Effects of decoupling on land use: an EU wide, regionally differentiated analysis

Landnutzungseffekts von Entkopplung: Eine EU-weite, regional differenzierte Analyse

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Abstract

This paper presents a quantitative analysis of the impacts of the „Luxembourg Compromise" as compared to a continuation of Agenda 2000 to the year 2010. The employed new version of the CAPRI model allows us to represent the different member states' implementations of the CAP reform and to reflect endogenous world market prices based upon a spatial global trade model. The specific contribution of the analysis is a detailed look at the impacts of national differences in the CAP implementation and regional production structures with respect to changes in land allocation. At EU level, cereal areas decrease by about 5% and oilseeds by about 3%. This is paralleled by increases in the set-aside acreage and extensive fodder production. However, significant differences at the regional level can be observed. They are caused mainly by differences in the shares of durum wheat and fodder maize.

Key words

decoupling; agricultural sector modelling; Luxembourg Agreement; land allocation

Zusammenfassung

Der vorliegende Beitrag diskutiert EU-weite Auswirkungen der so genannten „Luxemburger Beschlüsse" im Jahr 2010 im Vergleich zur Agenda 2000. Die der Analyse zugrunde liegenden Simulationsergebnisse basieren auf einer überarbeiteten Version des CAPRI-Modellsystems, das die national unterschiedliche Implementierung des Reformpaketes abbildet und gleichzeitig endogene Preise mittels eines globalen räumlichen Handelsmodells erfasst. Der Schwerpunkt bei der Ergebnisdarstellung bildet die Analyse von Landnutzungsänderungen vor dem Hintergrund regionaler Produktionsstrukturen und der spezifischen nationalen Ausgestaltung der Reform. Während EU-weit die Getreideflächen um ca. 5% sinken und der Ölsaatenanbau um ca. 3% zurückgeht bei gleichzeitiger Ausdehnung von Flächenstilllegung und extensivem Futterbau, zeigen sich deutliche regionale Unterschiede, insbesondere in Abhängigkeit von Flächenanteilen des Hartweizens und des Futtermais.

Schlüsselwörter

Entkopplung; Agrarsektormodell; Luxemburger Beschlüsse; Landallokation

1. Introduction

The Common Agricultural Policy (CAP) reform proposed by the Commission in 2002 as successor of the Agenda 2000 introduced a major change in the income support regime with potentially significant effects on land use: the decoupling of direct payments from production. Further important reform measures have been the introduction of obligatory modulation of payments to generate funds for rural development and agri-environmental programs (second pillar), the reduction of price support for dairy products (in part compensated through direct payments), and the introduction of obligatory cross-compliance. The idea behind this reform has been to increase the market orientation of European agriculture by cutting the link between payments and production (decoupling mechanism). This is expected to allow farmers to adopt those production activities that are most profitable under the current or expected market conditions.

However, the increasing concern about the effects of this policy reform on marginal agricultural areas led to a modification of the initial proposal and considerably increased the complexity of the system. The main change included in the final regulation was the adoption of 'restricted or partial decoupling' instead of full decoupling of premiums from production (COUNCIL OF THE EUROPEAN COMMUNITIES, 2003a). With this decision, member states kept the option of paying premiums for a specific group of activities coupled to production either fully or up to a certain percentage. Several studies have aimed at including these instruments and estimating the effects of this policy 'cocktail' on agricultural land use. BALKHAUSEN et al. (2005) compare results from different models[1] and conclude that cereal and silage maize areas as well as ruminant production in the EU-15 will probably decline as an effect of decoupling. The extent of the projected reduction, however, depends on the specific characteristics of the model used (suitability of modelling approach to represent decoupling, activity coverage, scenario baseline, etc.) and specific assumptions on national decoupling options. FAPRI estimates a reduction in cereal cropping of 1.1% in year 2012, whereas CAPSIM and ESIM estimate for year 2009 a decrease in land use of cereals of 5.0% and 4.0%, respectively. Previous studies with the CAPRI model show somewhat more pronounced effects with estimates for the EU-15 of -7.5% for cereal hectares based on the first mid-term review proposal (BRITZ et al., 2003) and -5.7% by taking into account only the 2003 legislation and estimating a 'most probable' set of national coupling implementation options. Furthermore, ESPOSTI et al. (2004) used the AG-MEMOD model and come up with a reduction in cereals of 2%.[2] On fodder activities only

[1] ESIM (ERS/USDA, Stanford and Göttingen University), CAPSIM (University of Bonn), CAPRI (University of Bonn; 2003 version), FAPRI (Iowa State University), AGLINK (OECD), GTAP (Purdue University) and FARMIS (BALKHAUSEN et al., 2005: 8).

[2] To date only results for a EU-9 have been published with the AG-MEMOD model. This 'composite model' covers: Italy, Spain, Greece, Finland, France, Belgium, Germany, Netherlands and United Kingdom.

CAPSIM and CAPRI include information at European level with estimates for acreage changes ranging around -5% and +15% for fodder maize and 'other fodder' respectively. FARMIS estimates a -7% variation in fodder maize area and +20% for other fodder in Germany.

In this paper, a revised version of the CAPRI model[3] is applied to evaluate regional and aggregate impacts of the Luxembourg agreement and subsequent smaller reform decisions (tobacco, olive oil, starch potatoes) on land use decisions in the EU compared with the Agenda 2000 policy. This revision includes the current implementation strategies regarding decoupling and type of premium regimes in the different member states, a re-specification of the market component reflecting most recent tariff data and a larger set of preferential trade agreements, and the expansion of the model to the 10 new member states. The analysis of the model results at various scales aims at explaining aggregated impacts based on differences in national policy implementation and the variations in regional production systems. In section 2, a brief overview of the model with special attention to land use allocation is given. In section 3, the baseline and impact scenarios are described. Section 4 is devoted to the analysis of modelling results at various scales, and in section 5, conclusions are drawn.

