Phasing out of Environmentally Harmful Subsidies:

Effects of the CAP 2003 Reform

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Abstract

A core element of the recent Common Agricultural Policy reform is to decouple payments that are merely linked to production from 2005 on. These subsidies are classified as environmental harmful by OECD. An agricultural sector model, using a modified version of the positive mathematical programming method, depicts the political, natural, and structural complexity of Austrian farming. Environmental effects of indicators that are linked to production and management measures are estimated. Simulation results show that the recent CAP reform will not only reduce the cost of production, but also improve the environmental condition of natural resources.

Keywords: CAP reform 2003, environmental indicators, agricultural sector model

Introduction

Subsidies are a common instrument of public policy making. On a global scale, subsidies amount to about 1 trillion US$ per year, accounting for 4% of world GDP (Pearce; van Beers and de Moor). About two thirds of this money is spent in OECD countries, with the main 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 unintended spillovers impair the health of people and animals, and deteriorate environmental quality, or because of vested interests of particular stakeholders. Agriculture is a sector with a very peculiar situation regarding subsidies, because:

a) the volume of subsidies to this sector is significant (in OECD countries they make up 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,

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

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

Some observers maintain the position that on a global scale agriculture is the primary threat for the environment (Clay). 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 high and reliable agri-environmental indicators are available (OECD, 2001, 2002a, 2002b). This paper tries to estimate the environmental consequences of the recent CAP reform that significantly changes the mechanism by which subsidies are provided.

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 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 for farmers will change fundamentally. Subsidies previously linked to output will be substituted by decoupled payments to farm operators which are based on historical entitlements.

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 - either positive or negative (Wier et al.). For the case of Austria, we analyze whether this conclusion holds for the CAP-2003 reform as well. Our paper is structured such that next we describe

core elements of the CAP by focusing on major subsidy programs and 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.

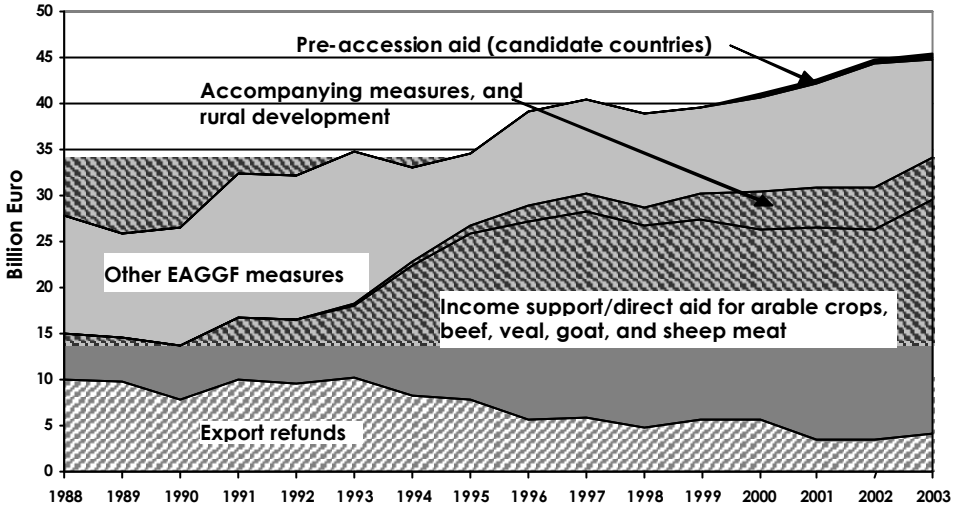
CAP measures, subsidies and the environment

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 mainly consumers had to maintain farm income. 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 farm and national quotas. When this system could no longer be sustained due to internal and external pressure, a substantial reform was implemented in 1992. A significant share of support was shifted towards direct payments which have been coupled to certain crops and livestock heads.

In 1992, the importance of taxpayers to support agriculture began to increase. This process was further reinforced in the Agenda 2000 reform which was agreed upon at the Berlin Council meeting in 1999. Administrative prices of cereals, oil crops and beef were further decreased and the corresponding direct payments were expanded. Apart from modifications of measures concerning farm commodities (now dubbed as the *first pillar* of the CAP) a new strategy was established: the program of rural development (*second pillar* of the CAP). This program integrated existing policies (payments for farms in less favored 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 26th June 2003. The key element is the introduction of a single farm payment (Greek Presidency; Fischler, 2003). It will replace premiums formerly linked to output or land (see *income support / direct aid* in Figure 1).



