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Evaluation Of Decoupling Scenarios in a Rural Development Context: Results for Austria

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Erwin Schmid*, and Franz Sinabell**

Abstract

The 2003 reform of the Common Agricultural Policy (CAP) brought about two major changes. First, various production linked support measures are substituted by a more transfer efficient single farm payment scheme, and secondly the programme for rural development will be expanded. This programme aims to attain a broad range of objectives by using many and different instruments. Such a policy shift challenges sector modelling approaches that were developed under a different policy paradigm. We present a quantitative model framework in spatial context, which accounts for the heterogeneity of programme objectives and instruments. The model is applied to Austria, a member state with an eminent programme for rural development.

Keywords: CAP evaluation, agricultural sector model, decoupling, rural development.

Introduction

The 2003 reform of the Common Agricultural Policy (CAP) brought about two major changes: farm income goals will be pursued in a more transfer efficient way and rural development objectives will gain more weight. Since January 2005, a substantial part of direct payments is no longer linked to the production of agricultural commodities, but to the maintenance of land. Support, previously granted if crops or cattle were produced, is now provided if “agricultural land is maintained in good ecological conditions”. This instrumental switch is accompanied by

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a shift of policy goals, as well. More resources will be allocated to the programme for rural development (dubbed the “Second Pillar” of the CAP) at the expense of commodity policies (“First Pillar” of the CAP).

This policy change challenges analytical tools which have been developed under a different paradigm. The recently introduced instrument of decoupled farm payments is expected to have output consequences. How large these effects will be, is difficult to evaluate, because this instrument did not exist in the past and therefore parameters, based on observations, are not available.

The introduction of decoupled farm payments was intended to make the attainment of CAP objectives more efficient. However, compromises during the decision making process eventually led to new output linked support measures and particular exceptions. Some EU Member States may implement the reform partially, they are free to introduce transition periods, and may choose between two different implementation strategies to allocate farm payments (a farm based approach and a regional approach). Consequently, the reform reduces complexities as far as commodities are concerned, but introduces new complexities with respect to spatial and time dimensions.

The programme for rural development is currently designed to address a wide range of goals, and instruments chosen for the implementation are manifold. For instance, hectare-payments, livestock-payments and amenity linked supports are granted to reach agri-environmental goals, farm based support is available in less favoured areas, investment aids are given to meet tighter animal welfare standards, and single lump-sum transfers are used to set up young farmers. In addition, some member states are financing and co-financing national programmes that should be also accounted for in agricultural policy evaluation and design.

Most policy models depict agricultural commodity markets in detail. This will be necessary in future as well, because commodity policies will prevail even in the era of single farm payments. The obligation to blend biofuel with others fuels in the transport sector (Directive 2003/30/EC) is only one example that “First Pillar” policies remain important.

Traditional farm policy models frequently ignore issues that are important for rural development, such as production and income possibilities beyond traditional farm commodity markets. This paper presents an approach to overcome such a deficiency. We make an attempt to deal with the heterogeneity of policy goals and instruments in a single modelling framework. Five aspects are addressed by the paper: (i) it introduces the Positive Agricultural Sector Model Austria (PASMA) that has been used to analyse the effects of the recent CAP reform for commodity and rural development policy in Austria; (ii) it discusses various data sources and data management issues; (iii) it presents a modified Positive Mathematical Programming version that allows the calibration of large scale models; (iv) it addresses rural development policy issues by measuring environmental indicators and secondary farm activities, and (v) it analysis how farmers might adjust to alternative de-coupling scenarios, among them more radical ones than those agreed upon in the recent CAP-reform.

In the next chapter, EU farm budget data are presented to exemplify the flexibility of the CAP and the diversity of its implementation in EU-15 member states. PASMA, a model to analyse rural development policies along with commodity policies, will be presented in more details in the following chapter. The heterogeneity of policies and programmes as well as their

economic and environmental effects necessitates delineation among regions and management practices, which make models fairly complex and large. Special attention is given to a linear calibration approach that facilitates large scale modelling. Finally, model scenario results are presented for Austria which are the base for some conclusive remarks.

