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Modelling multifunctionality of agriculture – concepts, challenges, and an application

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Abstract

A review of literature shows that the concept of multifunctionality is broad, ambiguous, and controversial. In order to obtain a better understanding that allows quantitative assessments, we narrow the scope of its meaning. We understand multifunctionality to be a bundle of goods and services for which markets are imperfectly developed or do not exist at all. We use an agricultural sector model to analyse whether the 2003 Common Agricultural Policy (CAP) reform is consistent with the promotion of multifunctionality in Austria. The results show that agricultural outputs decline due to the reform, environmentally friendly production methods become more attractive, and the level of environmental stress is reduced. We conclude that the recent CAP reform is enhancing important aspects of a multifunctional agriculture while others, like farm employment, are likely diminished.

Keywords: multifunctionality, agricultural sector model, common agricultural policy, Austria

1. Introduction

Policy makers frequently use the term multifunctionality, assuming that people have a clear understanding of its meaning. In particular, European policy initiatives aiming at strengthening the viability of rural areas have been put into the context of a multifunctional role of agriculture. In 1999, the Agenda 2000 reform was justified on these grounds: "*It is a fact that European society does care about the multiple functions of agriculture and therefore policies to ensure their supply have been established*" (EC, 1999).

Such unanimity cannot be observed within the international scientific community. Some authors warned of the abuse of the term before it was widely used (Bohman at al., 1999), and beginning

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with the new century many research papers and conferences (reviewed by van Dijk, 2001) had already dealt with this concept in a controversial way.

An OECD publication (2001a) that built on external expertise (*e.g.*, Boisvert, 2001), put multifunctionality into the context of external effects and market failure. However, this well established concept, frequently applied in environmental economics, was deemed to be too narrow, to account for all aspects which include sociological and cultural concerns (see *e.g.*, OECD, 2001b).

Even the views within the economic discipline are far from consensual. This debate can be categorised into following strands of literature:

- Some authors analyse the conditions under which multifunctional outputs are supplied in a production economics framework (*e.g.*, Boisvert, 2001; Lankoski and Ollikainen, 2001).
- Other authors conclude that positive non-commodity outputs of agriculture should be promoted while negative ones should be discouraged (*e.g.*, Blandford and Boisvert 2002; and Paarlberg *et al.*, 2002).
- There is a great deal of controversy about the question which instruments should be implemented, in order to resolve these issues, particularly in the context of WTO Green-Box-Payments:
    - Some authors suggest that providers of public good services that are positively valued by society should be compensated according to the Provider Gets Principle (*e.g.*, Hodge, 2000).
    - Other authors even argue that under certain conditions production tied support of agricultural commodities is justified (Vatn, 2002; and Prestegard, 2003).
    - In opposition to this view, other researchers object to any modification of the Green box criteria on the grounds of multifunctionality (*e.g.*, Anderson, 2000; Harvey, 2003).
- Much of the debate is centred on definitions and normative questions. There are only few positive analyses, which directly address multifunctionality empirically (*e.g.*, Lankoski and Ollikainen, 2003).

Our paper attempts to contribute to this literature, in particular to the last category. We employ an ex-ante approach to evaluate likely policy reform outcomes. We use an agricultural sector model to analyse the interaction between agricultural policies and the level of outputs which are associated with the multifunctional role of agriculture. Indicators that are consistent with the OECD methodology (OECD, 2001c) are employed to evaluate a bundle of effects of the 2003 CAP reform on multifunctional attributes.

Austria is chosen as a case, because

(a) the multifunctionality debate has a long tradition in this country (see next section),

(b) considerable funds are used to stimulate the provision of positively valued outputs and to reduce negative external effects associated with agriculture (section four) and

(c) sufficient data based on single farm observations are available to calibrate an agricultural sector model at a disaggregated level of up to 40 regional and structural production units (see third section) to evaluate consequences for rural viability.