2. Model details

2.1 Overview

For the purposes of this study, the CAPRI (Common Agricultural Policy Regionalised Impact) modelling system is chosen as the instrument for quantitative analysis (BRITZ, 2004)[4]. CAPRI is an agricultural sector model linking non-linear mathematical programming models for ca. 250 regions[5] covering the EU-25, Norway, Bulgaria and Romania with a global market model for agricultural products. In each regional model, agricultural supply of up to 39 crops and 19 animal activities covers all agricultural activities according to the definition of national accounts, as well as feed and further input demand. They are modelled by maximising market revenues plus premiums minus a non-linear cost function under a limited number of constraints: land availability, policy (quotas and set-aside obligations) and feeding restrictions. The supply component of the model allows for an explicit representation of the different (partially coupled) payment schemes of the CAP, differentiating between production activities and regions. The quadratic cost function is equivalent to the one typically employed in applications of 'Positive Mathematical Programming' (PMP; HOWITT, 1995). Contrary to linear programming models, the non-linear formulation ensures a diversified crop mix and smooth supply response observable at the aggregated level. It implicitly captures changes of marginal costs associated with changing activity levels due to capacity constraints or rotational effects. They also can be considered as a reduced form of representation of risk and aggregation errors (HECKELEI, 2002).

The regional supply models take netput prices as given. In order to achieve price endogeneity of the overall system, the supply models are linked to a market model. This market component is a global spatial multi-commodity model based on the 'Armington assumption' (ARMINGTON, 1969). It covers 40 products representing all marketable outputs delivered by the activities included in the regional supply models as well as oils and cakes from oilseeds, sugar and seven types of dairy products (skimmed and whole milk powder, butter, cheese, fresh milk products, cream and concentrated milk). Distinguishing imports by origin and exports by destination, the Armington assumption allows the modelling of bilateral trade flows between 18 countries or country blocks in the world.[6] These trade flows are affected by a complete set of import tariffs expressed in ad valorem and specific terms, tariff rate quotas (TRQs) and trade preferences given by the EU, flexible levies for cereals[7] as well as sugar and rice safeguards[8]. Export subsidies in the EU are modelled endogenously as a function of world and EU market prices, and changes in intervention stocks as a function of EU market and administrative prices. Flexible functions complying with microeconomic conditions ensure that the model's reactions are in line with economic theory and allow for a consistent welfare analysis.

The supply and market modules of CAPRI are linked by an iterative procedure which delivers in each iteration prices from the market model to the regional supply models. They are solved at these fixed prices and the resulting supply and feed quantities are then returned to the market model, so that a new set of prices is generated. This procedure is repeated until convergence of prices and quantities is achieved. Additionally, in between iterations, CAP payments are adjusted in an additional 'premium module' to comply with value or physical ceilings as notified by the

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3 In the current analysis the CAPRI_05v1 version (first version released in 2005) is used in order to differentiate from previous ones. In BALKHAUSEN et al. (2005) results of a previous version of CAPRI released in 2003 are discussed (BRITZ et al., 2003).

4 The CAPRI modelling system is maintained, applied and further developed by a network of European researchers co-ordinated by the Institute of Agricultural Policy, University Bonn, and mainly funded by EU research projects or directly by EU Commission services. A reference version of the model along with its documentation, underlying data base and exploitation tools is distributed to the network during yearly training sessions. Further information can be found at: http://www.agp.uni-bonn.de/agpo/rsrch/capri/capri_e.htm

5 These regions correspond to the Nuts 2 EUROSTAT nomenclature.

6 Trade blocks in the model are: EU-15, EU-10, Bulgaria & Romania, rest of Europe, USA, Canada, Mexico, MERCOSUR countries, rest of South America, India, China, Japan, rest of Asia, Australia & New Zealand, Mediterranean countries, least developed countries, ACP countries and rest of the world. The EU-15, EU-10, MERCOSUR and Mediterranean countries feature behavioural equations at single country level.

7 The flexible levy or tariff is equal to 155% of the intervention price minus the c.i.f. (cost, insurance and freight) import price as long as the resulting tariff is below the WTO bound rate.

8 Data on import tariffs are obtained from the Agricultural Market Access Database (http://www.amad.org) and aggregated to the product and regional coverage of the model. The final tariff is the result of a simple formula: sum of an unweighted arithmetic average (50%) and an import weighted average (50%) of all tariff lines related to one product category in the model.

Commission. Linked to the results of the premium and market modules, there is a module which calculates the complete first pillar of the FEOGA budget ex-ante. Finally, iterations also ensure that young animal markets at EU level are cleared by a price mechanism which links raising and fattening animal activities.

2.2 Land allocation

In CAPRI, the total agricultural area in each of the Nuts 2 regions is divided into arable and grassland, which are considered fixed resources and, consequently, are not changed in simulation runs. Crop activities, including set-aside and fallow land, compete with each other for this limited resource, which is distributed according to the activity contribution to the objective function under the explicitly modelled agronomic and economic constraints. The list of crop activities exhausts the whole Utilisable Agricultural Area (UAA) and covers vegetables, fruits, olive oil, etc. Nurseries, flowers and a residual activity from the Economic Accounts of Agriculture are trend forecasted and kept constant in the simulation. Under the Agenda 2000 policy package, obligatory set-aside is linked through additional constraints to Grandes Cultures. Moreover, all crop activities are modelled including a high and low yield variant with their own set of input and output coefficients and resulting gross margins. Yields at regional level are hence endogenous and react to changes in market and policy incentives. Even with grassland areas fixed, the model still might change the amount of grass produced through changing intensity of production.

For all activities, marginal revenues, consisting of market revenues plus premiums per hectare, are equilibrated with marginal costs at the optimal solution, including opportunity costs of exhausted resources. In the case of land, shadow prices are set to rental prices in the base period, when available, or are derived from the average profitability of the crop rotation. Here, the model specification differs from the typical PMP approach, where shadow values of limiting resources are set arbitrarily in a first step based on an auxiliary restricted linear program (HECKELEI and BRITZ, 2005). The linear and non-linear cost parameters are calibrated such that observed activity levels satisfy conditions for optimal land allocation given the shadow prices of land and prior information on supply elasticities.