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

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

From 1st January 2005 on, farmers generally need not to produce certain crops or livestock in order to obtain financial support[1]. Production decisions are expected to be based on market signals (i.e., prices) and consequently resource allocations are likely to improve. The de-coupled single farm payment entitlements are calculated on the basis of direct payments

[1] In some member states the reform will be implemented only partially: they may opt to retain a given percentage of direct payments for arable crops, sheep and goats, bulls and steers and suckler cows and retain a share of the slaughter premium. For some crops (olives, sugar beet, tobacco) reform decisions has been or will be made separately but consistent with the mid-2003 reform.

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.

CAP subsidies: environmentally relevant production incentives

Two problems have to be tackled in order to analyze the connection between subsidies and the environment. First, it has to be defined what a subsidy indeed is, and secondly, the functional relationship between a subsidy, the induced behavioral change and its impact on the environment needs to be identified.

It is far from easy to define subsidies in a precise way (Steenblik). The standard approach used by OECD is quite a wide-ranging definition, which even goes beyond the concept underlying the Agreement on Subsidies and Countervailing Measures of the WTO (WTO). The OECD definition includes price support which goes beyond Article XVI of the GATT 1994, and also includes government-provided general infrastructure (Steenblik). According to this definition, 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). 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, which is not available to others.

The second problem of the analysis of subsidies 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, but also related to the individual situation of a beneficiary (production structure, natural disadvantages, etc.). The usually highly complex relationship between such parameters makes a simple analysis through the observation of environmental indicators often 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. We are currently not able to analyze the environmental consequences of *all* support measures to the farm sector. However, we try to estimate some consequences of a policy shift that includes a subset of support measures which we think are relevant in the context of this policy reform. Support for general infrastructure, agricultural research and other measures are assumed to have long term effects and therefore are excluded in this analysis. Still, the model being employed incorporates a broad set of environmental indicators along with almost a complete list of CAP support measures that likely have effects on production decisions.

CAP and the environment: an indicator based approach

Several studies have shown significant impacts of agriculture on the environment. A broad coverage of such effects in the EU 15 was recently presented by DG Environment (Baldock et al., 2000 and 2002; Beaufoy; CEAS et al.; and Poux). These studies have explicitly taken into account CAP integrated environmental policy goals from 1992 on.

Since 1992, member states were legally obliged to implement agri-environmental programs that were co-financed by the EU (van Huylenbroeck and Whitby). This regulation was initially resisted by farm unions. The negative outcome of their lobbying resulted partly from disarray among the organization's national policy constituencies, but also from skillful counter lobbying by the Commission (Clark and Jones). EC 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: *While the objective is to assure the availability of food supplies at reasonable prices, 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 to improve the natural environment.

A coherent and systematic way to evaluate the environmental improvements due to the policy reform 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, 2001). 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.

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

- agriculture in the broader economic, social and environmental context 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 and pest management, 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 refer to this concept and concentrate on indicators related to soil, water and air, those environmental media which were identified above to be at risk in the EU due to agricultural production.

The Model and scenarios results

The Positive Agricultural Sector Model Austria

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 to (i) reproduce observed production activities, and (ii) generate production and environmental responses due to policy and price changes. Consequently, analytical tools should cover all relevant production possibilities and policy instruments and still 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 CAP reform 2003 on selected agricultural and environmental indicators. PASMA is designed to sufficiently 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 *Allgemeines Land- und Forstwirtschaftliches Informationssystem* (ALFIS), *Integrated Administration and Control System* (IACS), *Economic Accounts of Agriculture* (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 analysis 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 program ÖPUL, and the support programme for farms in less-favoured areas (LFA). Thus the two most important components of the program for rural development are covered on a measure by measure basis. Apart from major components of the program for rural development the almost 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[2] and is calibrated to historic crop, forestry, livestock, and farm tourism activities by using the method of Positive Mathematical Programming (PMP). Howitt has initially published PMP and since then it has been modified and applied in several models e.g., Lee and Howitt; Paris and Arfini; Heckelei and Britz; Cypris; Röhm; Röhm and Dabbert. 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

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

LP (Linear Programming) gross margin of each activity in the base-run. This 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, 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; McCarl; Önal and McCarl, 1989, 1991), the model is robust in its use and results.