The results obtained for Austria (section five) should be representative for a large number of regions in the EU which share some of its characteristics, (i) a large share of farms in less favoured areas, (ii) an agricultural sector with significant secondary activity outputs (*e.g.,* farm tourism, direct marketing), and (iii) governments/taxpayers with a strong commitment for rural development (high national expenditures to match EU co-finance funds).

2. The multifunctional role of Agriculture

2.1 Multifunctionality in the international agricultural policy debate

Originally, "multifunctional aspects" of agriculture had been discussed in the context of food security and sustainable development in the UN Agenda 21 (UN *s.a.*, chapter 1). Shortly after, multifunctionality was identified to be an element of "non-trade concerns" of Article 20 of the Uruguay Round Agreement on Agriculture (discussed by Neunteufel, 1992 and Anderson, 2000).

The concept of multifunctionality was further developed in highly industrialised countries with a strong commitment to agriculture, like Norway, Switzerland, South Korea, Japan, and some EU member states. In autumn 1997, at the EU council meeting in Luxemburg, the European model of agriculture was presented: Apart from its production function, the agricultural sector *"must be capable of maintaining the countryside, conserving nature and making a key contribution to the vitality of rural life, and must be able to respond to consumer concerns and demands regarding food quality and safety, environmental protection and the safeguarding of animal welfare"* (Council of the European Union, 1997).

Shortly later, in 1998, at the ministerial meeting of the committee for agriculture, OECD farm ministers acknowledged that the role of agriculture is *"going beyond the provision of food and fibre [...] by contributing to rural development and generating environmental and amenity services for which there are often no or very imperfect markets"* (OECD, 1998, 4). The ministers used "multifunctionality" to describe this role.

In the current international agricultural policy debate, multifunctionality seems to represent a set of issues (environmental and rural development concerns) that is understood to be a sub-set of

"non-trade concerns" which encompass food security, environment, structural adjustment, rural development, poverty alleviation, and so forth (WTO, 2004).

2.2 Multifunctionality of Austrian agriculture

The first written record of the multifunctional role of agriculture in Austria is likely to date back almost four decades. Pevetz (1966) observed a mutually beneficial relation between tourism and agriculture. Two years later, he argued that agriculture supplies public benefits and should be compensated by direct payments. The public goods were identified to be: supply of landscape amenities and countryside stewardship services, maintenance of rural infrastructure and the role for the viability of rural economies.

In 1972, Austria introduced a support programme for mountain farms. Shortly after, Pevetz (1974) proposed a method to "estimate the value of the social benefits supplied by agriculture which are not reflected in the market prices of farm commodities". He suggested an evaluation approach similar to the Contingent Valuation Method (CVM). But it took another two decades until Pruckner (1995), and Hackl and Pruckner (1997) published estimates of external benefits of Austrian agriculture. By using CVM, they found that foreign tourists had a willingness to pay 0,67 € per day for landscape-enhancing activities of agriculture.

The original idea of Pevetz to compensate positive environmental services was taken on board by agricultural policy. An organic farming scheme was established in 1992, and the Austrian agri-environmental programme was introduced when Austria entered the EU, in 1995. Until today, payments of this programme are officially dubbed *Leistungsabgeltung* (service fee) to convey the connotation of a transaction instead of a transfer. However, the original idea of Hackl and Pruckner to use demand side evaluations to make "*compensation programmes more efficient*" has not (yet) been as successful as Pevetz' proposals.

In the beginning 90s, the concept of multifunctional agriculture was well established in Austria. Several authors contributed to a classification of the goods, services and functions either in the context of broader publications (Wytrzens, 1994), monographs (Pevetz, 1998) or series of conference contributions (Wohlmeyer and Dissemond, 1999).

