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Phasing out of Environmentally Harmful Subsidies: Consequences of the 2003 CAP Reform

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Abstract

Subsidies linked to production have been classified to be environmentally harmful by OECD. A core element of the EU 2003 Common Agricultural Policy (CAP) reform is to decouple income support from production. This paper estimates the environmental consequences of this policy reform. An agricultural sector model using a modified version of the positive mathematical programming method depicts the complex natural, structural, and political relationships of Austrian farming. Changes in management measures can be analyzed with respect to their environmental effects by using appropriate indicators. Simulation results show that the 2003 CAP reform will not only reduce average cost of production, but may also improve environmental conditions regarding soil, water, and greenhouse gases. Thus, this reform is likely to bring about outcomes which the previous CAP-reform (Agenda 2000) promised, but did not deliver.

JEL-Classification: Q12, Q18, Q24, Q28

Keywords: Common Agricultural Policy reform; Environmental indicators; Agricultural sector model; De-coupled subsidies;

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1. Introduction

Subsidies are a common instrument of public policy making. On a global scale, subsidies amount to about US$ 1 trillion per year, accounting for 4% of world GDP (Pearce, 2003; van Beers and de Moor, 1998, 2000). About two-thirds of this money is spent in OECD countries, with the bulk of these transfers being concentrated on agriculture, mining, and road transport.

While a rationale of subsidies is to increase net welfare in society, in quite a few cases opposite effects take place. This mostly occurs when stakeholders with vested interests push through welfare diminishing market interventions, and when unintended spillovers deteriorate environmental quality and impair the health of people and animals. Production linked subsidies are deemed to be particularly problematic with respect to their overall welfare effects.

Agriculture is a sector with a very peculiar situation regarding subsidies, because

a) the volume of subsidies to this sector is significant (OECD countries make 30% of all subsidies being paid globally),

b) support measures are applied to attain quite heterogeneous and sometimes even conflicting objectives, which may result in highly complex and frequently inconsistent and contradictory incentives (e.g., production premiums and extensification programs),

c) the influence of interest groups, among them farmers, is substantial, and

d) agricultural production usually takes place in a natural environment and therefore spillovers are hard to prevent.

Production linked subsidies, the predominant transfer vehicle in agriculture, are classified by OECD as environmentally harmful (Portugal, 2002; Steenblik, 2002). Some observers maintain the position that on a global scale agriculture is the primary threat for the environment (Clay, 2002). Hence, attempts to quantify the impact of subsidies granted to this sector and the magnitude of their consequences for the environment is of substantial interest. The Common Agricultural Policy of the European Union (CAP) provides an example to analyze the consequences of farm subsidies on the natural environment, because subsidies are the dominant policy vehicle, and reliable agri-environmental indicators are available (OECD, 2001a, 2002a, 2002b).

This paper tries to estimate the environmental consequences of the recent CAP reform, which significantly changes the transfer mechanism. We use a model that incorporates the complex set of regulations of EU farm policy over which a further layer of national policies affects

production and management decisions in many ways. Models like those presented by Wier et al. (2002) focus on the causal relationship between farming and environmental outcomes, another class of models like CAPRI-Dynaspat (Britz and Perez, 2004) emphasize the spatial dimension of EU farm policy. The model used for this analysis is disaggregated at regional, commodity, and policy levels to capture a wide range of production responses to a policy change. In addition, agri-environmental indicators have been incorporated and thus it is capable of measuring pressures.

In 2004, the EU will spend about 48 bn € for agriculture, with 27,5 bn € for plant products, 12,5 bn € for livestock products, and 7,9 bn € for rural development, which includes agri-environmental programs. After including transfers via market price support and other indirect support measures, total support to European farmers, expressed in PSE, will be about 107 bn €, which is equivalent to 36% of domestic production value (OECD, 2003). From 2005 on, the total level of support will be held more or less constant, but the instruments by which major subsidies are provided to farmers will change fundamentally. Subsidies previously linked to output will be substituted by decoupled payments, based on historical entitlements, to farm operators.