Rural development: a view at the EU-15 agricultural sector

This section provides a short summary of the importance of rural development policies for the agricultural sector in the EU. Even if the weight of the policy addressing rural development seems to be minor, its importance is eminent in some European regions. In some member states, support from this policy is already more important than previously commodity linked support.

Measures of the rural development programme must be co-financed by member states. The funds from national budgets are significant, and therefore domestic agricultural policy design needs to be accounted for in farm sector analyses. The 2003 reform gives member states considerable room to address specific goals within the framework of the CAP. It seems likely that national farm policies will even gain more on importance with the new programme for rural development.

The relative weight of the rural development programme varies substantially among EU Member States. Detailed data will be available when the mid-term evaluation reports of the programme will be published. In the meantime, transfers accounted for in the position 'other subsidies' of the Economic Accounts of Agriculture (EAA) can serve as a proxy for the volume of rural development expenditures. The EAA are national satellite accounts and allow for a detailed look on the agricultural sector (Eurostat, 2000). Most of the expenditures in the position 'other subsidies' are due to the programme for rural development and this sum is clearly an upper bound of total programme transfers.

The position 'other subsidies' recorded in EAA is accounting for 47 % of factor income in Austria and even more in Finland (63 %). This shows that the 'second pillar' of the CAP actually is the 'first pillar' in many member states. Sweden (31 %), Luxembourg (30 %), and Ireland (26 %) are other countries with significant shares. However, at the EU-15 level, 'other subsidies' were equivalent to 11 % of factor income in 2002 (Tab. 1). In several member states (e.g. Greece) the planned budgets of the rural development plan were not yet made available for the agricultural sector yet, therefore, this figure is likely to increase.

With the introduction of single farm payments, a maximum of 68 % of farm subsidies will be granted in a production *neutral* way. Production decisions of farmers are mostly driven by market signals and policies. Given the efforts of the ongoing Doha round to lower tariffs on agricultural commodities and to abolish export subsidies, it seems to be likely that the programme for rural development will become the most important element of EU farm policy and thus have an impact on land allocation and the composition of agricultural outputs.

In some countries, its role is already eminent before the recent CAP reform (Finland, Austria, Luxembourg, Sweden, Ireland (see Tab. 1). In Austria, more than 60 % of total public ex-

penditures in agriculture and forestry were transferred via this programme (BMLFUW, 2004). The biggest budget shares had the Austrian agri-environmental programme (628 million Euro) and compensatory allowances for farmers in less-favoured areas (280 million Euro in 2003). This volume is noticeable because in Austria – representing only 2 % of EU-15 farm output – a total of 7 % of funds of the rural development plan are spent.

Table 1. Subsidies to the agricultural sector according to the Economic Accounts of Agriculture (EAA) Ø 2001-2004 and the annual budget for the rural development plan (RDP)

	support to the agricultural sector Ø 2001-04					RDP ¹⁾ annual budget mill. €	share of factor income Ø 2001-04			
	total	EAA subsidies		other subsidies	RDP ¹⁾ annual budget mill. €		total	EAA subsidies		RDP ¹⁾ annual budget mill. €
		on products	mill. €					%	on products	
	mill. €	mill. €	%	mill. €	%	mill. €	%	%	%	%
EU15	41,970	28,663	68	13,307	32	14,014	35	24	11	12
BE	474	393	83	81	17	139	22	19	4	7
DK	902	774	86	129	14	123	39	34	6	5
DE	5,623	4,111	73	1,513	27	2,145	51	37	14	20
GR	2,859	2,508	88	351	12	868	36	31	4	11
ES	6,252	3,815	61	2,437	39	2,030	25	15	10	8
FR	9,175	7,167	78	2,008	22	1,973	39	31	9	8
IE	1,526	863	57	663	44	629	59	34	26	25
IT	4,744	2,980	63	1,765	37	2,046	21	13	8	9
LU	57	27	47	30	53	55	56	26	30	54
NL	659	425	65	234	35	164	11	7	4	3
AT	1,699	539	32	1,161	68	968	69	22	47	39
PT	827	463	56	364	44	783	29	16	13	27
FI	2,017	787	39	1,229	61	857	103	40	63	44
SE	955	532	56	423	44	402	71	39	31	30
UK	4,200	3,281	78	919	22	830	46	36	10	9