2.3 Implementation of premium schemes

The model distinguishes about 25 different payment schemes of the CAP, including the options introduced with the Luxembourg Compromise 2003. These schemes differ regarding the payment base (per hectare, per head, per slaughtered head or per production unit), the list of eligible activities and the type of premium ceilings (expressed either in physical and/or value limits). The payments may vary across member states or even Nuts 2 regions depending on historic yields or, as in case of the Luxembourg Compromise, on premium envelopes based on historic volumes. All premiums are then linked to production activities and can be interpreted as activity specific factor subsidies paid either per hectare of land for crop activities or per animal/slaughtered head for animal production activities. So *technically*, premiums are generally 'not decoupled'. However, the impact on land allocation depends on the differentiation of premiums between production activities. In the case of a regional flat rate premium, no differential impact on profitability of activities per hectare would be exerted.

The different premiums paid to the activities are proportionally cut if ceilings of the relating scheme are exceeded. For example, under a certain scheme herds with 1,000 animals benefit from the full declared premium. If the actual herd size is 2,000, each animal receives only 50% of the declared premium. A herd with less than 1,000 animals implies that the budget of the scheme is not exhausted.

Despite its richness in detail, a certain aggregation bias of this approach has to be discussed. First of all, the effect of premium ceilings can only be evaluated at the lowest regional breakdown of the model, currently Nuts 2 regions[9]. Secondly, further farm specific conditions for premium modulation are not implemented. In the case of stocking density restrictions, we would expect 'shadow premiums' attached to fodder area if we solve ex-post a (binary) linear programming problem for a single farm. These shadow premiums would capture the fact that animal premiums are paid (or increased) if a certain fodder area is existent. That effect is mimicked in CAPRI by reallocating in a rather ad-hoc manner certain percentages of the animal premiums to fodder producing activities[10]. And thirdly, due to the proportionate cut of premiums in case of exceeded ceilings, the model is not able to capture a farm specific ceiling which lets the marginal premium drop to zero. This drawback should be kept in mind when looking at the results of the Luxembourg Compromise for such countries where the so-called farm premium was implemented, leading to the number of eligible hectares being generally larger than the base area. In this case, we would expect the rent to go rather to the premium entitlement and not to the land. In CAPRI, however, the premium paid per hectare would be proportionally reduced to satisfy the value ceiling and would thus affect the land rent.

3. The scenarios

3.1 Baseline scenario

The *CAPRI baseline* captures the current CAP legislation: the *2003 Luxembourg Compromise plus 2004 amendments* dealing with fibre crops, tobacco and olive oil (COUNCIL OF THE EUROPEAN COMMUNITIES, 2003a and COUNCIL OF THE EUROPEAN COMMUNITIES, 2004). The baseline reflects the projections by DG-AGRI, FAPRI and FAO on hectares, yields and production for major crops and animal products at European and international level (COMMISSION OF THE EUROPEAN COMMUNITIES, 2004; FAPRI, 2003; BRUINSMA, 2003). Results are presented for the year 2010 in current prices, inflation being set at 1.9% per annum. In opposite to previous reforms, the new CAP introduces a certain degree of flexibility regarding the implementation of the new payment schemes. The following table shows the implementation options selected by the different member states in-

[9] A model version with farm types inside the Nuts 2 regions is currently in revision and planned to be operational in the near future.

[10] 50% of bull premiums, sheep and goat premiums, national envelope for sheep and goats, suckler cow premiums and national envelope for bovine meat cattle are mapped to grass and fodder land. Additionally 70% of bull and suckler cow extensification premiums are also mapped to grass and fodder land.

cluded in the CAPRI baseline. The information contained in it draws to a large extent on a recent review by MASSOT MARTÍ (2005) (see table 1).

The effect of the different payment schemes offered as part of the Luxembourg Compromise in CAPRI can be described as follows:

- In the case of the so-called *regional or hybrid models* (identical premiums at regional level), all crops are eligible, including to a certain percentage of fallow land. Simple hybrid models (Denmark and Sweden) define certain percentages of payments as farm specific and maintain them constant in the future. Dynamic hybrid models (Germany, Finland, United Kingdom and EU-8) lead to a regional flat rate per hectare within a defined time period. The decoupled part of the crop and animal specific premium is converted into a flat rate premium for any type of agricultural land kept in good agricultural condition. Different premiums may also be paid on arable and grassland (in all cases but Sweden). For example, in Germany uniform premium rates are defined at Nuts 1 level (regionalisation level of individual "Länder") at the end of the transition period in 2013.
- In the case of *individual farm premium models* all so-called "COP" activities (cereals, oilseeds, fodder including grassland, fibre crops, sugar beet and all types of set-aside) are eligible but the base areas exclude sugar beet (as stated in the legislation). Contrary to the regional flat rate, fruits and vegetables as well as other permanent crops are excluded both from the base area and the list of eligible crops. As already mentioned, a certain aggregation bias must be admitted in this analysis, since each Nuts 2 region is treated in the model as one farm. Accordingly, in case of the farm premium model, premiums per hectare for the eligible crops are identical at Nuts 2 level.

The premium envelope in € per year and region for the different premium schemes is evaluated based on the payments per activity valid in Agenda 2000 plus the modifications introduced by the Luxembourg Compromise and subsequent reforms (tobacco, olives, starch potatoes).Thy are multiplied by the base year levels (three-year average 2000-2002). At this stage, eventual cuts in declared premiums per head or hectare might occur if ceilings on quantities or values are exceeded. Finally, premiums are reduced according to the modulation percentages set by the Commission. These amount to 5% from 2008 onward subject to farm structure dependent reductions in the modulation percentage as the first 5,000 € of premiums per farm are exempt from modulation.