A recent analysis of the Agenda 2000 reform of the CAP, implemented in 1999, concluded that it had significant economic costs but almost no effects on the environment - neither positive nor negative (Wier et al., 2002). For the case of Austria, we analyze whether this conclusion holds for the 2003 CAP reform as well. We describe core elements of the CAP by focusing on major subsidy programs and a selection of environmental indicators that are used in our model analysis. The employed agricultural sector model, along with some results, is presented in the third chapter. We conclude with a discussion of further options to improve the environmental performance of the CAP and some recommendations for farm policy reforms in industrialized countries.

2 CAP measures, subsidies and the environment

2.1 A brief description of recent CAP reforms

In the early years of the CAP, market price support was the dominating form of subsidizing farmers, therefore consumers mainly had to support farm incomes. Domestic prices of major commodities were significantly higher than world market prices, which boosted production and made export subsidies necessary. Additionally, sugar and dairy production surpluses have been controlled by quotas. When this system could no longer be sustained due to internal and external pressures, a substantial reform was implemented in 1992. A significant share of support was shifted towards direct payments coupled to certain crops and livestock heads.

Since 1992, the importance of taxpayers to support agriculture has begun to increase, most obviously reflected by ever rising expenditures for income support (see breakdown of EAGGF Guarantee funds in Figure 1). This process was further reinforced by the Agenda 2000 reform, agreed at the Berlin Council meeting in 1999 (more details are provided in Wier et al., 2002). Administrative prices of cereals, oil crops and beef were further reduced and the corresponding direct payments were raised. Apart from modifications of measures concerning farm commodities (now dubbed as the *first pillar* of the CAP) an additional approach was established: the program for rural development (*second pillar* of the CAP) which continues the accompanying measures of the 1992 CAP reform (Figure 1). This program integrated existing policies (payments for farms in less-favoured areas, agri-environmental measures, programs to facilitate rural adjustment) and introduced new instruments such as modulation (reduction of payments for larger farms) and cross-compliance (environmental standards for recipients of CAP payments).

In July 2002, the Commission published a mid-term review of the Agenda 2000 reform. A final compromise on the proposals of the reform was reached on 26 June 2003. The key element is the introduction of a decoupled single farm payment (Greek Presidency, 2003; Fischler, 2003). It will replace premiums formerly linked to output or land (see *income support / direct aid* in Figure 1).

— Figure 1 —

From 1 January 2005 on, farmers generally do not need to produce certain crops or livestock in order to obtain financial support[1]. Production decisions are expected to be based on market signals and consequently resource allocation is likely to improve. Decoupled single farm payments are calculated on the basis of direct payments received in the reference period 2000-2002. The single farm payment entitlements are transferable with or without land and between farmers within a region or a country. However, payment entitlements can be only received if accompanied by eligible hectares and agricultural land is maintained in good ecological conditions.

2.2. Subsidies and the environment

Two problems have to be tackled in order to analyze the connection between subsidies and the environment. First, it has to be defined what in fact a subsidy is, and secondly, the functional

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[1] In some member states the reform will be implemented only partially: countries may opt to retain a given percentage of direct payments for arable crops, sheep and goats, bulls and steers and suckler cows, or some share of the slaughter premium. Reform decisions for some crops (olives, sugar beet, tobacco) have been or will be made separately.

relationship between a subsidy, the induced behavioral change and its impact on the environment needs to be identified.

The standard OECD definition of subsidies (i.e., price and income support, government provided infrastructure) is quite wide-ranging (Steenblik, 2002). It goes beyond the concept underlying Article XVI of the GATT and the Agreement on Subsidies and Countervailing Measures of the WTO (WTO, 1994). Accordingly, a subsidy is defined as *a benefit provided to individuals or businesses as a result of government policy that raises their revenues or reduces their costs and thus affects production, consumption, trade, income, or the environment* (Portugal, 2002). Hence, a subsidy may include anything from a transparent direct transfer payment to a widely-hidden indirect benefit through a particular tax exemption for agriculture that is not available to others.