¹⁾ Rural development plan (EAGGF Guidance and Guarantee plus national funds). Source: own calculations based on Economic Accounts of Agriculture, Eurostat, NewCronos, Theme 5, Cosa, EAAE_01, EAA 97; 2004 data are provisional for some member states; Rural development plans (RDP) according to Regulation (EC) n° 1257/1999, http://europa.eu.int/comm/agriculture/rur/countries/index_en.htm

To our knowledge, most agricultural sector models do not, or only limited account for the programme for rural development, so far. For the EU as a whole and for many of the EU Member States this was probably not yet necessary, because of its minor importance, so far. Given the political commitment to strengthen rural development it can be foreseen, that analyses of the EU farm sector at the aggregate level will become more difficult, unless information systems and research tools are developed which allow the inclusion of national policies. An approach to tackle this challenge is presented in the next section. After that, an application

demonstrates that such a modelling framework is flexible enough to successfully analyse highly complex policies like the Austrian programme for rural development.

The Positive Agricultural Sector Model Austria - PASMA

Development means change. Consequently, policy analysis must track changes in a sector or region. Therefore, analytical tools should cover all relevant policy instruments and be flexible enough to account for various needs. 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 at national and regional scale. The effects on rural and agricultural development are measured by a set of agricultural and environmental indicators.

Data, policies, and programmes

The overall goal of PASMA is to build an integrated modelling system which is consistent with the structure of the Economic Agricultural Account (EAA). This information system gives a detailed account of the outputs from agricultural sector, total transfers, and farm incomes at a member state level. However, EAA-data lack on information for important policy fields, like outcomes of agri-environmental policies. Given the national approach of EAA, the total of support for agriculture is measured, however, the spatial consequences of agricultural policy, like support for farms in less favoured areas, are not included.

In PASMA, several additional data sources are employed to address these deficiencies. The Agricultural Structural Census (ASC) provides information on the spatial dimension of agricultural production. Single farm observations from the Integrated Administration and Control System (IACS) are used to measure programme participation, support per region, and land-use activities of almost all farms. Annual sequences of crop allocation and animal production at farm level allow a detailed view on the interaction between production decisions and programme participations.

Price and cost information are derived from official price statistics and standard gross margin calculations, which are published by the official farm extension services. As a consequence, the modelling system aligns with official, standardised data and statistics, incorporates annual updating of single farm data, and provides comparable and systematic policy analyses. The likely developments of commodity prices are taken from recent OECD and FAPRI projections (OECD, 2004 and FAPRI,-Ireland-Partnership, 2003). These sources are used to obtain future price estimates assuming a constant price wedge between EU-15 prices and Austrian farm gate prices.

These data mainly provide the necessary information on production technology and resource and production endowments for up to 40 production units. The units are differentiated with respect to regional and structural (alpine farming zones) characteristics. Given the fact that single farm observations are available, arbitrary regional entities can be constructed according to problem requirements (e.g. zones of natural disadvantages, NUTS-classification, river basins). Regional crop yields, milk yields per cow, reproduction of sows, etc. are derived

from farm statistics and cross-checked with regionally differentiated FADN-data analyses (Salhofer and Streicher, 2004).

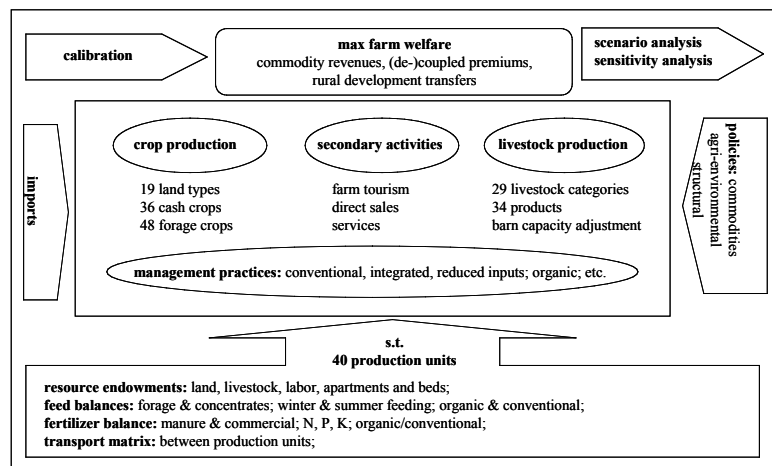
The mathematical programming model extensively differentiates crop and livestock production activities. Given that IACS observations are available, the participation of farmers in almost all rural development programmes can be duly attributed to production units. Consequently, the model considers conventional and organic production systems (crop and livestock). In addition, all other relevant management measures from the Austrian agri-environmental programme, the support programme for farms in less-favoured areas and secondary farm activities like agri-tourism are captured in the model.