In terms of decoupling, it should be understood that the current legislation has been, more or less, literally translated into the model specification. In the case of 'full decoupling' (Germany, United Kingdom, Ireland, Italy and Malta), the affected premiums are removed from the activities where they had been paid to and added to a new budget which is evenly distributed to all crops defined as eligible under the new scheme. Hence, the new premiums are interpreted as 'crop specific subsidies to land', with many or even all crops receiving the same premium per hectare. The

Table 1. Most probable implementation by EU-25 member states of the policy options approved with the Luxemburg compromise

Member state	Arable crops partial decoupling				Lifestock partial decoupling				Reference for the Single Farm Premium			Implementation period	Integration of milk reform in SFP
	25% direct premiums	**or** 40% Durum Wheat premium	0-40% Olive and olive oil sector	60% Tobacco [3]	50% sheep and goat premium	100% suclercow + 40% slaughter premium	**or** 100% shlaughter premium	**or** 75% male beef premium	Individual farm premium	Hybrid model simple	Hybrid model dynamic		
France	x				x	x			x			2006	2006
Belgium + Luxemburg [1]							x (Belgium)		x (Belgium)	x (Lux.)		2005	2006 (Belgium) 2005 (Lux.)
Netherlands					x		x		x			2006	2007
Austria						x			x			2005	2007
Germany				x							x	2005	2005
Finland					x			x			x	2006	2006
Denmark					x			x		x		2005	2005
United Kingdom [2]									x (Wales, Scotland)	x (North Ireland)	x	2005	2005
Ireland									x			2005	2005
Sweden							x			x		2005	2007
Spain	x		x (5%)	x	x	x			x			2006	2006
Portugal						x			x			2005	2007
Greece	x				x	x			x			2006	2007
Italy				x					x			2005	2006
Rest (EU-10) [4]											x	2007-09	---

[1] Belgium and Luxemburg are modelled together in CAPRI.

[2] Within the United Kingdom England has chosen a dynamic hybrid model, Wales and Scotland a farm historical premium scheme and North Ireland a static hybrid model.

[3] It is allowed to keep 60% of tobacco payments coupled until 2010. Afterwards 100% decoupling must be assumed.

[4] For the EU10 countries no partial decoupling is considered. A flat rate premium is assumed to increase gradually over time until 2013 (in 2012, 90 % of the negotiated premium ceiling values are paid to agricultural activities).

Source: Arts. 66 and 68 of (COUNCIL OF THE EUROPEAN, 2003b); Art. 110 Reg. EC/864/2004; partially based on the compilation made by (MASSOT MARTÍ, 2005).

premiums are 'paid out' in the model at 100%, but since (almost) all types of agricultural land uses are covered, the major part is mapped into a change of the land rent. Indeed, if the gross margins of all crops in a region were increased by the same amount per hectare, the only effect would be an increase of the land rent by the very same amount, ceteris paribus. However, effects on the simulation at hand are somewhat more complex, since (a) previously coupled premiums are removed both from crop and animal activities, but replaced by flat rates paid solely to crops, (b) not all crops are eligible depending on the implementation scheme, (c) there are additional exogenous changes in other parameters such as administrative prices and set-aside obligations, and (d) there is a simultaneity of price and land allocation changes.

In almost all European regions, there is *fallow land*, which was not in set-aside programs in the past. The question is if this land should be made eligible for premiums under the Luxemburg compromise. The consideration of two corner solutions sheds some light on this issue. The first one is to exclude any fallow land currently not in set-aside programs from being eligible, following the argument that it is not possible to keep it in 'good agricultural conditions' if it was not found in set-aside programs so far. This argument may be backed up with the assumption that cross-compliance may be more strictly enforced in the future. The second solution would consider all fallow land found in statistics as eligible for decoupled premiums. There are two possible arguments which favour this solution: (1) in the Agenda 2000, upper limits on set-aside at farm level were initially established in some member states. These restrictions are removed under the new legislation and could trigger an increase in voluntary set-aside; (2) it could be argued that farmers may have been cautious about putting large land shares in set-aside programs in an 'environment' of coupled support schemes, fearing future drawbacks on production entitlements or premium rights. These considerations could be removed if the new legislation is felt as a 'no return' switch to decoupled support. Reality will probably lie somewhere in between the two corner solutions. A mix of both is used for the simulations presented here which renders between 25% and 75% of the fallow land found in the base year outside of set-aside programs as eligible, depending on the share of voluntary set-aside compared to that of fallow land.[11]

3.2 Comparison scenario

The results for the Luxembourg Compromise are contrasted with simulation results for 2010 under a continuation of *Agenda 2000*, which not only would have led to different future premium schemes but to some further changes in Common Market Organisations (CMOs). Notably, we define Agenda 2000 as the legislation in place before the Luxembourg CAP reform for the year 2010. In this scenario, administrative prices would remain at higher levels in 2010 for cereals (+2.5%)[12], rice (298 € instead of the 150 € agreed in the Luxemburg compromise) and butter (+10%). Moreover, contrary to the Luxembourg Compromise, no limits on the intervention of butter, rice and rye are introduced, along with subsidies paid to process or market dairy products at base period levels. The latter are assumed to drop by 50% in the comparison scenario with respect to the base period budgetary outlays, assuming that these cuts were used to finance increased payments to dairy cows.

4. Results

Generally, a reduction of activity levels profiting from coupled support under the Agenda 2000 along with price increases for related outputs and/or substitution with imports is expected from the application of the Luxemburg agreement. This effect should be especially large in marginal areas, where the probability that part of the coupled premiums is required to cover production costs is higher. Likewise, the removal of coupled support should increase land rents if land is the scarce factor to activate the premium entitlements. The current analysis supports these general expectations, but allows simulating the quantitative dimension of these reactions at EU, national and regional level.

4.1 Pan-European perspective on land use changes

As presented in table 2, the main effects of the Luxembourg Compromise on land use at EU-25 level compared to Agenda 2000 are a reduction of the area of cereals (-5.5% or -3 Mio. ha) and oilseeds (-2.7% or -164 thousand ha) as well as of vegetables and permanent crops (-1.6% or -224 thousand ha), the latter an effect of decoupling premiums paid to olive trees (-203 thousand hectares, 50% being removed in Spain). These changes are offset by a larger number of hectares of set-aside and fallow land (+13,2%) and fodder production (+2.4%). These land use changes interact with a drop in beef fattening activities (-3.5%).

The effect in the new member states is generally stronger than in the EU-15, as premiums there constitute a larger part of the farm's gross margin. It may be somewhat astonishing to see differences in obligatory set-aside of -1.3% for the EU-25, since the new legislation stipulates *a continuation of the historic set-aside obligation*. This effect can be explained, however, through the changes in cropping pattern between the base 2000-2002 (for which the historic set-aside obligation was calculated) and the year 2010 under the Agenda 2000 regime plus a decreasing share of small producers[13]. This leads to a higher proportion of crop production activities with set-aside obligations attached, so that the average set-aside rate increases under the Agenda 2000 from the base year to 2010. For the Luxembourg Compromise, however, the set-aside obligations are fixed at the three year average 2000-2002.