Using material of these authors gives us a comprehensive list of multifunctionality attributes. This list does not present a consistent set which these authors have agreed upon. Each of them has had something slightly different in mind. Our eclectic list shows how broad this concept is (in italic are the attributes presented by the European Commission, 1999):

- production function, supply of services
    - food, feed, fibre, biomass, energy carriers
    - tourism, secondary activities, community services, waste management, recycling

- *food security, animal welfare*

- spatial function, *viability of rural economies*
  - rural infrastructure, street network, provision of land, open landscape
  - direct and indirect employment, rural value added, direct sales, buffer function on labour market, support system for rural dwelling
- ecological and landscape esthetical functions, viability of rural environment
  - landscape stewardship, landscape management, provision of cultural landscapes
  - maintenance of natural resources, biodiversity, deer feeding, genetic resources
- protection function and regeneration of natural resources
  - groundwater recharge, maintenance of surface water courses
  - *protection of the environment*, protection against natural hazards
- socio-cultural function, cultural role of farmers
  - rural live style, maintenance of historical objects and local traditions

At the same time, the public had become aware of negative spillover effects, as well. Hofreither and Sinabell (1993) provide an extensive survey of the environmental consequences of farming in Austria. Soil, water and air were identified to be at risk due to intensification, monoculture, loss of nutrients and hazardous chemicals. Other threats were observed as well, like loss of biodiversity, over-grazing, abandonment of buffer strips, degradation of cultural landscapes, loss of agricultural species and traditional livestock breeds, animal welfare issues, and groundwater depletion.

Policy has taken action to address these concerns. A blend of command and control measures and environmental subsidies (the agri-environmental programme) has been put in place. Extensive monitoring activities and evaluation reports document these efforts in depth. Consequently, there are good indicators to address many multifunctionality issues quantitatively like in a spatial approach of an agricultural sector model.

3. Modelling the effects of policy changes on indicators of multifunctionality

3.1. Towards indicators of multifunctionality

Negative external effects are well addressed by an analysis which employs the Driving force-Pressure-State-Impact-Response concept (DPSIR) as used by the European Environment Agency (2002). This concept is resembling 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 David Rapport and Anthony Friend (1979) that was subsequently adopted by the OECD's State of the Environment group (OECD, 2001a).

The DPSIR framework was further elaborated by Zalidis *et al.* (2004) who presented a functional relationship between the following elements:

- 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 and the emission of nutrients and potential harming gases. How the CAP reform will affect market conditions has already been analysed by other authors (*e.g.*, FAPRI-Ireland-Partnership, 2003; OECD, 2004).

How other driving forces will be affected, namely management decisions on farm, has not been analysed elsewhere yet. We use the Positive Agricultural Sector Model Austria (PASMA) to close this gap. This model is capable to differentiate a wide range of management options (from reduced input use over integrated production to management where chemical inputs are banned for certified organic farming).

Management options, negative and positive external effects are well captured in the DPSIR framework. But it is too narrow to account for aspect like the "viability of rural economy" or positive valuation of landscape amenities. One option to overcome this limitation is to identify indicators that are associated with these services.

We know that at least some Swedes have a positive willingness to pay for open landscape (Drake, 1992). Therefore the share of agricultural land relative to forest land can serve as an indicator for the benefits of agricultural landscapes. The pattern of land use in regions with a high willingness to pay for land managed by farmers can be another one. Other indicators are the level of employment in the agricultural sector, the level of input purchases, the output of products for processing, the level of local services (*e.g.*, farm tourism), the rate of adoption of organic farming (with stricter animal welfare requirements).

Thus some of the frequently mentioned aspects of multifunctionality can be addressed in a quantitative manner. Admittedly, such an approach is still crude and needs further elaboration. We are aware that it will be impossible to capture all variables adequately given that we already know them. We therefore acknowledge the limitations of quantitative modelling approaches.

3.2. Modelling multifunctionality in Austria with PASMA

Development means change. Consequently, policy analysis must track changes in the sector. Therefore, analytical tools should cover all relevant policy instruments and be flexible enough to account for various needs, e.g. accounting for multifunctionality. In this chapter, we present an approach that strives to meet these 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 to measure rural/agricultural development. PASMA depicts the political, natural, and structural complexity of Austrian farming in a very detailed manner (Fig. 2).