Apart from the data which are specific for the Austrian situation, the model captures all relevant elements of CAP like quota, crop and livestock premiums, guaranteed prices, and land use restrictions. Community environmental policies, like production restrictions due to the Nitrates Directive (91/676/EEC) are also considered.

Model structure

PASMA depicts the political, natural, and structural complexity of Austrian farming in a 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. Using an extensive set of data (see section above) the model is capable to estimate production, labour, income, and environmental responses for up to 40 regional and structural production units.

The model maximises farm welfare, the total of revenues from crop and livestock products, secondary activities (e.g. farm tourism), and farm policy transfers (LFA-payments, single farm payments, CAP-premiums, etc.) from EU and national funds, minus cost. It 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 Austrian 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.



Source: own construction.

Figure 1. Structure of the regionalized agricultural sector model PASMA

PASMA is calibrated to historic cropping, grassland, 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; Cypri, 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 for observed levels of production activities. Product prices and other model assumptions are referenced elsewhere (Sinabell and Schmid, 2003; and Schmid and Sinabell, 2003).

Linear approximation using the PMP calibration method

Following (Howitt, 1995), a linear programming model (LP) is used to derive PMP calibration coefficients according to base-run production activities. This method requires that two major conditions are fulfilled: (i) marginal gross margins of each activity are identical in the base-run, and (ii) the average PMP gross margins are identical to the average LP gross margins for each activity in the base-run. These conditions imply that the PMP and LP objective function values are identical in the base-run.

Another assumption concerns the assignment of the marginal gross margin effect to either marginal cost, marginal revenue, or a fractional to both. In PASMA, the marginal gross margin effect is completely assigned to the marginal cost. Consequently, coefficients of linearly increasing marginal cost curves are derived. In PASMA, linear approximation techniques are utilized to mimic the non-linear PMP approach (Schmid and Sinabell, 2005). Thus large-scale

models can be solved in reasonable time. In combination with an aggregation procedure, i.e. building convex combinations of historical crop mixes (Dantzig and Wolfe, 1961; McCarl, 1982; Önal and McCarl, 1989, 1991), the model is robust in its use and results. In PASMA a set of three almost identical LP models is used to obtain simulation results:

1. The purpose of the first model is to assign all farm activity levels i.e. crop, forestry, livestock, and farm tourism, and remaining cost shares from feed and manure 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). These activities and remaining cost shares (i.e. fertilizer and feed) are accordingly assigned using historical livestock records and detailed feed and fertilizer balances (phase 1).
2. Phase 2 is a second LP model which incorporates the perturbations coefficients (Howitt, 1995). These are used to compute the calibration coefficients of a linearly increasing marginal cost curve in a similar way as suggested by (Röhm and Dabbert, 2003).
3. The third model is the actual policy evaluation model which is used for scenario analyses.

Calibration coefficients are built in using linear approximation techniques that allow calibration of crop, grassland, 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 stands, a transport matrix, and imports of feed and livestock are included to allow reasonable responses in production under various policy scenarios. The linear approximation of multi-variant cost increments of quadratic shape, as used in PASMA, is illustrated in a little model given in equations (1) to (7).

Suppose, the objective is to maximize producer surplus (PS) from the production of i crops using v different management practices (such as conventional or organic systems with or without environmentally friendly management measures like winter cover crops). Production increments (index s) are e.g. percentages (ψ_s) of observed production levels ranging, for instance, from 10 to 200 percent. The design of increments can be such that the deviations are smaller around the observed level and get larger the further it gets away from this point, e.g. one percent increments around the observed point, which increase the further they are away (e.g. 5 or 10 % increments).