The second problem is that identical subsidy levels may have different impacts, e.g., on production and the environment, depending on the institutional framework and its particular implementation in a given country, but also related to the individual situation of a beneficiary (production structure, natural disadvantages and environment, etc.). A complex relationship between such parameters often makes a simple analysis through the observation of environmental indicators a hopeless venture (e.g., time lags, causal relationships, uncertainty).

Even if we analyze only a small sector in a small country it would be challenging to account for all subsidies according to the OECD definition. Currently, we account for approximately 85 % of total transfers but do not consider general infrastructure, agricultural research, and other measures are assumed to have long term effects and therefore are excluded from our analysis. Thus we are not able to analyze the environmental consequences of *all* support measures to the farm sector.

The model being employed incorporates a broad set of environmental indicators along with almost a complete list of CAP support measures that likely affect production decisions. Therefore, we are confident that estimating the consequences of a policy shift is feasible within the Economic Account of Agriculture (EAA) framework.

2.3. CAP and the environment

Several studies have shown significant impacts of agriculture on the environment. A broad coverage of such effects in EU15 was recently presented by DG Environment (Baldock et al., 2000 and 2002; Beaufoy, 2000; CEAS et al., 2000; and Poux, 2000). These studies have explicitly taken into account environmental policy goals being integrated in the CAP from 1992 on.

Since 1992, member states have been legally obliged to implement agri-environmental programs that were co-financed by the EU (van Huylenbroeck and Whitby, 1999). EU policy makers acknowledged the fact that agriculture had been identified as a major cause of environmental degradation. This was also stated in the Fifth Environmental Action Program (*Towards Sustainability*), which addressed agriculture as one of the targeted sectors: *[...] changes in farming practices in regions of the EU have led to over-exploitation and degradation of the natural resources on which agriculture itself ultimately depends: soil, water and air* (EC, 1993).

The program review of 1998 emphasised the importance of *integrating environmental considerations into agricultural policy-making [...] pursuant to the process of the reform of the common agricultural policy* (EC, 1998). Subsidies to the agricultural sector were not expressively identified to be a cause of environmental problems. However, the reference to intensive production methods makes it evident that production stimulating supports are (partly) responsible for them.

In the follow up action program (*Environment 2010: Our Future, Our Choice*), environmental objectives should be strategically approached by *encouraging reforms of subsidies that have considerable negative effects on the environment and are incompatible with sustainable development* (EC, 2002). The CAP reform 2003 was initiated at the same time under the heading *towards sustainable farming* (Fischler, 2003). The reform did not refer to this environmental action program explicitly; however, the objectives of the policy reform include improving the natural environment.

2.3. Agriculture and environmental indicators

A coherent way to evaluate the environmental improvements after policy reforms is to monitor indicators. Apart from the work on environmentally harmful subsidies, OECD has developed 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 (OECD, 2001a). Consequently, the current CAP reform gives an opportunity to analyse how environmental indicators and farm management might change due to the abolishment of subsidies that were previously linked to farm output.

OECD (2001a) classified agri-environmental indicators according to the following categories:

- agriculture in the broader economic, social and environmental view with contextual information (like agricultural value added, farm employment) and information on farm financial resources (farm income, agri-environmental expenditures);

- farm management indicators of whole farms (organic farming, farm management plans), nutrient pest, soil, land, irrigation and water management;
- use of farm inputs and natural resources concerning nutrient use (nitrogen balance and efficiency), pesticide use and risk, and water use (water use intensity, water efficiency, water stress);
- environmental impacts of agriculture with respect to soil and water quality, land conservation, greenhouse gases, biodiversity, wildlife habitats, landscape and ecosystem diversity.

In our quantitative analysis we do concentrate on indicators related to soil, water and air, those environmental media. They were identified above to be at risk in the EU due to agricultural production and hence are addressed by agri-environmental programs. The analysis is consistent with the Driving force-Pressure-State-Impact-Response concept (DPSIR) used by the European Environment Agency (2004). This concept resembles the Driving force-State-Response (DSR) model formerly used by the UNCSD in its work on sustainable development indicators and the Pressure-State-Response (PSR) model developed by Rapport and Friend (1979) and subsequently adopted by the OECD's State of the Environment group (OECD, 2001b).