The structure ensures a broad representation of production and income possibilities that are essential in comprehensive policy analyses, i.e., development analysis. Data from the Integrated Administration and Control System (IACS), Economic Agricultural Account (EAA), Agricultural Structural Census (ASC), Farm Accountancy Data Network (FADN), the Standard Gross Margin Catalogue, and the Standard Farm Labour Estimates provide necessary information on resource and production endowments for 40 regional and structural (i.e., alpine farming zones) production units in Austria.

Consequently, PASMA is capable to estimate production, labour, income, and environmental responses for each single unit. Most production activities are consistent with EAA, IACS and ASC activities to allow comparable and systematic policy analyses with official, standardised data and statistics. The model considers conventional and organic production systems (crop and livestock), all other relevant management measures from the Austrian agri-environmental programme ÖPUL, and the support programme for farms in less-favoured areas (LFA). Thus the two most important components of the programme for rural development are covered on a measure by measure basis. Future model development will focus on farm investment aid and additional diversification measures. Apart from major components of the programme for rural development the complete set of CAP policy instruments is accounted for, as well. Both, the set of instruments before and after the 2003 reform are modelled explicitly.

The model maximises sectoral farm welfare and is calibrated to historic crop, forestry, livestock, and farm tourism 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 Arafini (1995), Heckelei and Britz (1999), Cypris (2000), Röhm (2001), 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 to guarantee that the PMP and LP objective function values are identical in the base-run: (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 gross margin of each activity in the base-run.

An assumption needs to be made by assigning the marginal gross margin effect to either marginal cost, marginal revenue or fractionally to both by building a linear combination. In PASMA, the marginal gross margin effect is completely assigned to the marginal cost and consequently coefficients of linear marginal cost curves are derived. 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 and feed mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

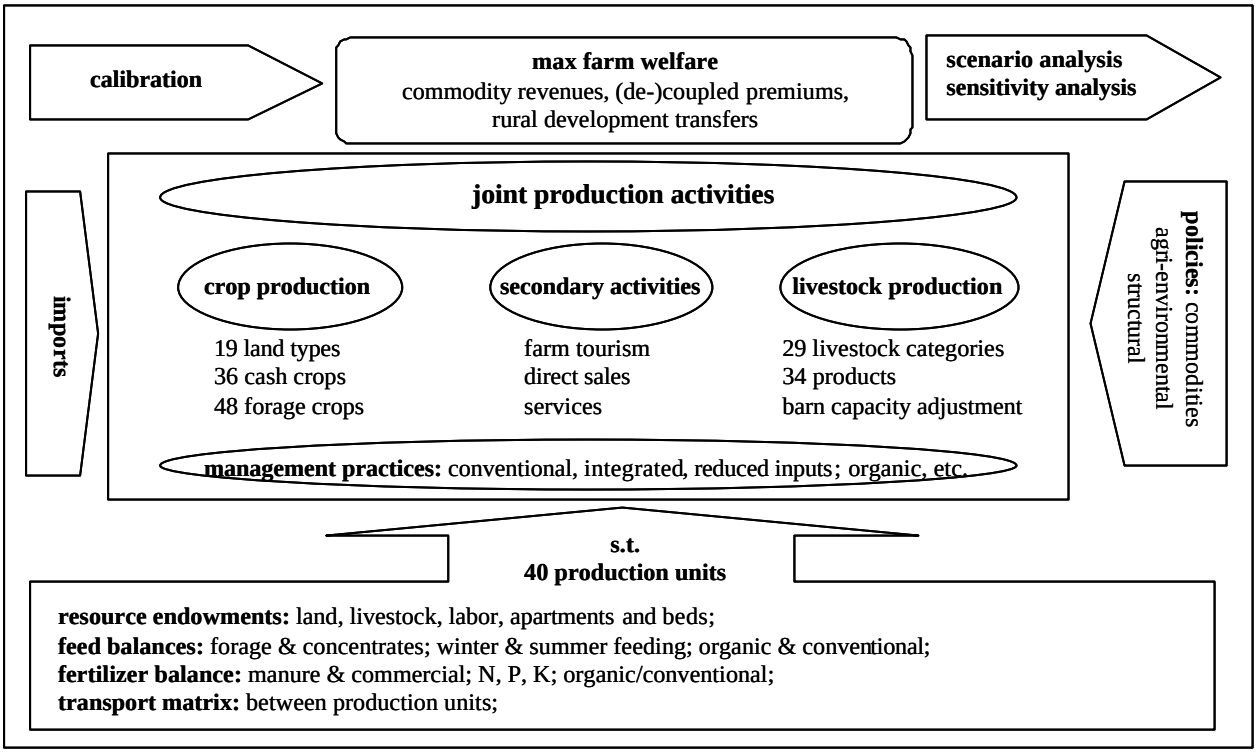
PASMA is a set of three almost identical linear programming (LP) models:

- In the first LP all farm activity levels (crop, forestry, livestock, secondary activities) and remaining cost shares from feed and manure balances are assigned using historical livestock records and detailed feed and fertilizer balances.[2]
- The second LP incorporates the perturbations coefficients (Howitt, 1995). The calibration coefficients of a linear marginal cost curve are computed following an approach similar to Röhm and Dabbert (2003).
- The third LP is the actual policy model. Calibration coefficients are built in using linear approximation techniques that allow calibration of crop, forestry, livestock, and farm tourism activities to observed and estimated shares.

Other model features such as convex combinations of crop and feed mixes, expansion, reduction and conversion of livestock production, a transport matrix, and imports of feed and livestock are included to allow reasonable responses in production capacities under various policy scenarios. Product prices and other model assumptions are referenced in Sinabell and Schmid (2003), and Schmid and Sinabell (2003).

[2] For instance, the area of meadows is recorded in various data sources listed above. However, information on which activities are actually carried out and to what extent are not available (*e.g.*, grazing, hay, silage, or green fodder production activities).

Figures 1: Structure of the agricultural sector model PASMA



Source: own construction.

4. Model assumptions and scenarios

4.1. Elements of the 2003 CAP reform

In mid 2002, the European Commission published a mid-term review of the Agenda 2000 reform. A final compromise on the reform proposals was reached on 26 June 2003. The key element is the introduction of a single farm payment (Greek Presidency, 2003; Fischler, 2003). This payment will replace a multitude of premiums formerly linked to output or land. Direct payments of the rural development programme are not affected by this reform. Support payments for organic farming will therefore not be decoupled.

When the reform proposals were drafted, it was anticipated that decoupled premiums have considerable impact on production incentives. Farmers will not need to plant certain crops or raise bulls in order to obtain financial support. In future, production decisions are expected to be based on market signals (i.e., prices) and consequently resource allocations are likely to improve. The policy change will become effective on 1 January 2005. Payment entitlements are calculated on the basis of direct payments received in the reference period 2000-2002, they are transferable with or without land and between farmers within a region or a country. They can be only received if accompanied by eligible hectares and agricultural land is maintained in good ecological conditions.

Member States may choose to introduce the single farm payment in full or they may opt to keep some premiums attached to output or factor usage or to retain up to 10 % of direct payments for measures that have a positive environmental effect or improve the quality and marketing of agricultural products. In addition, they may implement the single farm payment at regional level. This implies that payments are redistributed between farm enterprises.

All farmers receiving direct payments must set aside part of their land (organic and small farms are exempted) and will be subject to compulsory cross-compliance. Recipients of farm payments must abide by a list of 18 statutory European standards in the field of environment, food safety, and animal health and welfare (*cross compliance*). Direct payments to larger farms (above a threshold of € 5,000) will be reduced by 3 % in 2005, 4 % in 2006 and 5 % from 2007 to 2013 (*modulation*). Channelling expenditure away from market policies will make more than € 1.2 billions available for rural development.

For cereals (apart from rye), the intervention price remains the same with some modifications. Other crop regulations were simplified, but some production related premiums (notably those for durum wheat, protein crops, and energy crops) have been introduced by the reform. A reformed milk quota system will be maintained until the 2014-15 marketing year. Regulated prices of butter and skimmed milk powder will be cut asymmetrically in four stages. The quota will be moderately expanded in 2006 and a decoupled milk quota premium will add up to the single farm payment.