The set of exogenous coefficients and parameters include prices (ρ), outputs from crop production (\mathcal{O}), approximated production cost increments (\mathcal{X}), factor uses and other technical requirements (\mathbf{A}), and resource endowments (\mathbf{b}). The choice on crop and management shares is obtained by assigning fractions (θ) to convex combinations of $b_{i,v,s}^g$. The model is calibrated to some observed production activity levels ($b_{i,v}$) using the extended PMP method of variant production technologies developed by (Röhm and Dabbert, 2003).

$$\max_{\theta} PS = \sum_{i,v,s} [(\rho_{i,v} * o_{i,v,s} - \chi_{i,v,s}) * \theta_{i,v,s}] \quad (1)$$

$$\text{s.t.} \quad \sum_{i,v,s} (A_{i,v} * b_{i,v,s}^g * \theta_{i,v,s}) \leq \sum_{i,v} (b_{i,v}) \quad (2)$$

$$\sum_s (\theta_{i,v,s}) = 1 \quad \text{for all } i \text{ and } v \quad (3)$$

$$0 \leq \theta_{i,v,s} \leq 1 \quad (4)$$

where $\chi_{i,v,s} = \int_0^{b_{i,v,s}^g} \left(\alpha_{i,v} + 2 * \beta_{i,v} * b_{i,v,s}^g + 2 * \varphi_{i,v} * \sum_v (b_{i,v,s}^g) \right) db_{i,v,s}^g$ are approximated multi-variant production cost increments of quadratic shape that are calculated for each production grid $b_{i,v,s}^g$. Production grids are computed as $b_{i,v,s}^g = b_{i,v} * \psi_s$. The coefficients of a linearly increasing multi-variant marginal cost curve are $\alpha_{i,v}$, $\beta_{i,v}$, and $\varphi_{i,v}$, and are derived in the PMP process (Phase 2). The intercept coefficient of the linear multi-variant cost curve is

$$\alpha_{i,v} = 1 - \frac{(\lambda_i + \lambda_{i,v})}{VC_{i,v}}, \quad (5)$$

the slope coefficient of variant activity levels is

$$\beta_{i,v} = \frac{\lambda_{i,v}}{VC_{i,v} * b_{i,v}}, \text{ and} \quad (6)$$

the slope coefficient of crop activity levels is

$$\varphi_{i,v} = \frac{\lambda_{i,v}}{VC_{i,v} * \sum_v b_{i,v}}. \quad (7)$$

The λ are modified duals of the perturbed model. The variable costs (VC) of production activities are from the Austrian standard gross margin catalogue (BMLFUW, 2002). For more elaboration see (Röhm and Dabbert, 2003).

By definition, the area beneath a linear marginal cost curve is the *variable* cost of production as expressed in $\chi_{i,v,s}$, or a point on the associated quadratic cost curve. Total crop output for each production grid is computed as $o_{i,v,s} = b_{i,v,s}^g * \gamma_{i,v}$, where $\gamma_{i,v}$ is crop yields per hectare. The convexity and identity condition in equation (3) allows any weighed combination between production grids ($b_{i,v,s}^g$). The optimal crop and management shares in hectares are finally com-

puted by $b_{i,v,s}^g * \theta_{i,v,s}^*$. Similarly, total production output is the sum of $o_{i,v,s} * \theta_{i,v,s}^*$, total revenue is the sum of $\rho_{i,v} * o_{i,v,s} * \theta_{i,v,s}^*$, and total production cost are the sum of $\chi_{i,v,s} * \theta_{i,v,s}^*$.

Management options play an important role in analysing economic and environmental effects of policies at regional scales. The multi-variant production cost approach, as argued by Röhm and Dabbert (2003), provides a more closely exchange between different management technologies (i.e., applying environmentally friendly management measures) than between crops. This means for instance that a reduction of an agri-environmental premium will likely lead to a decline of the specific management measure which is preferably used up by the conventionally managed part of a crop and not necessarily by a different crop.