3. The model, scenarios, and results

3..1 A Model of the Austrian Agricultural Sector

Many environmental programs in the EU offer cost-sharing or compensation payments as an incentive to farmers to voluntarily adopt environmentally friendly management measures. Assessing such program features requires models that are able (i) to reproduce observed production and management activities, and (ii) to generate production and environmental responses due to policy and price changes. Consequently, empirical tools should cover all relevant production possibilities and policy instruments and should be flexible enough to account for various needs. In this chapter, we present an approach that strives to meet these modelling challenges. The *Positive Agricultural Sector Model Austria* (PASMA) is employed to estimate the impact of the 2003 CAP reform on selected agricultural and environmental indicators. PASMA is designed to adequately depict the political, natural, and structural complexity of Austrian farming.

The construction of the model ensures a broad representation of production and income possibilities that are essential in comprehensive policy analysis. Data from the *Integrated Administration and Control System* (IACS), *Economic Accounts of Agriculture* (EAA), the recent *Agricultural Structural Census* (ASC), the Austrian *Farm Accountancy Data Network* (FADN), the *Standard Gross Margin Catalogue*, and the *Standard Farm Labour Estimates*

(Greimel et al., 2002) provide necessary information on resource and production endowments for 40 regional and structural (i.e., alpine farming zones, less-favoured areas) production units in Austria. Consequently, PASMA can estimate production, labour, income, and environmental indicator responses for each of the units. Production activities are consistent with EAA, IACS and ASC activities to allow comparable and systematic policy analysis with official, standardised data and statistics.

Due to its partial approach, the model treats the farm sector without any behavioural interaction with other sectors of the economy or to the rest of EU's agriculture. Policies and prices are given exogenously and output changes are assumed not to affect equilibrium prices (i.e., demand is perfectly elastic). The model is calibrated to reflect resource endowments and production activities of a base period (1999-2001).

Conventional and organic crop and livestock production systems, all other relevant management measures from the Austrian agri-environmental program (e.g., cover crops, erosion control, buffer strips), and the support program for farms in less-favoured areas (LFA) are modelled explicitly. Thus the two most important components of the program for rural development are covered on a measure-by-measure basis. The complete set of CAP policy instruments relevant for Austria is accounted for as well. The set of instruments before and after the 2003 reform are implemented explicitly.

The model maximises sectoral farm welfare[2] and is calibrated to historic crop, forestry, livestock, and secondary farm activities by using the method of Positive Mathematical Programming (PMP). Howitt (1995) has initially proposed the PMP-method and since then it has been modified and applied in several models (e.g., Lee and Howitt, 1996; Paris and Arfini, 1995; Arfini and Donati, 2003; Heckelei and Britz, 1999; Cypris, 2000; Röhm and Dabbert, 2003). This method assumes a profit-maximizing equilibrium (e.g., marginal revenue equals marginal cost) in the base-run and derives coefficients of a non-linear objective function on the basis of observed levels of production activities.

Two major conditions need to be fulfilled: (i) the marginal gross margins of each activity are identical in the base-run, and (ii) the average PMP gross margin is identical to the average LP (Linear Programming) gross margin of each activity in the base-run. These conditions imply that the PMP and LP objective function values are identical in the base-run. Another important assumption needs to be made by assigning marginal gross margin effects to either marginal cost,

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[2] Farm welfare is a monetary measure of the following components of farm-income: agricultural outputs (crops, forestry and livestock products), output-linked support (direct payments), payments for agri-environmental measures, support for farms in less-favoured areas, revenue from agricultural services and secondary activities, and a single farm payment (to be introduced in 2005).

marginal revenue, or fractionally to both. In PASMA, the marginal gross margin effect is completely assigned to the marginal cost and consequently coefficients of linear marginal cost curves are derived.