4.2. Scenarios and model assumptions

The scenarios analysed in this paper are a comparison between modelled outcomes in 2008. A continuation of Agenda 2000 (reference scenario) is compared with three versions of the 2003 CAP reform in 2008 (by this year the reform will be fully implemented). The idea is to comparatively analyse important aspects of multifunctionality that will be likely affected by the reform in different ways. The scenarios are:

- **Reference scenario**: The continuation of Agenda 2000 as decided at the Berlin Council in 1999 with particular adjustments of administrative prices, direct payments, and a milk market reform. This scenario is based on its own set of prices (based on OECD, 2004). All other scenarios share the same price assumptions which are different from this scenario.
- **Austria**: This scenario mimics the reform implementation in Austria. The premium for suckler cows will remain coupled to production by 100 % and the slaughter premiums by 40 %. All other premiums will be decoupled according to the Council decision on the reform.

- In the other two scenarios all direct payments are decoupled from production: Payments, previously linked to output, are allocated among farm operators who will become holders of premium entitlements, from 2005 on. We analyse two scenarios with a subtle, but important difference.
    - **Land**: This scenario implements the Council decision of full decoupling. If land is not maintained in *good agricultural and ecological condition*, entitlements are foregone.
    - **Persons**: This is a fictive scenario similar to the Council decision. The difference is that premium entitlements are not linked to agricultural land but to persons. Farm operators are not restricted in the use of entitlements. Most importantly, land can be afforested without loosing entitlements.

A moderate exogenous rate of technical progress and constant real input prices are assumed. We did not adopt exogenously given labour decline in order to isolate the policy affect on structural adjustment and thus rural viability. The price wedge between conventional and organic products is assumed to be as observed in recent years.

Due to the complexity of some measures and the lack of information on the participation we are only able to account for the most important components of the Austrian rural development programme (i.e., we include transfers for farms in less favoured areas and the agri-environmental programme which together account for 85 % of the total programme funds). The rest is treated as a lump sum payment linked to the representation of regional and structural units in PASMA.

Two further assumptions were made:

a) components and measures of the programme for rural development do not change between the base period (2003) and the simulation period (2008),

b) farmers may enter a new contract and adjust to the new conditions (*e.g.,* quit, enter or continue the organic farming scheme).

New measures are likely to extend the scope of the programme: food quality measures, meeting standards which are not yet introduced at member state level, animal welfare measures, support for the implementation the biodiversity programme Natura 2000. How these elements will be integrated in the existing framework, and how much funds will be available, is not known yet.

Many details are eminent, because several aspects of multifunctionality are addressed by this programme:

- support for farms in less favoured areas to promote settlement in remote areas;

- agri-environmental programmes to address a wide range of concerns covering the provision of biodiversity goods, the reduction of environmental stress and attaining landscape aesthetic goals;
- promotion of multi-activities of farm households, development of alternative income sources, investments in infrastructure of rural villages, funding of extension and education programmes;
- investment support for animal friendly production units, measures to prevent natural hazards like floods.

5. The 2003 CAP reform: effects on multifunctionality aspects of Austrian agriculture

The relevance of multifunctional agriculture can be classified in the following categories:

(a) What are the elements of this concept and how can the characteristics be described and quantified?

(b) Which are the conditions that must be met to enable the agricultural sector to provide multifunctionality outputs?

(c) Is there a demand for the positively valued multifunctionality outputs and services, what are the social cost of negative spillovers?

(d) Is there an incidence for policy involvement?

We use a set of indicators which are more or less closely related to various aspects discussed in the literature to address question (a). A selection of these indicators is listed in Table 1. In our analysis, question (b) is not analysed explicitly. We rather look at the outcomes (measured by the indicators) and we infer which kind of policy change will have an impact on the level of a given indicator. Our model reflects only the supply side, therefore answers to question (c) are only rudimentary. However, if programme objectives are understood to be valid proxies for consumer demand, our indicator based approach can be used to benchmark programme success or failure. Given the heavy involvement of agricultural policy question (d) might seem to be rather pointless. But, using a very broad approach like the one attempted in this analysis, allows us to identify the trade-offs between policy approaches (first pillar versus second pillar) and the outcomes of slightly different instruments and regulations (premium entitlements attached to land versus persons).