Consequently, there are separate slope coefficients. One depends on the management-variant activity level (β), and the other on the total crop activity level (φ). Such an approach assures higher substitution between different management variants of a particular crop (e.g. winter wheat with and without reduced commercial input use) than between different crops (e.g. wheat, corn, barley). These substitution schedules might have considerable consequences in regional and sectoral modelling especially, when agronomic considerations and agri-environmental policies play an important role in the production decision of a farmer.

Model assumptions and scenario results

Core elements of the 2003 CAP reform

In mid 2002, the European Commission published a mid-term review of the Agenda 2000 reform which was decided upon at the Berlin summit in 1999. A final compromise on the proposals of the reform was reached on 26th June 2003. The key element is the introduction of a single decoupled farm payment (Greek Presidency, 2003; Fischler, 2003). This transfer replaces a multitude of premiums formerly linked to outputs. Direct payments of the rural development programme are not affected by this reform, e.g. subsidies for organic farming will not be decoupled.

When the reform proposals were drafted, it was anticipated that decoupled premiums have considerable impact on production incentives. In future, production decisions are expected to be more based on market signals (i.e. prices) and consequently resource allocations are likely to improve. All farmers receiving direct payments must set aside part of their land (organic farms are exempt). Recipients of farm payments must abide by 18 statutory European regulations 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 the rural development programme.

Scenarios and model assumptions

The scenarios analysed in this paper are a comparison between modelled outcomes in 2008 (by this year the reform will be fully implemented). The Austrian implementation of the reform is the reference scenario. Outcomes of this scenario are compared to a continuation of the CAP according to the Agenda 2000 and two alternative versions of the 2003 CAP reform. The objective is to analyse the interaction of the farm policy reform with important aspects of the programme for rural development. The scenarios are:

- **Reference scenario:** This scenario mimics the implementation of the CAP reform in Austria. Premiums for suckler cows will remain coupled to production by 100 % and slaughter premiums by 40 %. All other premiums apart from rural development payments will be decoupled. Individual premium entitlements are based on historic farm receipts. Prices are based on OECD forecasts (OECD, 2004);
- **Agenda 2000:** 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);
- **full decoupling strategy (Council):** In this scenario the Council decision for full decoupling will be evaluated. Almost all direct payments are decoupled and allocated among farm operators. Premium entitlements must be matched by an equivalent amount of eligible hectares. If land is not maintained in “good agricultural and ecological condition”, entitlements are foregone;
- **complete decoupling strategy (fictive scenario):** This is a fictive scenario but is similar to the previous one. The difference is that premium entitlements are not linked to agricultural land but to farm operators. They can do with them whatever they like (within cross-compliance restrictions). Most importantly, land can be afforested without losing 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 continue as observed in recent years.

Due to the complexity of some measures and the lack of information on participation we are 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 PΑΣMA.

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 its requirements (e.g. quit, enter, or continue the organic farming scheme).

Simulation results on farm welfare, production cost and land use

We use a set of indicators which are more or less closely related to various aspects addressed by the programme for rural development. 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). Indicators (as summarized in table 2) are aggregates at national scale, which are also available at regional and structural scales.

Value added is the engine of economic development. Net incomes in agriculture and other sectors are therefore the best gauge of rural welfare unless external effects are overwhelming. Given this measure, the 2003 CAP reform shows positive effects. Farm welfare (the sum of producer surplus of agricultural and forestry activities of farm holdings, direct payments and transfers) increases in the reference scenario compared to the Agenda 2000 scenario, however only slightly. The Austrian reform implementation implies that income opportunities are not fully utilized due to some remaining payment coupling. Farm welfare is largest in a scenario of linking premium entitlements to persons (complete decoupling strategy) instead of linking them to eligible land (full decoupling strategy).

Variable cost and farm product revenues indicate how upstream and downstream industries of the rural economy are affected by the 2003 CAP reform. These variables could 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 (reference scenario) increases the purchase of inputs in livestock production compared to other scenarios. In addition, cattle production is biggest in the reference scenario, the use of arable land would be highest if Agenda 2000 was perpetuated.