[11] In order to estimate the costs linked to cross-compliance conditions (an additional problem), an ex-post cost estimation for the existing set-aside based on econometric work with FADN data and standard gross margins is used (and then kept constant during simulations). In the case of fallow land currently not included in set-aside programs, a 50% extra cost compared to the existing set-aside is assumed to render it eligible.

[12] This corresponds to the abolishment of the monthly reports in the Luxemburg Compromise.

[13] Small producers are considered those whose COP production is less than 80 tonnes. These are exempt of the set-aside obligation. The small producer shares for 2010 are trended forecasted based on information from the European Commission for the EU-15 member states.

Table 2. Land use, yield and production effects for groups of activities in the EU-25 (Agenda 2000 and Luxemburg Compromise; year 2010)

	Agenda 2000				Luxembourg compromise 2003			
	Income [1]	Hectares or herd size	Yield	Supply	Income [1]	Hectares or herd size	Yield	Supply
	Euro/ha or head	1000 ha or hds	kg or 1/1000 head/ha or head	1000 t	Euro/ha or head	1000 ha or hds	kg or 1/1000 head/ha or head	1000 t
Cereals	408.2	54349.4	5390.1	292948.4	418.3 *2.5%*	51345.6 *-5.5%*	5471.3 *1.5%*	280928.9 *-4.1%*
Oilseeds	304.0	6189.2	2533.3	15678.9	347.0 *14.1%*	6024.8 *-2.7%*	2527.1 *-0.2%*	15225.3 *-2.9%*
Other arable crops	1410.2	9355.4	30029.1	280935.5	1466.2 *4.0%*	9388.2 *0.4%*	30681.1 *2.2%*	288041.5 *2.5%*
Vegetables and Permanent crops	3627.8	13990.0	20512.6	286970.6	3584.2 *-1.2%*	13766.4 *-1.6%*	20801.9 *1.4%*	286367.1 *-0.2%*
Fodder activities	112.0	71188.3	18153.1	1292290.9	250.0 *123.2%*	72920.4 *2.4%*	17638.2 *-2.8%*	1286187.3 *-0.5%*
Set aside and fallow land	130.4	13696.4	169.8	2326.0	199.6 *53.1%*	15510.2 *13.2%*	147.2 *-13.3%*	2282.9 *-1.9%*
All cattle activities	337.3	93763.9	1999.8	187508.9		92133.9 *-1.7%*	2022.4 *1.1%*	186326.9 *-0.6%*
Beef fattening activities	12.7	32978.6	180.7			31839.1 *-3.5%*	181.3 *0.3%*	

[1] Income is defined as revenues plus premiums minus costs. It is important to note that in the case of animal activities decoupled premiums do not remain at the activity level but are distributed to land (fodder and grassland), so that income is not anymore a good indicator.

Source: own calculations; CAPRI Modelling System

4.2 Land use changes in Germany at large

The effects on land use in Germany are similar in direction to those observed for the EU-25 but are smaller in magnitude, at least for the major crop activities (see table 3). The main driving force underlying the smaller changes in crop rotations in Germany compared to the EU-25 is the share of crops on total arable land where coupled premiums had been paid, i.e. *the larger the share, the lower the effect*[14]. In Germany the share of crops which were not profiting from premium schemes in Agenda 2000 (e.g. vegetables, horticulture) is quite low, so that the effect of the premium redistribution is dampened with respect to the European average. However, Germany features larger shares of arable land used for fodder production which where not eligible for premiums under the Agenda 2000, and here, the effect is stronger compared to the EU-25 average. Furthermore, in southern European countries, significant reductions in durum wheat production occurs, as this has been one of the more highly subsidized production activities before the most recent CAP reform. Due to the regional premium model, the redistribution of the animal premiums in Germany solely impacts on land rent, not on the allocation change for crops, as all crops under a specific land constraint benefit from the same amount per hectare stemming from regional animal envelopes. That is not the case in countries using the farm premiums, as there, the animal premiums are redistributed between a smaller number of eligible crops, which may explain to a certain degree stronger reactions in EU-25 compared to Germany. Some effect is caused by the partial coupling premiums in the different member states. Taking crop and animal premiums into account, larger changes could be expected under 'full decoupling' and 'uniform regional premiums' compared to the farm premium model. However, this effect is not easy to differentiate when comparing Germany and the EU-25: whereas the EU-10 uses a specific implementation of the regional flat rate premium, the so-called 'Single Area Payment Scheme', most other member states apply the farm premium system, some keeping parts of the old premiums coupled. Compared to the European average, the degree of decoupling in Germany is higher, so that stronger reactions in Germany could be expected, but the effect on the crop allocation appears to be limited given the above crop share argument. Finally, it should be mentioned that the larger changes in the EU-25 aggregate come from the EU-10, where the quality of certain results is still doubtful, as explained in more detail below.

In animal production, decoupling of premiums leads to rather pronounced changes in gross margins of some cattle activities, depending on the member state specific implementation. As shown in tables 2 and 3, reactions in Germany (-10.4% in beef meat activities) are more pronounced compared to other member states (-3.5% on average for the EU-25), mainly due to the fact that some countries keep certain percentages of premiums in the cattle chain as coupled support (see table 1). Additionally, Germany has a rather large share of less profitable cattle activities in mid-range mountain areas.

Further reactions in the model are more easily understood if the interactions with markets for outputs, young animals

[14] This is easily understood when looking at the extreme situation where a farm would only crop cereals and oilseeds under Agenda 2000 and the individual farm premium scheme would now be introduced. Apart from modulation, there would be no effect on premiums or cropping shares since the Agenda 2000 regime would have already acted as a uniform premium per hectare.

