cost of programmes in less-developed regions (so called Objective 1 regions), and up to 50% in other regions. In the late 90s, programme coverage had reached in average 20% of EU's total farmland, with up to 70% in some member states or regions (Austria, Finland, and some German Länder) while in Belgium, Denmark, Greece, the Netherlands and Spain the coverage was below 5% (Baldock *et al.*, 2002).

Figure 1

Distribution of agri-environmental payments across EU member states.

In 2002, agri-environmental payments financed by EU agricultural funds amounted to €2 billion, the difference to the (estimated) total of €3.7 billion was financed by member states. Agri-environmental payments are only a modest proportion of the total CAP budget (€40.5 billion per annum) which is ceiled for the 2000-2006 period.

The distribution of these funds across member states is not equal (Figure 1). Germany, Ireland, Luxemburg, Austria, Finland, and Sweden spend relatively more on agri-environmental programmes than other EU member states (scaled to gross-value added of agriculture). Theses countries have relatively high national incomes and a large share of farmers in less favoured areas. Whereas countries which have a very competitive agricultural sector (*e.g.*, Denmark, The Netherlands, Belgium) spend less on agri-environmental programmes.

In mid 2002, the Commission published a mid-term review of the Agenda 2002 reform. It led to another reform proposal which was adopted by the Council of Ministers with some modifications in June 2003 (Greek Presidency, 2003). The key element is the introduction of a single farm payment. It will replace premiums formerly linked to output or land (labelled "EAGGF income support / direct aid" in Figure 2) and will be equivalent to more than half of the EU funds spent on agriculture.

Many support schemes are not part of the decoupling process (*e.g.*, subsidies for agri-environmental programmes and payments for farms in less favoured areas). Also exempt from the decoupling process are national farm policy expenditures which add up to almost €15 billion per year (top area in Figure 2). An evaluation of the impact of the CAP reform therefore needs to account for financial flows that are not affected by the reform, but have a significant influence on production decisions of farmers.

Figure 2

EAGGF Guarantee section expenditures plus national farm policy expenditures.

3. Modelling the effects of policy changes on the choice of management practices

3.1. The modelling framework

In a framework of Driving forces-Pressure-State-Impact-Response (DPSIR), developed by Zalidis *et al.* (2004), a functional relationships between the following elements is presented:

- Driving Forces which can be differentiated in management decisions made by farmers (area under agri-environmental policy, organic farming, conventional farming) and market conditions (pricing of agricultural products);
- Pressures (crop pattern and use of water, agri-chemicals, fertilizers, energy);
- State-Impact (identification of zones of specific functional interest, selection of data, functional evaluation of each zone);
- Response (decision making in terms of applied agri-environmental policy, market and technology in the area).

Within this framework, the CAP reform can be seen as a comprehensive response affecting driving forces on market conditions and production incentives. These interact with driving forces on farm that increase or lessen pressures like the use of agri-chemicals. How the CAP reform will affect market conditions has already been analysed by other authors (*e.g.*, Fapri-Ireland-Partnership, 2003). However, how the other driving forces (management decisions on farm) will be affected, has not been analysed elsewhere yet. In order to evaluate these effects, the Positive Agricultural Sector Model Austria (PASMA) is employed.

3.2. The Positive Agricultural Sector Model Austria

The advantage of PASMA over other agricultural sector models is that agri-environmental programmes and national support schemes are incorporated in a very detailed manner. For Austria, such an approach is necessary, because the sum of agri-environmental payments plus support for farms in less favoured areas (€900 million) significantly outweighs direct payments (€535 million in 2002) which are going to be decoupled. Due to the importance of the agri-environmental programme, data on management practices and compensation payments are available at the farm level for several years. These data are used to calibrate management parameters in the model.

Figure 3

Block-diagram of PASMA

PASMA is employed to estimate the effects of the CAP reform on farm income, crop and livestock production, farm labour, and environmental indicators at regional and national scales. Data from the Austrian Agricultural Information System (ALFIS), the Integrated Administration and Control System (IACS), the Economic Agricultural Account (EAA), the latest Agricultural Structural Census, the Standard Gross Margin Catalogue, and Standard Farm Labour Estimates provide necessary information on

resource and production endowments for 40 regional and structural production units. Consequently, PASMA is capable to estimate production, labour, income, environmental responses for each single production unit. Such a broad regional and structural differentiation allows flexible aggregation in the model and its results (*e.g.*, federal states or major production regions, and alpine farming zones).