In case that decoupled premiums were linked to persons instead to land (complete decoupling), product revenues would substantially decline. Savings in input costs and a more or less unchanged payment flow would make farmers even better off (see position sector welfare). Thus we assume 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 weaken the Austrian farm sector.

In the reference scenario less arable land will be used compared to the Agenda 2000 and full decoupling strategy scenarios, and grassland will expand because of the increase in cattle production. However, the level of livestock products is likely to decline due to extensification processes – apart from milk where quotas are increased.

Table 2. Effects of various decoupling strategies on Austrian agriculture in 2008

	units	decoupling strategy		
		None (Agenda 2000)	full (Council)	complete (fictive scenario)
percentage change versus Austrian implementation				
farm welfare (revenues, direct payments, transfers)				
sector welfare (agriculture and forestry)	Euro	- 0.7	+ 0.5	+ 0.7
welfare per labour unit	Euro	- 0.8	+ 0.6	+ 1.7
farm labour	hours	+ 0.2	± 0.0	- 1.0
variable costs				
plant production	Euro	+ 0.8	- 0.2	- 4.9
livestock production	Euro	- 2.5	- 2.0	- 5.8
farm product revenues				
plant production (incl. premiums)	Euro	- 0.8	+ 2.6	- 26.6
livestock production (incl. premiums)	Euro	+5.0	- 1.8	- 3.2
land use				
forest land	ha	+ 0.3	± 0.0	+ 4.2
agricultural land	ha	- 0.3	± 0.0	- 4.3
arable land	ha	+ 1.7	+ 0.2	- 5.4
grassland	ha	- 3.0	- 0.2	- 5.5
conventional crop land and livestock herd				
cereals including maize	ha	+ 1.6	+ 0.2	- 5.7
cattle	heads	- 0.5	- 1.6	- 4.0
pigs	heads	- 0.2	+ 0.2	- 1.8
organic crop land and livestock herd				
cereals including maize	ha	+ 0.6	- 0.1	- 2.0
cattle	heads	- 0.6	- 1.2	- 3.7
pigs	heads	- 3.9	- 1.2	+ 5.0
indicators of environmental stress				
livestock densities	LU/ha	+ 1.7	- 1.1	+2.9
surplus of nitrates (nitrogen balance)	tonnes	± 0.0	- 0.7	- 2.7
carbon in topsoil: forest + agricultural land	tonnes	- 0.1	± 0.0	+ 1.0
carbon stored in topsoil: agricultural land	tonnes	- 0.6	± 0.0	- 3.7
methane emission	tonnes	+ 0.5	- 0.8	- 3.1

Notes: Simulation results are forecasts for 2008 (exogeneous prices based on OECD, 2004). *Reference Scenario*: Austrian implementation of the 2003-CAP-reform (100 % of suckler cow premiums and 40 % of slaughter premiums remain coupled, other CAP-premiums are decoupled; rural development program is not affected); *Scenario Agenda 2000*: direct payments are not decoupled; *Scenario full (Council)*: all direct payments are decoupled premiums are granted if land is maintained in "good agricultural and ecological condition"; rural development program is not affected; *Scenario complete (fictive scenario)*: owners of entitlements benefit from decoupled premiums with no restrictions on land use beyond cross-compliance; rural development program is not affected. Source: own calculations.

Outputs also would decline when decoupled premiums were linked to persons. In particular, some farms would withdraw from beef production. Given the fact that Austria is a net beef exporter, this reduction should not raise food security concerns. In the scenario of the Austrian reform implementation the output decline is limited, because premiums remain tied to raise suckler cows and slaughtering cattle.

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 expand. A marked difference can be observed when the complete decoupling strategy is compared to others. If the de-coupled premiums were not contingent upon the maintenance of land in “good agricultural and ecological condition” forest land would be expanded at the cost of agricultural land in Austria.

Simulation results on environmental outcomes

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

- Indicators measuring the impact on air (*methane emission*) and water (*livestock densities*) and *carbon storage in top-soils* indicate less environmental stress after the reform compared to the continuation of Agenda 2000. However, the direction of environmental change is not unambiguous, because no single scenario guarantees an improvement of all indicators simultaneously.
- The acreage of organic cereal production decreases slightly after the reform. However, it decreases at a lesser extent than conventionally managed arable land (see *crop and livestock production*). Organic farming therefore is getting relatively more attractive after the CAP reform, given that the programme for rural development does not change.