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 employed aggregation procedures, e.g., convex combinations of historical crop and feed mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

— Figure 2 —

In Austria, about 85 % of all payments to farms come from three sources: production linked subsidies (to be shifted to the single farm payment from 2005 on), the agri-environmental program ÖPUL, and the program for farmers in less-favoured areas. Consequently, indicators measuring the effects of farm policies are related to farm welfare, crop and livestock production, land use, and environment (livestock densities, nutrient balances, gaseous emissions, farm management). The estimates are made at regional scale and aggregated to an arbitrary level (e.g., river basins, provinces, whole country).

3.2. Model assumptions and scenarios results

Apart from the core elements of the CAP reform 2003 outlined in section 2, several reform details are also of importance for our analysis. For cereals (apart from rye), the intervention price remains the same but the monthly increments will be cut by half. 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. Prices of butter and skimmed milk powder will be cut asymmetrically in four stages. The milk quota will be moderately expanded in 2006 and a decoupled quota premium will add up to the single farm payment.

The scenario analysed in this paper is a comparison between the modelled outcomes in 2003 with the Agenda 2000 in place and the situation in 2008 where the reformed CAP will be fully implemented. The rationale of this comparison is to contrast a situation in which the Agenda 2000 reform has been almost completed with the anticipated implementation of a much bolder follow-up reform. The overall idea is to see if we can actually expect an improvement of environmental outcomes.

In order to analyse the sensitivity of the results with respect to the exogenous prices, three sets of price expectations (high, medium, and low), based on forecasts by OECD (2003) and FAPRI-Ireland-Partnership (2003), are compared.

Organic farming will not be affected by the reform directly. We assume that the organic farming support scheme does not change and that farmers will get commodity mark-ups for organic production similar to those observed presently. A moderate rate of technical progress and constant real input prices are exogenously given. In order to isolate the policy effect on structural adjustment we did not adopt exogenously given labour decline. As required by regulations, decoupled premiums must be matched by eligible hectares of land. More details underlying these scenarios are documented in Sinabell and Schmid (2003), and Schmid and Sinabell (2003, 2004).

The results (Table 1) are obtained by simultaneously maximising the monetary measure of farm welfare (which includes product revenues and transfer payments) of 40 regional production units and aggregating the results at the national level.

The effects of the 2003 CAP reform on economic variables are:

- aggregate farm welfare will decline moderately,
- the income per farmer is smaller because farm labour demand will also decline,
- if we assume an exogenous structural change, income per farmer would increase (also confirmed by other studies), and
- farm income is likely stabilised by a single farm payment even though there would be some justification to assume that this payment is actually a transfer to households.

— Table 1 —

The effects on-farm production are:

- production will become more extensive, because arable land will be turned into grassland and less farm inputs will be used,
- the cross-compliance requirement prevents farm land afforestation, therefore the acreage of total farmland changes only slightly, and
- some outputs decline (in particular beef) while others adjust within given limits (i.e., milk due to the maintenance of the quota system).

Selected environmental indicators show a change in inputs and/or outputs and a change in land-use.

- Indicators measuring the quality of soil (organic carbon) and air (methane emission) and the impact on water (surplus of nitrates, livestock density) show a decreasing environmental stress.
- The acreage of arable land that is organically farmed decreases slightly, but to a lesser extent than conventionally managed arable land.
- Soil cover in winter is declining at the same pace as arable land.

The results show that less land will be used for arable crop production which can be interpreted as a net environmental benefit. Given that arable land will shrink by 4 % whereas organically managed arable land will only decline by 0,9 % indicates that organic farming will become more attractive to farmers.

4. Conclusions and outlook

A comparison between our results on the effects of the 2003 CAP reform and those of other studies need to account for the fact that in most other model analyses an Agenda 2000 scenario is compared to the 2003 CAP reform scenario at a given year. We compare two different years, each with different policies and prices. Nevertheless, our results on economic indicators (income and production responses) are consistent with those of other studies (FAPRI-Ireland-Partnership, 2003, and OECD, 2004).