Table 3. Land use, yield and production effects for groups of activities in Germany (Agenda 2000 and Luxemburg Compromise; year 2010)

	Agenda 2000				Luxembourg compromise 2003			
	Income	Hectares or herd size	Yield	Supply	Income	Hectares or herd size	Yield	Supply
	Euro/ha or head	1000 ha or hds	kg or 1/1000 head/ha or head	1000 t	Euro/ha or head	1000 ha or hds	kg or 1/1000 head/ha or head	1000 t
Cereals	412.0	7301.1	7024.1	51283.6	469.5 *14.0%*	7100.7 *-2.7%*	7048.2 *0.3%*	50047.0 *-2.4%*
Oilseeds	508.8	867.3	3897.7	3380.7	582.5 *14.5%*	851.0 *-1.9%*	3903.5 *0.2%*	3321.7 *-1.7%*
Other arable crops	2031.4	992.2	40211.9	39897.1	2263.3 *11.4%*	1005.9 *1.4%*	41155.7 *2.4%*	41399.5 *3.8%*
Vegetables and Permanent crops	12695.7	301.9	109947.5	33195.5	12862.3 *1.3%*	302.3 *0.1%*	109869.7 *-0.1%*	33212.6 *0.1%*
Fodder activities	419.3	6906.8	32127.5	221899.6	550.6 *31.3%*	7107.9 *2.9%*	31041.4 *-3.4%*	220640.6 *-0.6%*
Set aside and fallow land	308.1	1615.4	830.4	1341.4	377.1 *22.4%*	1614.5 *-0.1%*	819.9 *-1.3%*	1323.7 *-1.3%*
All cattle activities	531.5	13207.7	2697.0	35621.3	440.9 *-17.1%*	12693.4 *-3.9%*	2786.3 *3.3%*	35367.9 *-0.7%*
Beef fattening activities	39.5	3570.8	245.8		-41.3 *-204.6%*	3199.9 *-10.4%*	249.7 *1.6%*	

[1] Income is defined as revenues plus premiums minus costs. It is important to note that in the case of animal activities decoupled premiums do not remain at the activity level but are distributed on land (fodder and grassland), so that income is not anymore a good indicator.

Source: own calculations; CAPRI Modelling System

and the effect on fodder areas are kept in mind. For meat markets the EU trade regime effectively allows imports only under preferential agreements, in many cases upper-bounded by binding Tariff Rate Quotas (TRQs). This prevents to a larger extent import substitution when EU meat production drops, which in combination with a rather inelastic demand leads to a strong price effect (see table 4). Secondly, the majority of calves in the EU still originate from dairy cow production, where the drop in administrative prices for butter and skimmed milk powder reduces quota rents but does not eliminate them. The effect is that the dairy cow herd in the EU remains almost unchanged[15]. In addition, there are only modest reactions in the number of suckler cows as member states with large suckler cow herds (e.g. France) have decided to keep suckler cow premiums coupled. The reduced demand for calves from beef fattening activities resulting from premium removal thus meets a rather inelastic supply of calves and leads to a reduction in prices for calves. This in turn dampens the income loss in fattening activities. Thirdly, the uniform premiums render fodder production more attractive, as the competitiveness of cereals and oilseeds is reduced.

The model simulates feeding practices with reduced cereals and increased fodder shares compared to Agenda 2000. It should be mentioned in this context that fodder prices used to calculate the gross margins of the activities as shown in table 3 under 'income per hectare or head' are calculated based on the Economic Accounts for Agriculture for the average year 2000-2002 and inflated to 2010. Since they are not changed between scenarios, the income drop observed in cattle activities (-17.1%) is most probably exaggerated. It must be kept in mind that, compared to marketable feed, fodder costs reflect production costs and substitution values in the regional supply models.

4.3 The regional dimension of changes in premiums

The *changes in premiums* at regional level stem from four different effects: (1) cuts of premiums due to modulation, (2) increased premiums for dairy cows, abolishment of durum wheat support in so-called 'established' regions, and some minor changes in support to energy crops, pulses and durum wheat in "traditional" regions, (3) a re-distribution of premiums in case of regional flat rate schemes between Nuts 2 regions inside a Nuts 1 region and (4) reductions in the fill rate of premium envelopes under reduced coupled support.

On average, premiums increase by about 2% in EU-25. Figure 1 shows "no change" as medium grey, so that accordingly more regions have increased premiums (dark grey) compared to decreased premiums (light grey). It should be mentioned that in some cases the average amount paid per hectare in Agenda 2000 is quite small, so that small changes may trigger a large percentage cut (e.g. 'Castilla y Leon' in Spain, where average premiums drop from 111 to 106 €/ha).

The so-called "modulation" could cut premiums up to 5%, but the actual effect depends on the farm structure, as the first 5,000 € of premiums received per farm are exempted from modulation. Unfortunately, information on the distribution of farm premiums was available only at member state level, so that no regional differentiation of modulation is reflected here. U.K. and Germany show the highest cut

[15] There are two „types" of dairy cows in the model differentiated by milk yields, so that changes in the herd size may take place at regional level even if total milk production is constant.

factors. Most farms in the majority of the other countries are in a group where cuts are around 3%, so that modulation would cut premiums by about 3% on average. Smaller average cuts due to modulation are found in Greece, Portugal, Spain, Italy and Finland, reflecting the fact that larger shares of farms are exempt from modulation. The low percentages in the Mediterranean not only reflect small average farm size, but also a production program with generally smaller premiums per hectare.

Decreases of premiums, for example in some French regions (Limousin and Auvergne), are due to the effect of reduced beef fattening activities in combination with coupled support. Whereas envelopes for beef fattening activities are simulated to be exhausted under Agenda 2000 in France, under the Luxembourg Compromise less than the remaining decoupled budget is paid, since the simulated drops in herds no longer fill the envelopes. An analogous effect can be observed for durum wheat premiums in Greece, partially coupled under the Luxembourg Compromise. Further effects in Mediterranean regions result from other general changes in the durum wheat premium schemes, the cuts of about 5% of the envelopes for the so-called traditional regions being the major effect. In Greece, for example, this premium scheme accounts for more than 10% of all premiums received.