Less environmental stress is indicated, the more payments are decoupled from outputs. The 2003 CAP reform is therefore consistent with the environmental action programme goal to lessen negative consequences of the farm sector. It would be wrong to conclude, that our findings show ambiguous environmental results because organic farming (frequently assumed to be highly valued by society) will decline. The decline is a consequence of less intensive production levels, but organic farming will be affected at a lesser extent. The fact that less land will be used for arable crops is likely a net environmental benefit (less soil erosion, nutrient runoff, farm input use, and higher carbon storage). Decoupled payments – as intended by EU farm ministers – are incentives to use land for agricultural production. However, the incentive to *intensively* use this land are substantially reduced.

Conclusions

After the implementation of the 2003 CAP reform, rural development will likely become the most important agricultural policy field in the EU. The three major objectives of the new programme for rural development (i.e. enhanced competitiveness and structural adjustment, sustainable land use management, and diversification of employment opportunities in rural areas) require instruments which were not frequently used in the era of commodity dominated farm policy. New information systems need to be established to track the effectiveness of sub-programmes and enhanced tools need to be developed which allow comprehensive analyses. To adequately address all three objectives in a single analytical framework, is a challenging endeavour. The challenges are manifold: (i) new policy issues will get more weight but many commodity policies stay in place (e.g. milk quota system) and therefore the reformed CAP remains complex from an analytical point of view, (ii) the programme for rural development addresses many local problems, therefore any analysis must account for the spatial dimension, (iii) the focus on sustainable land management requires a solid analytical interface to account for the economic and environmental consequences of measures in an equally reliable way, and (iv) the extension of policy goals from farm employment to rural employment requires that the agricultural sector is not treated separately but viewed in the context of the whole rural economy.

In this paper we presented an approach how to address the first three of these challenges. A new model was applied to analyse a farm policy experiment in Austria. Rural development policies had been more important than commodity policies already before the 2003 CAP reform. The Austrian farm policy can therefore be seen as a test field for developments to come in member states which had put less emphasis on the programme in the past. Our model results demonstrate that after the 2003-CAP-reform, agricultural production will be more extensive in Austria as a whole, but not necessarily in every single region. Thus the reform is compatible with major objectives of the coming rural development programme. The 2003 reform will induce more pressure on structural adjustments. This is counter-productive to the objective of agricultural employment but consistent with the goal to increase competitiveness. We, therefore, see the need to strengthen those measures that aim at diversification of farm activities and income opportunities, issues that are addressed by the new programme.

The modelling framework presented in this paper is capable to analyse commodity policies and rural development policies simultaneously. The set of instruments that are explicitly accounted for, are production incentives for commodities as implemented in the Agenda 2000 reform (acreage and livestock premiums, slaughter premiums, extensification premiums, production quota, set aside requirements), the newly introduced single farm payment scheme, and the most important components of the programme for rural development (support for farms less favoured areas, and agri-environmental payments). In addition, activities important for many Austrian farms, but frequently neglected in sector analyses, forestry and farm tourism, are captured by the model, too. The effects of these interventions are measured in their spatial context. 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. 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 downstream and up-stream sectors, explicitly. Other components that should be included are farm administration and related private sector service firms.

Sector models are only a complementary tool to other approaches. Many aspects of a policy with such a breath as the rural development programme cannot be addressed by a model similar to the one presented here. Rural development means - or should mean, to economists - structural and institutional changes in rural parts of a wider economy. This definition would include changes in all components, including production, consumption and trade, as well as economic processes such as new forms of marketing and policy delivery (Thomson, 2001). Given such a claim, it is evident that the research agenda is much broader than can be covered by a single tool, even if it is very detailed. Farm ministers in EU-25 are committed to strengthen rural development. Following the principle of subsidiarity this may involve more national expenditures. The role of Member States' budget shares therefore needs to be accounted for when policies are to be evaluated. Analyses of the EU farm sector at the aggregate level will therefore become more difficult, unless information systems and research tools are developed which allow the inclusion of national policies.

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