PASMA is calibrated to historic crop and livestock activities by using the method of Positive Mathematical Programming (PMP). Howitt (1995) has initially published PMP and since then it has been modified and applied in several models (*e.g.*, Lee and Howitt, 1996; Paris and Arfini, 1995; Röhm and Dabbert, 2003). In PASMA, linear approximation techniques are utilized to mimic the non-linear PMP approach. Thus large scale models can be solved in reasonable time. In combination with an aggregation procedure, *i.e.*, building convex combinations of historical crop mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

Farm welfare (from crop and livestock production, policy transfers and secondary farm activities) is maximized subject to regional resource endowments (*i.e.*, land, livestock, and farm labour). PASMA differentiates production activities with respect to 19 land categories, 36 cash crops, 48 feeding activities and crops, 29 livestock categories, and 34 livestock products. Single farm observations of adoption of 32 management measures from the agri-environmental programme provide the necessary input for the module on management choice. All agri-environmental subsidies, CAP premiums, prices and production and compliance costs of activities listed above are simultaneously accounted for.

The activities are available in each of the 40 regional and structural production units. Feed balances (organic/conventional forage and feed concentrates) and plant nutrient balances (manure/commercial fertilizer) assure transfers between crop and livestock activities. A comprehensive transport matrix allows transfers of crops, animals, forage, and concentrates between all 40 regions. Product prices, other model assumptions and features are referenced in Sinabell and Schmid (2003a and 2003b).

4. Model scenarios and results for Austria

4.1. Details of the CAP reform 2003

When the CAP reform proposals were drafted, it was anticipated that decoupled premiums have considerable impact on production incentives. Farmers will no longer need to plant certain crops or raise bulls in order to obtain financial support. Entitlements for single farm payments are calculated on the basis of direct payments received in the reference period 2000-2002. They are transferable within a region or a country. In future, production decisions are expected to be based on market signals (*i.e.*, prices) and consequently resource allocations are likely to improve.

Single farm payments are contingent upon several restrictions. Entitlements need to match eligible hectares and agricultural land must be maintained in good ecological conditions. Farmers receiving a single farm payment will have to set aside part of their land (organic farms are exempt) and will be subject to compulsory cross-compliance (18 statutory European standards in the field of environment, food safety, and animal health and welfare).

Member states may choose to introduce the single farm payment in full or they may opt to retain some of the production linked direct payments. In addition, member states may implement a single farm payment individually or at regional level.

For cereals (apart from rye), the intervention price will not be reduced, as originally planned by the EU Commission. For other crops regulations were simplified, but not all production related premiums have been abolished (notably durum wheat, protein crops, and energy crops). A reformed milk quota system will be maintained until the 2014-15 marketing year. Administrative prices of butter and skimmed milk powder will be cut asymmetrically in four stages. Milk quotas will be moderately expanded in 2006 and a decoupled milk quota premium will add up to the single farm payment.

Single farm payments to larger farms (above a threshold of €5 000) will be reduced up to 5%. Despite a gradual phasing-in, channelling expenditure away from market policies will make more than €1.2 billion available for rural development measures.

4.2 Scenarios and simulation results for economic and environmental indicators

The scenario analysed in our study is a comparison between the modelled situation in 2003 (with the Agenda 2000 in place) and the situation in 2008 (when the reformed CAP will be fully implemented). Most prices are exogenously given and based on OECD (2003) and FAPRI-Ireland-Partnership (2003) forecasts. In order to analyse the sensitivity of the results with respect to the exogenous prices, three levels of price expectations (low, expected, and high) are compared.