PASMA is a set of three almost identical LP models. The purpose of the first one is to assign all farm activity levels i.e., crop, forestry, livestock, and farm tourism, and remaining cost shares from feed and fertilizer balances. 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). In the model, these activities and remaining cost shares (e.g., fertilizer and forage) are accordingly assigned using historical livestock records and detailed feed and fertilizer balances (phase 1). Phase 2 is the second LP in which the perturbations coefficients (Howitt) are incorporated to compute the calibration coefficients of a linear marginal cost curve primarily following the approach of Röhm and Dabbert. The third LP (phase 3) is the actual policy model. Calibration coefficients are incorporated using linear approximation techniques that allow calibration of crop, forestry, livestock, and farm tourism activities to observed and estimated activity levels. 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. Commodity and input prices

and other model assumptions are referenced in Sinabell and Schmid (2003a, 2003b, 2003c), and Schmid and Sinabell.

In the model several indicators are used to measure the level at which policy and program objectives are reached. In Austria, 85 % of all payments to farms is coming 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. Indicators measuring the effects of farm policies therefore are related to farm welfare (differentiated according to the source of income, including secondary activities), crop and livestock production, land use, and environmental indicators (livestock densities, nutrient balances). The estimates are made at regional scale.

About 15 % of subsidies to the Austrian farm sector are not accounted for at a measure by measure level, in the current version of PASMA. The reason for this deficiency is that the findings of the mid-term evaluation of the program for rural development have not yet been integrated in the model.

Model assumptions and scenarios results

Apart from the core elements of the CAP-2003 reform outlined in section 2, several aspects are important for the modelling effort. 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 situation in 2003 (with the Agenda 2000 in place) and the situation in 2008 (by this year the reformed CAP will be fully implemented). More details on the assumptions underlying these scenarios are documented in Sinabell and Schmid (2003a and 2003b). Most prices are exogenously given

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

The results (Table 1) show that agricultural producer surplus will decline due to the reform. Since farm labour will be declining as well, the income effect per farmer will be smaller. Income is stabilised by the farm payment which is calculated to be part of the producer surplus even if there would be some justification to assume that this payment is actually a transfer to households.

Table 1: Effects of the Common Agricultural Policy reform in Austria

	price scenario in 2008		
	lower prices	medium prices	higher prices
	Percentage change versus 2003 (Agenda 2000 Reform)		
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

Source: own simulation results.

Note : 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 of rural development (€ 17 million euros annually) are not accounted for in the total of transfers.

Production will become more extensive: less arable land will be managed and less beef is produced. The cross-compliance requirement implies that farm land must not be afforested, therefore the acreage of total farmland may change only slightly.

Environmental indicators show that conditions of natural resources may improve. The indicators measuring the quality of soil (organic carbon), air (methane) and water (nitrates and livestock densities) show a decrease of environmental stress. Consequently, a shift of production linked support measures to a single farm payment will benefit the environment. In contrast, the acreage of arable land which is organically farmed is slightly decreasing but to a lesser extent than conventionally managed arable land. Another management indicator, soil cover in winter, shows also deterioration, however, it is misleading because the use of cover crops declines at the same pace as arable land. Since, arable land, whether organically or conventionally farmed is turned into grassland, this actually has to be seen as an improvement.

Discussion and conclusions

The findings with respect to economic variables (income and production responses) presented in this paper are consistent with results of other studies that analyzed the effects of the CAP-2003 reform (e.g. FAPRI). The changes of the levels of environmental indicators are similar to those identified by a team of researchers (LEI, IAP and IAM) who analyzed the likely effects of the CAP-reform before it was finalized. A study which focused on organic farming (Häring et al.) concluded that *the overall conclusion on the CAP reform 2003 is that it the positive effects for organic farming seem to clearly outweigh some negative effects*. According to our results the output of organic farming will decline as well 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.

At least partially, this reform made possible recent political offers with respect to a substantial reduction of EU export subsidies (Fischler, 2004). Although domestic effects of export subsidies are captured in the model through higher commodity prices (e.g., milk, sugar beet), ana-

lyzing the environmental impacts in foreign countries is beyond the scope of the current model version.

There are several challenges for a further development of the modelling approach we have presented here. Currently, 15 % of the funds of the rural development programme are treated as regional lump sum payments. When the results of the mid-term review of the rural development programme will become available, the remaining measures can be integrated in the model. The integration of investment measures will make it necessary to overhaul the model substantially to account for dynamic effects of policy instruments. Another direction of future development is to extend the coverage of the model to account for more parts of the rural economy beyond agriculture. A promising approach seems to be the integration of this model into a regional input-output model which accounts for down-stream and up-stream sectors, explicitly. Other components that could be included are farm administration and related private sector service firms.

According to our model results, the CAP-2003 reform will likely make production more extensive which have positive effects on the environment at an aggregate level. This reform is a consequent and further step in the CAP development that has been induced in 1992. However, decoupling may still be a transitional solution which in the long run could be replaced by a coherent and adequately targeted program for rural development.

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