The changes in the levels of environmental indicator are comparable to those identified by a team of researchers (LEI, IAP and IAM, 2003) who analyzed the likely effects of the CAP reform before it was officially decided. Another study (Häring et al., 2004) confirms the overall conclusion of the CAP reform 2003 that positive effects for organic farming seem to clearly outweigh some negative effects. According to our results, the output of organic farming will decline and income losses will not be fully compensated by the program for rural development. However, organic farms are less affected by the reform than conventional farms.

This reform is a consequent and further step in the CAP development that has been launched in 1992. According to our model results, the 2003 CAP reform will likely make production more extensive, which implies positive effects on the environment at an aggregate level. Moreover, this reform provides important political leeway to substantially reduce EU export subsidies as demanded in the Doha Development Round of the WTO (Fischler, 2004). While domestic effects of export subsidies are captured in the model through higher commodity prices (e.g., milk, sugar beet), analyzing the environmental impacts in foreign countries is beyond the scope of the current model version. The same holds with respect to other implications of the CAP, among them the regressive distributional effects, which are still to be solved. Thus, the current approach of full-decoupling may still be a transitional solution. In the long run, the current CAP

could, and probably should, be replaced by a coherent and adequately targeted program for rural development with a more balanced score regarding its economic, social and ecological dimension.

Model results are always preconditioned by the assumptions and limitations embedded in model structures and scenarios. This holds for the results presented in this paper as well, and so a number of options for the further development of the underlying modelling approach exists. An example is given by the fact that currently about 85% of the rural development program funds are modelled explicitly while the rest (mainly investment aids) is treated as a regional lump sum payment. Taking account of these transfers appropriately will make it necessary to model dynamic effects of policy instruments explicitly, which is also necessary to improve the estimates of environmental outcomes. Another direction of future development is to extend the coverage of the model to account for non-agricultural segments of the rural economy. A promising approach seems to be the integration of this model into a regional input-output model that explicitly accounts for down-stream and up-stream sectors. Other components that could be included are farm administration and related private sector service firms.

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Table 1: Percentage change of the Common Agricultural Policy reform with three price scenarios in Austria in 2008

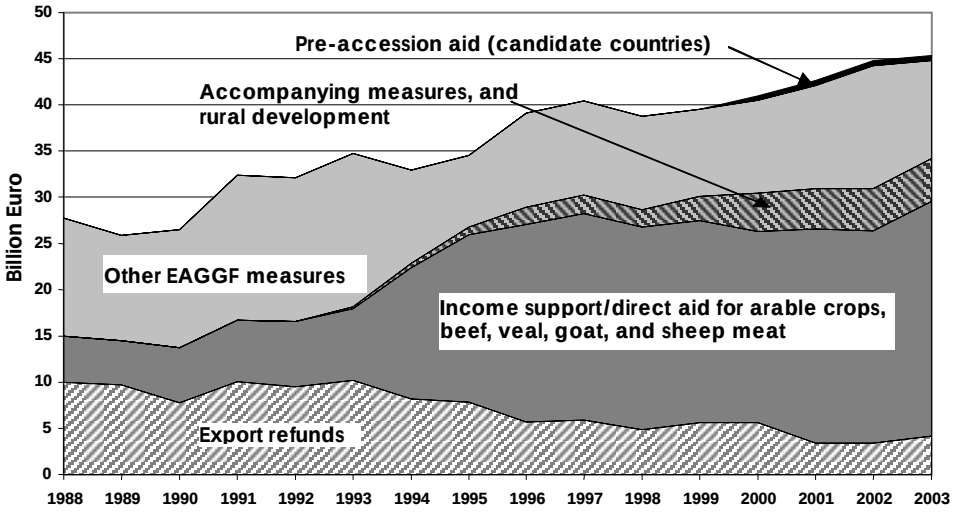
	lower prices	medium prices	higher prices
economic indicators			
producer surplus at sector level	-8.9	-4.9	-0.9
producer surplus per AWU[1)]	-7.1	-3.9	-0.7
variable cost livestock products	-8.2	-6.3	-4.2
variable cost crops	-4.2	-3.9	-3.5
factor use indicators			
total arable land	-4.0	-4.0	-4.0
total meadows	8.0	+8.0	8.0
farm labor input	-3.6	-3.2	-2.8
output indicators			
output of beef	-12.0	-10.0	-10.0
output other meat and eggs	±0.0	±0.0	±0.0
environmental indicators			
methane emission	-1.5	-1.4	-1.4
carbon storage in soil	+0.6	+0.6	+0.6
nitrate from manure	-5.1	-4.7	-4.3
nitrate from mineral fertilizers	+1.0	+1.0	+1.0
nitrogen surplus	-5.1	-3.7	-4.2
farm management indicators			
organic farming on arable land	-0.8	-0.9	-0.9
organic farming subsidies	+1.1	+1.2	+1.1
soil cover during winter	-4.4	-4.4	-4.4
livestock units	-5.1	-4.7	-4.3