Viability of rural areas

Value added is the motor of economic development. Net incomes in agriculture and other sectors are therefore the best gauge of rural welfare unless external effects are overwhelming. Given that measure, the 2003 CAP reform has positive effects. *Farm welfare* (the sum of pro-

ducer surplus of farming and peasant forestry, direct payments and rural development transfers) increases, however only slightly. The model reflects a situation that some income opportunities are foregone due to coupling suckler cow premiums to production (*scenario AUSTRIA*). Farm welfare is highest in a scenario of linking premium entitlements to persons (*scenario PERSONS*) instead of linking them to eligible land (*scenario LAND*).

Variable cost and *farm product revenues* indicate how upstream and downstream industries of the rural economy are affected by the reform. These variables should be fed into regional input-output models to evaluate the cross-sectoral impacts of a reform. Such models are not yet available, therefore our analysis is restricted to some reasoning. The Austrian implementation of the reform (*scenario AUSTRIA*) increases the average purchase of inputs (in particular livestock production) and lessens output reductions. Thus we interpret that Austrian policy makers had an eye on the rural economy when the decision was made to maintain some coupled premiums. Potential cost savings for agriculture and thus competitiveness gains are not fully realized. This will (slightly) benefit upstream and downstream sectors but (slightly) weaken the Austrian farm sector.

Production of private goods (food, fibre), food security and food safety

C*rop and livestock products* are likely to decline due to the reform. In particular, farms may withdraw from beef production. This reduction should not raise food security concerns, because Austria is historically a net exporter in beef. In the scenario *AUSTRIA,* the output decline is limited because premiums remain tied to the suckler cow herd and a premium is granted for slaughtering cattle. Both, conventional and organic crop and beef production are affected by the reform in similar ways. However, conventional production declines at a larger scale than organic production. The model is (in its current version) not capable of measuring food safety indicators. Therefore, we are not able to indicate any effect of the reform on this attribute of farm production yet.

Public good services linked to land

Austrian farmers own only a small set of property rights usually associated with land. Depending on the type of land use, farmers usually tolerate that other people access their property. A fine network of roads and trails throughout the country gives visitors access to almost any parcel of land. Inhabitants and visitors take this openness for granted. Access to land explains part of the attractiveness of Austria for tourism.

The scenario results on *land use* and land allocation show that the acreage of arable land will decline after the reform while (extensive) grassland will increase. A marked difference can be observed when the scenario *PERSONS* is compared to the other ones. If the de-coupled pre-

miums are not contingent upon the maintenance of land in good *agricultural and ecological condition*, forest land will be expanded at the cost of agricultural land.

Table 1: Estimated effects of the 2003 CAP reform in Austria in 2008

		Scenario of the CAP reform		
		AUSTRIA	**LAND**	**PERSONS**
direct payments are decoupled		partially	fully	fully
premium entitlements are linked to		land	land	persons
farm welfare: revenues and farm policy payments				
sector farm welfare (agriculture + forestry)	€	+ 0.7	+ 1.2	+ 1.4
farm welfare per labour unit	€	+ 0.8	+ 1.4	+ 2.5
farm labour	hours	– 0.2	– 0.2	– 1.2
variable costs				
plant production	€	– 0.8	– 1.0	– 5.6
livestock production	€	+ 2.5	+ 0.5	– 3.4
farm product revenues				
plant production	€	- 6.9	– 4.1	– 20.3
livestock production	€	– 4.8	– 6.5	– 7.8
land use				
forest land	ha	– 0.3	– 0.3	+ 3.8
agricultural land	ha	+ 0.3	+ 0.3	– 4.0
arable land	ha	– 1.7	– 1.5	– 7.0
grassland	ha	+ 2.0	+ 1.9	– 1.6
conventional crops and livestock				
cereals including maize	ha	– 1.5	– 1.3	– 7.2
cattle	heads	+ 0.5	– 1.1	– 3.5
organic crops and livestock				
cereals including maize	ha	– 0.6	– 0.7	– 2.7
cattle	heads	+ 0.6	– 0.5	– 3.1
livestock herd (conventional and organic)				
male cattle and calves	heads	– 5.3	– 3.8	– 3.2
cows and heifers	heads	+ 1.8	– 0.4	– 3.5
pigs	heads	+ 0.2	+ 0.4	– 1.5
indicators of environmental stress				
livestock densities (livestock units)	LU/ha	– 1.7	– 2.5	+ 0.9
surplus of nitrates (nitrogen balance)	tons	– 0.0	– 0.7	– 2.8
carbon in topsoil: forest + agricultural land	tons	+ 0.1	+ 0.1	+ 1.1
methane emission	tons	– 0.5	– 1.3	– 3.5