Table 1

Effects of the CAP reform from 2003 in Austria

The model results show that:

- the CAP reform will have moderate effects on aggregate farm income if structural adjustments are accounted for;
- the reform will slightly accelerate structural adjustment (which means fewer people employed in agricultural production);
- decoupling will lead to a significant decline of the use of arable crops and reduce the output of beef while outputs of other farm commodities (*e.g.*, eggs and pork) will not be affected significantly;
- output reductions are reflected by a decline of inputs;
- the nitrate balance at a national level (according to OECD methodology) will improve.

These results are contingent upon the conjecture that the programme for rural development will be prolonged more or less unchanged (coverage of measures, and most importantly the financial volume), and farmers are eligible for new agri-environmental contracts.

4.3. Effects of the CAP reform on the choice of farm management practices

Agri-environmental indicators have become standard for most analyses about this policy reform. In order to provide a broader view, we have made an effort to evaluate another block of Driving Forces, in particular the effects on management procedures. The OECD classification of farm management indicators is used as a reference. A list of such indicators was originally proposed by Doyle (1999) and further developed by the OECD in the report on agri-environmental indicators (2001):

- whole farm management (farm management plans, organic farming);
- nutrient management (nutrient management plans, soil tests);
- pest management (area of cultivated crops not treated with chemical pesticides, area of cultivated agricultural land under integrated pest management);
- soil and land management (soil cover, management practices like contour cultivation and conservation tillage); and
- irrigation and water management (water saving irrigation technology).

For Austria, an official matrix that matches the set of OECD indicators to the observed management measures does not exist yet. Therefore, we indicate a tentative correspondence between the list of OECD management indicators and agri-environmental measures for which data are available (Table 2).

In Austria, total agri-environmental compensation amounted to €600 million in 2002. The Austrian programme ranks among those with the broadest coverage and attracted many participants. A total of 59% of agricultural land (first data column in Table 2) is allocated in the 'basic scheme'. We classified it as 'nutrient management plan' according to OECD terminology. In this scheme farmers commit themselves to stricter environmental standards and do not abandon land during the contracting period. The second most important scheme is a soil coverage programme. It addresses soil erosion and nutrient leakage and attracts 30% of all farms (second data column in Table 2). The organic farming scheme is also ranking among the most important measures. In Austria, 8% of agricultural land are managed according to organic farming criteria and the volume of support is equivalent to 13% of agri-environmental programme expenditures (third data column in Table 2).

Moreover, a condensed overview of the multitude of measures is provided in Table 2. It shows that even the comprehensive set of OECD management indicators does not fully cover the breadth of environmental issues addressed by this programme. In particular those measures that focus on the notion of 'cultural landscapes' (open, managed space with bucolical amenities) seem to be not covered well.

Given the policy change, we expect that organically managed land will increase by 2% (see fourth data column in Table 2). In addition, several environmentally friendly management practices are likely to be extended. However, some of them (*e.g.*, soil cover, erosion control) will decline. This is explained by the fact that approximately 5% of arable land will be turned to grassland or pasture (Table 1).

Table 2:

Overview of the agri-environmental management practices and expected changes due to the CAP reform 2003

5. Discussion

The approach presented in this paper is an attempt to close a gap that existed between agricultural sector models (*e.g.*, Fapri-Ireland-Partnership, 2003) that ignore environmental side effects of policy changes and biophysical models (*e.g.*, Zalidis, *et al.*, 2004 or Jordan *et al.*, 1994) which have to treat responses of farmers to policy changes exogenously.

Our modelling approach is comparable to integrated ecological and economic models like those developed by Moxey *et al.* (1995), Vatn *et al*. (1997), Önal *et al.* (1998), and Yiridow and Weersink (1998). The major extension is, that PASMA is not limited to a small region or a watershed but covers a whole country that is regionally and structurally differentiated. Due to the availability of observed farm management information we are able to model actual management responses while the works cited relied on anticipated behaviour. However, the advantage of these approaches over PASMA is that the environmental consequences (*e.g.*, nitrates in groundwater) are modelled explicitly. Results obtained by PASMA only indicate environmental pressures (*e.g.*, nitrogen surpluses).