[1)] Full time working equivalent (figures reflect technical labor input requirements not exogenously given structural change).

Source: own simulation results.

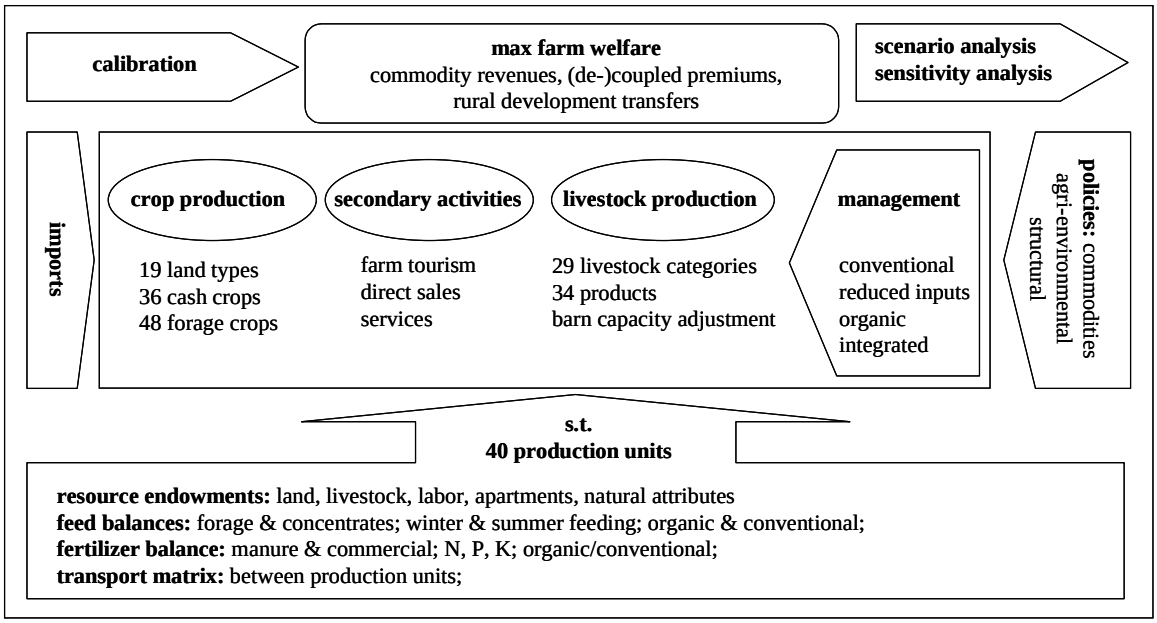
Note: Percentage change versus AGENDA2000 in 2003; Assumptions: 50,000 additional suckler cow premium entitlements are shared among owners of heifers. Suckler cow premiums and 40 % of slaughter premiums remain coupled (this holds for Austria and not necessarily for other EU member states). The supplementary refund is accounted for as the slaughter premium. Additional funds for the program for rural development (€ 17 million Euros annually) are not accounted for in the total of transfers.

Figure 1: EAGGF Guarantee section expenditure for the EU-15 and pre-accession aid for the candidate countries



Source: European Commission, Directorate General for Agriculture, Agriculture in the European Union, Statistical and Economic Information, various issues.

Figure 2: Structure of the Positive Agricultural Sector Model Austria - PASMA



Source: own construction.

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