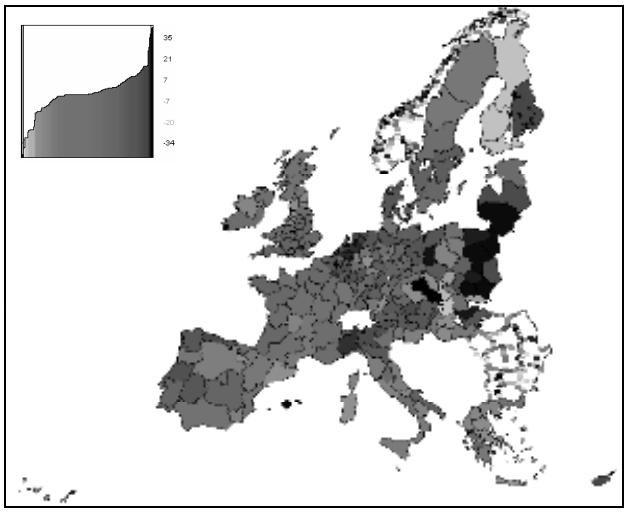
As for the old member states, larger increases in the premium budget are closely linked to a significant milk production per hectare (the dark grey regions in figure 2: the Netherlands, Namur in Belgium, Brittany and Basse-Normandie in France, Lombardia, and to lesser extent Veneto and Emilia-Romana in Italy, Galicia and Cantabria in Spain, Denmark, Germany and parts of Austria), as shown in figure 2 (white to light grey: 600 kg/ha or less; dark grey to black: more than 1,500 kg/ha).

Table 4. Evolution of premiums for groups of activities in Germany (Agenda 2000 and Luxemburg compromise; year 2010)

	Agenda 2000				Luxembourg compromise 2003			
	Ceiling physical	Actual level physical	Value ceiling	Actual value paid	Ceiling physical	Actual level physical	Value ceiling	Actual value paid
	1000 ha or head	1000 ha or head	Mio Euro	Mio Euro	1000 ha or head	1000 ha or head	Mio Euro	Mio Euro
Direct payment to grandes cultures	10156.0	10938.0		3534.9	*-100.0%*			
Specific payment for pulses								11.0
Established payment to durum wheat	10.0	4.6		0.6	10.0			
Payments to starch potatoes			78.7	78.7			47.2 *-40.0%*	47.2 *-40.0%*
Energy crop payment								15.3
Payments to fruits and vegetables			33.6	33.6			33.6	33.6
Payments to wine sector			10.8	10.8			10.8	10.8
Paymanets to tobacco			34.4	34.4			20.7 *-40.0%*	20.7 *-40.0%*
Suckler cow premium	639.5	1583.7		127.9	*-100.0%*			
Special premium to bulls and steers	1782.7	1722.1		361.6	*-100.0%*			
Direct income support to dairy cows			480.4	480.4			*-100.0%*	
Direct payment for sheep and goat	2432.0	6228.0		73.6	*-100.0%*			
Suppl. payment for sheep and goat			7.0	7.0			*-100.0%*	
National envelope for sheep and goat			1.8	1.8			*-100.0%*	
National envelope dairy cows			261.0	261.0			*-100.0%*	
National envelope bovine meat cattle			88.4	88.4			*-100.0%*	
Slaughter premium for adult cattle	4357.7	3826.4	348.6	306.1	*-100.0%*		*-100.0%*	
Slaughter premium for calves	652.1	909.8	32.6	32.6	*-100.0%*		*-100.0%*	
Extensification premium			46.4	46.4			*-100.0%*	
Regional flat rate premium					5448.5	5224.7	1309.2	4090.2
Farm specific payment					16983.4	17413.5	67.2	66.4
Hybrid premium farm							1445.4	1403.6
Sum				5479.9				5698.8 *4.0%*

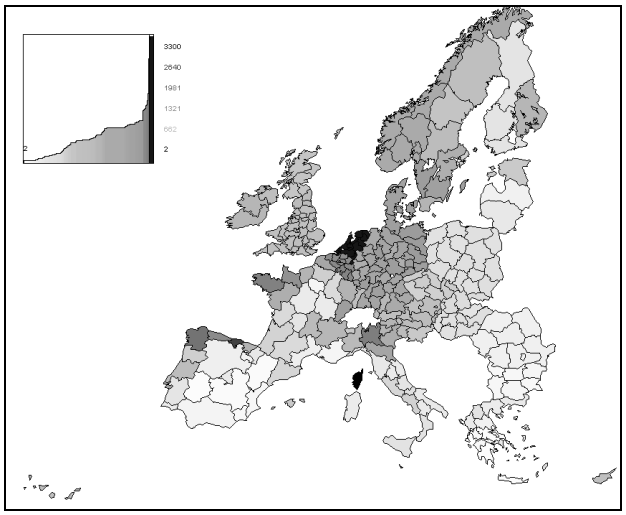
Source: own calculations, CAPRI Modelling System

Figure 1. Premiums per hectare in European Nuts 2 regions (Luxemburg Compromise / Agenda 2000 in %; year 2010)



Source: CAPRI Modelling System

Figure 2. Milk production per hectare in Europe (Agenda 2000 in kg/ha; year 2010)



Source: CAPRI Modelling System

An *analysis of changes in premiums paid* by comparing the two scenarios *for Germany* is far from straightforward, due to the multiple effects impacting on the results (see table 5 for an overview). Nevertheless, there are a few interesting points to note. The highest premiums per hectare according to the model calculations under Agenda 2000 in the year 2010, as shown in figure 3, are found in Schleswig-Holstein and in the regions[16] Arnsberg und Düsseldorf with close to 400 €/ha and the lowest ones in the regions Oberbayern, Weser-Ems und Brandenburg with 260-280 €/ha. High premiums in Germany, as elsewhere in Europe, are found in mixed regional production systems with an overall high intensity, producing temperate zone commodities under CMO's mainly affected by lower administrative prices and compensating premiums since the 1992 MacSharry reform. Low premiums per hectare in Germany are found in marginal areas, either in mountainous regions such as Bavaria, or in regions with less productive soils such as Brandenburg, where historic crop yields and stocking densities in cattle are comparatively low, the two major determinants for the average premium per hectare. It may be interesting to note that the two marginal regions mentioned draw comparable amounts of premiums per hectare of agricultural land from cattle farming despite their different natural conditions.