Issues which are not adequately accounted for in the model are uncertainties and risk-attitudes of farmers. As shown by Schmid (2001) and Isik (2002) price and output uncertainties in combination with risk-attitudes of farmers should to be accounted for very carefully when policy recommendations are made.

We recommend that further developments of modelling efforts similar to ours should go in four directions: (i) increase the spatial coverage, (ii) the inclusion of more environmental and management indicators, (iii) the integration of bio-physical models which allow a more sophisticated evaluation of environmental consequences of climate, land use, and management changes, and (iv) integration of risk attitudes of farmers as well as economic and environmental uncertainties.

6. Policy Conclusions

Analysts of the reform agree that it will likely reach the anticipated goals, namely reduce outputs and keeping farm incomes constant (FAPRI-Ireland-Partnership, 2003; LEI, IAP and IAM, 2003). Output declines are linked to a reduction of inputs which are potentially environmentally harmful. As corroborated by our results environmental pressure will therefore be alleviated. One explicit objective of the reform is less environmental harm due to agriculture which seems to be reachable.

The detailed analysis of the interaction between existing agri-environmental policies and changing commodity policies showed that environmentally friendly farming practices will become more profitable for farmers. This effect is explained by lower opportunity costs. We therefore expect, that future programmes with premiums similar as today, will likely attract more farmers willing to participate. However, to design environmental policies efficiently one need to quantify the demand for environmental quality and landscape amenities provided by agriculture.

The model results we obtained in our analysis for a country which represents only 2% of farm output in the EU. Austria is a small member state, however, it represents a

number of countries that are characterized by (i) relatively high national *per capita* incomes, (ii) a high willingness to complement EU-funds for agri-environmental measures by national funds, and (iii) a large proportion of farmers in less-favoured areas (Finland, Germany, Ireland, and Sweden). Several other countries with similar sizes and incomes like Belgium, Denmark or The Netherlands invest much less in agri-environmental programmes. They obviously have chosen to head towards a different path of agricultural development. This dualistic system of agricultural development seems a key strategy to overcome income disparities and simultaneously provide environmental and landscape amenities where they are demanded.

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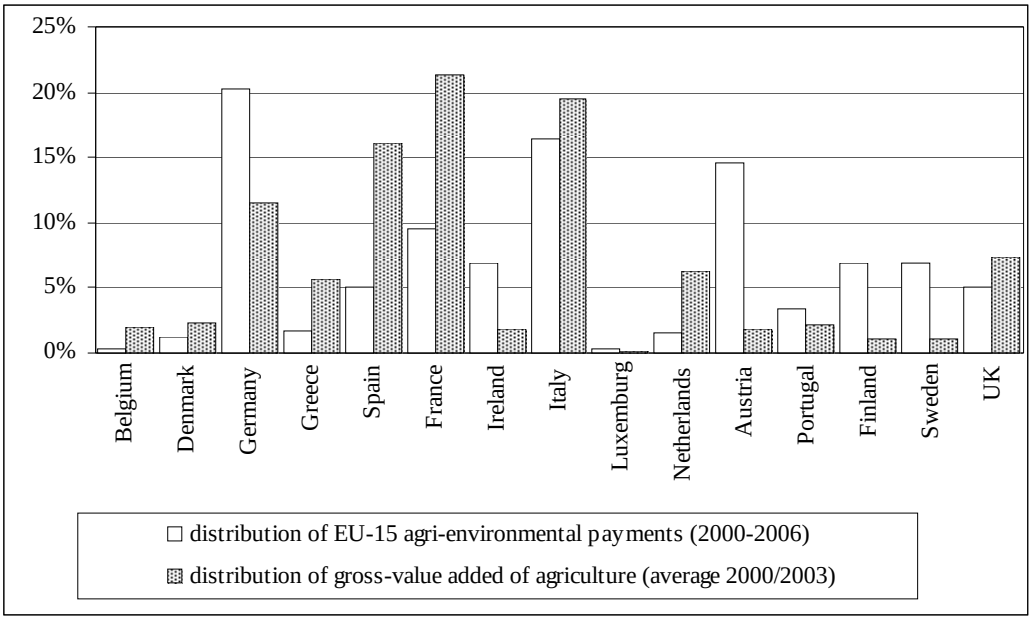