Scenarios: The numbers reflect percentage change of the 2003 CAP reform versus a continuation of Agenda 2000 reform. AUSTRIA: 100 % of suckler cow premiums and 40 % of slaughter premiums remain coupled, the rest is decoupled (this is the Austrian implementation of the CAP reform); LAND: decoupled premiums are granted if land is maintained in *good agricultural and ecological condition*; PERSONS: owners of entitlements benefit from decoupled premiums with no restrictions on land use beyond cross-compliance.
Source: Own calculations.

Thus benefits associated with landscape stewardship services provided by agricultural activities will likely drop. Since forests are providing social benefits as well, it is not clear what the net social benefit will be. This result stresses the need for further investigations on the demand of countryside stewardship goods and services.

Preservation of the environment

Indicators of environmental stress are reflecting both, the change in inputs and outputs, as well as land-use changes:

- Indicators measuring soil quality (*carbon stored in topsoil*), the impact on air (*methane emission*) and water (*surplus of nitrates, livestock densities*) show less environmental stress as a consequence of the 2003 farm policy reform.
- The acreage of organic cereal production decreases slightly, but to a lesser extent than conventionally managed arable land (see *crop and livestock production*). Organic farming and other extensive farming practices (not reported in the table) become more attractive.

In general, our results suggest that de-coupled subsidies lessen environmental stress. The 2003 CAP reform is therefore consistent with the goal of the Environmental Action Programme of the EU. In particular less land will be used for arable crops which brings about net environmental benefits (less soil erosion, less nutrient runoff, less farm input use, higher soil carbon sequestration) at an aggregate level.

6. Conclusions

The 2003 CAP reform is a consequent further step in the CAP development that has been induced in 1992. According to our model results, production will become less intensive. We expect positive environmental outcomes at an aggregate level. The results suggest that the multifunctional role of agriculture will be strengthened. However, the conclusion may be biased by our personal view of what multifunctionality actually is and how trade-offs between different goals should be weighted.

Since Austria is representing only 2 % of agricultural production in EU-15 and an almost negligible share in EU-25, we can not draw very strong conclusions concerning foreign trade. But there are good reasons to assume that major results obtained in our study hold for the EU as a whole (as confirmed by LEI, IAP and IAM, 2004). We expect that some outputs (like beef) will decline and therefore the need for subsidised exports will diminish. Smaller crop harvests in regions with marginal land in the EU will give more competitive regions an edge to gain market shares. Thus the 2003 CAP reform seems to be a credible commitment of the EU in the negotiations for less distorted agricultural trade.

The findings of the model analysis indicate the path for a further development of the CAP. In the long run, the current CAP could and probably should be replaced by a coherent and adequately targeted programme for rural development with a more balanced score regarding its economic, social and ecological dimension. Models similar to the one presented in this paper can complement the toolbox of instruments to design such programmes (Dobbs and Pretty, 2004).

Model results are always preconditioned by the assumptions and limitations embedded in the 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 funds of rural development programmes are modelled explicitly while the rest (mainly investment aids) is treated as a regional lump sum payment. Taking appropriately account of these transfers 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 expand 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 which 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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