Figure 1: Distribution of agri-environmental payments across EU-15 member states. Source: EU DG-Agri 2004 (http://europa.eu.int/comm/agriculture/rur) and EUROSTAT New Cronos, June 2004

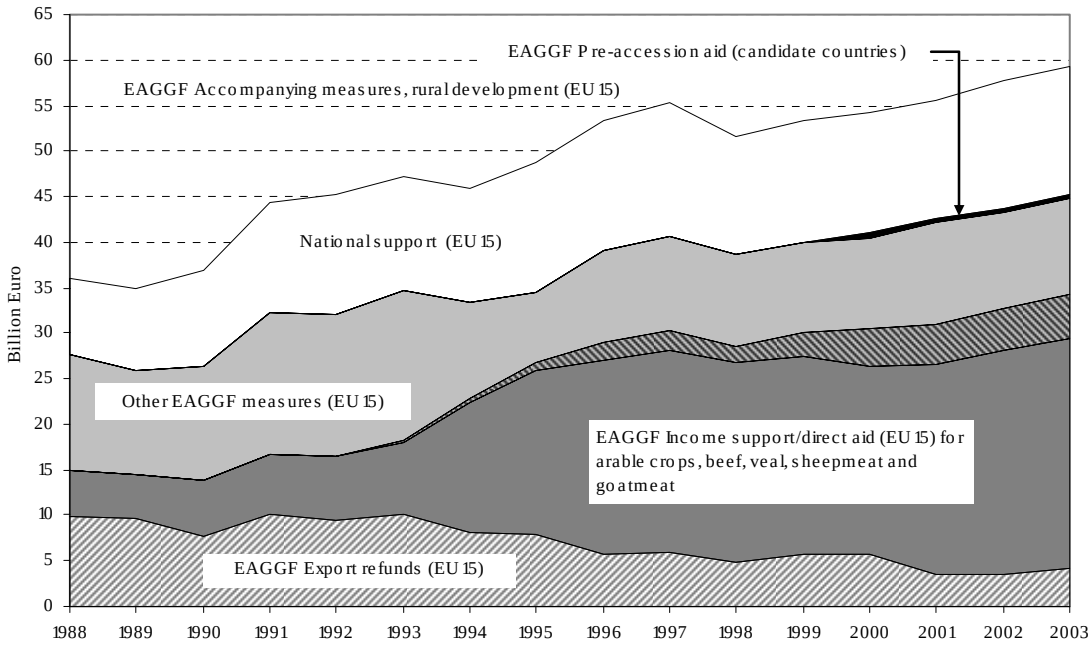

Figure 2: CAP expenditures (EAGGF Guarantee Section) and national support for agriculture (EU-15). Source: European Commission, Directorate-General for Agriculture, Agriculture in the European Union, Statistical and Economic Information.

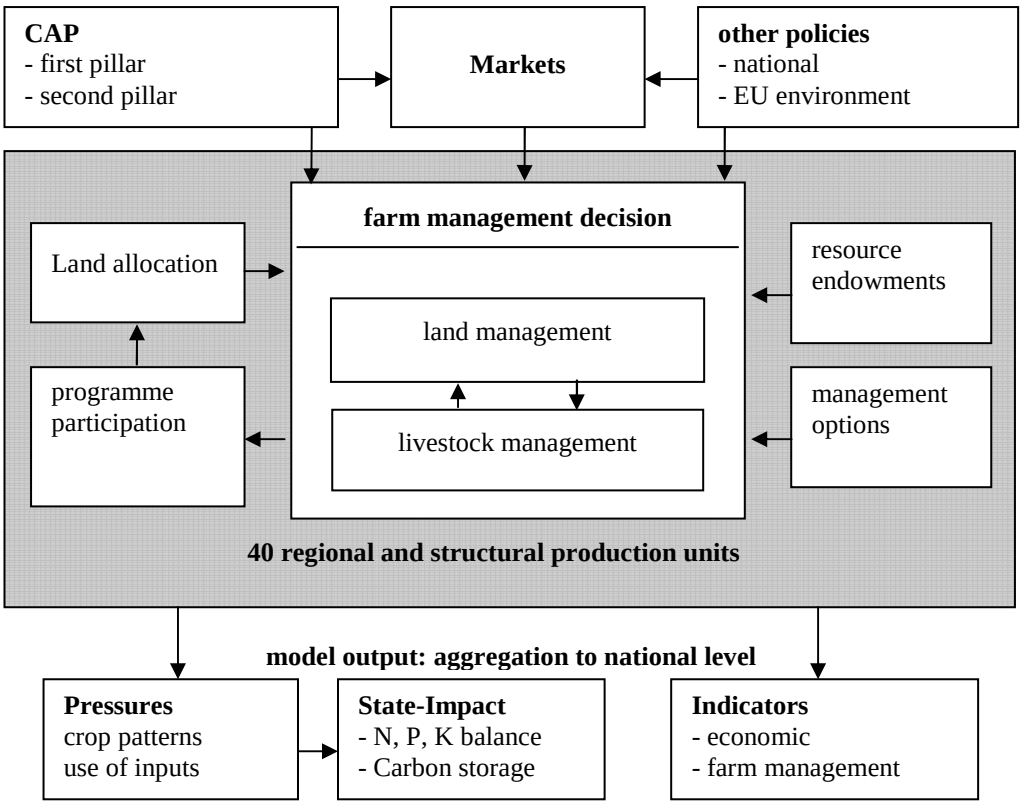

Figure 3: Block-diagram of PASMA

Table 1 Effects of the CAP reform from 2003 in Austria

	price scenario in 2008 (completion of CAP reform)		
	low	expected	high
	percentage change versus 2003 (Agenda 2000 Reform)		
economic indicators			
producer surplus at sector level	-6.3	-3.1	+0.2
producer surplus *per capita*	-2.7	-0.6	+1.5
farm labour input	-2.6	-2.0	-1.3
output of beef	-7.0	-6.3	-4.7
output other meat and eggs	±0.0	±0.0	±0.0
output of cereals	-5.0	-4.5	-3.8
pressures and state-impact indicators			
arable land	-4.8	-4.3	-3.8
meadows and pastures	+5.8	+5.5	+4.9
nitrate from manure	-3.4	-2.5	-1.5
nitrate from mineral fertilizers	+0.3	+0.3	+0.1
loss of nitrate	-3.4	-2.5	-1.6

Notes: Time horizon 2008. Assumptions: 50,000 additional suckler cow premium entitlements are shared among owners of heifers. Suckler cow premiums and 40% of slaughter premiums remain coupled (this holds for Austria and not necessarily for other EU member states). The supplementary refund is accounted for as the slaughter premium. Additional funds for the programme for rural development (17 million Euros annually) are not accounted for in the total of transfers.

Table 2: Overview of the agri-environmental management practices and expected changes due to the CAP reform 2003

agri-environmental measures in Austria	programme coverage			simulation
	land	farms	funds	results
	%	%	%	% change
measures corresponding to OECD indicators				
nutrient management plan (basic scheme)	59	61	17	+1.2
soil cover	31	30	16	-4.4
integrated pest management	20	35	16	-0.3
not treated with chemical pesticides	17	43	13	+4.0
organic farming	8	9	13	+1.5
land management practices (soil erosion)	4	8	1	-1.2
whole farm management plan	3	3	4	±0.0
other measures				
groundwater protection plan	3	2	2	±0.0
management of alpine meadows	8	4	4	±0.0
management of open landscape	6	27	7	±0.0
ban of silage	3	5	3	±0.0
habitat management	2	13	4	±0.0
high stem fruit production	>0	10	>0	±0.0
livestock threatened of extinction	>0	2	>0	±0.0
low yield traditional crops	>0	1	>0	-4.2

Notes: Total farm land is 3.38 million ha, the number of farms is 199,000 and total funds of the agri-environmental programme are 600 million Euros. Programme coverage of land does not add to 100% because the same parcel of land may be brought into more than one schemes (*e.g.*, soil cover and organic farming). Simulation results refer to the medium price expectation level in Table 1.

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