A significant part of premium increases moving from the Agenda 2000 to the Luxemburg compromise originates from higher premiums to dairy cows, falling in the flat rate premium and in some cases, from the redistribution between Nuts 2 regions inside a Nuts 1 region, as shown in figure 4. The strong percentage increase in Brandenburg, Lüneburg and Trier, all showing up in dark grey, is fully due to an approximate doubling of premium envelopes to dairy cows, introduced to offset the reduction in the administrative prices. Stronger reductions in Arnsberg and Düsseldorf, regions with very high premiums under Agenda 2000 (see figure 3), are due to a redistribution inside of 'Nordrhein-Westfalen' towards other regions, as the regional flat rate system gradually leads to uniform premium rates at Nuts 1 level. Oberbayern, as the opposite, had comparatively low premiums under Agenda 2000 but benefits under the Luxembourg Compromise from a redistribution from other Nuts 2 regions in Bavaria, receiving up to 100 €/ha higher premiums. This explains the reduction in regions surrounding Oberbayern. In Brandenburg, however, there are no redistribution effects shown in our calculations, since all Nuts 2 regions have quite similar premiums per hectare.

The changes in premiums in the new member states are generally stronger compared to the EU-15. A comparison of the two policy regimes for these countries is not that simple: despite the fact that we have some information on base areas and herd sizes for the EU-10 discussed during the negotiation phase, they may not completely reflect how premium budgets and their related ceilings may have looked like after the final negotiations regarding the accession. For the EU-10, premiums increase on average by 5% when moving to the Luxembourg Compromise. As an over-

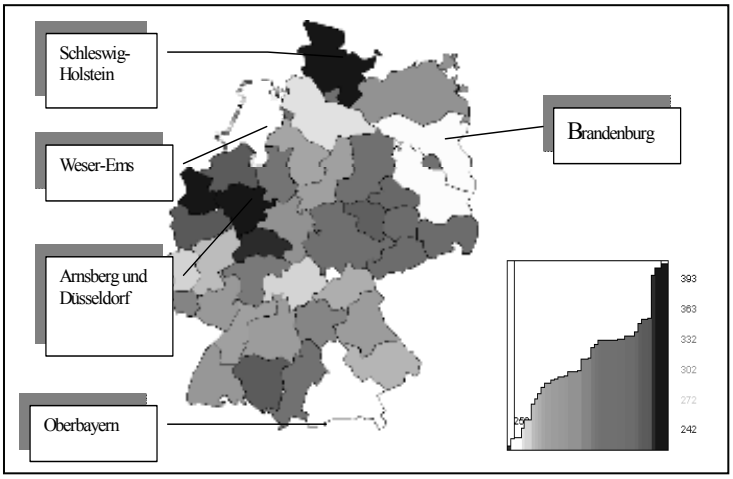
Table 5. Producer prices in Germany (Luxemburg Compromise / Agenda 2000 in €; year 2010))

	Producer Price % Lux. Compromise/ Agenda 2000
Soft wheat	3.2%
Rye and meslin	-0.7%
Barley	3.9%
Oats	7.6%
Grain maize	4.5%
Other cereals	6.6%
Pulses	0.7%
Potatoes	0.4%
Beef	8.4%
Pork meat	1.1%
Sheep and goat meat	10.0%
Poultry meat	1.5%

Source: own calculations; CAPRI Modelling System

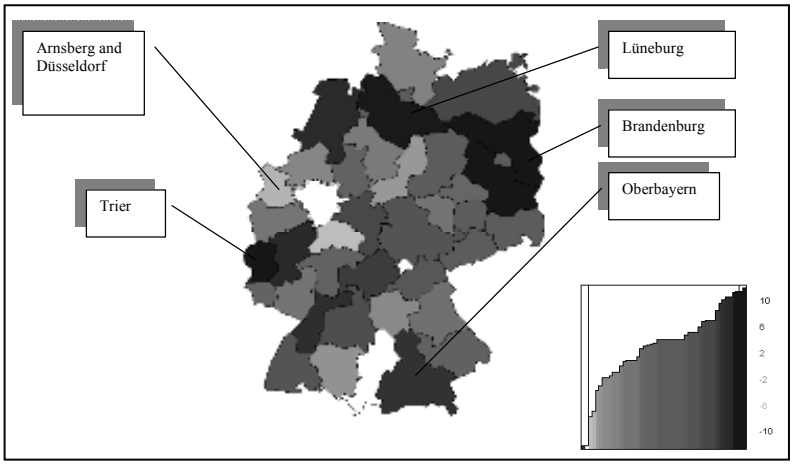
[16] The Nuts 2 regions in Germany correspond to „Regierungsbezirke" and the Nuts 1 regions to „Bundesländer".

Figure 3. Premiums paid per hectare in Germany (Agenda 2000 in €; year 2010)



Source: CAPRI Modelling System

Figure 4. Change in premiums paid per hectare in Germany, (Luxembourg Compromise compared Agenda 2000 in %; 2010)



Source: CAPRI Modelling System

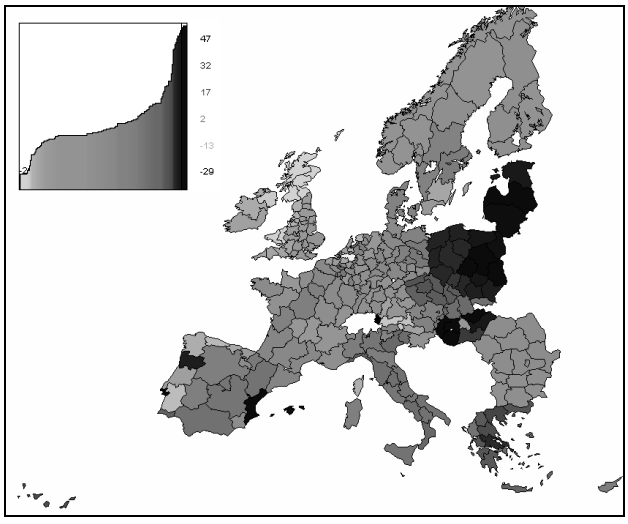
all picture, we infer that the less productive regions may have benefited from the compromise as they exhaust their budget, whereas under Agenda 2000, the combination of coupled support and lower prices had put them in a position where base areas for some countries and production activities would not have been filled. Decreases in some of the new member states (Czech Republic, Slovak Republic, Slovenia) may hint at a data constellation where the assumed base areas and herds under Agenda 2000 had been optimistic compared to what was negotiated under the Luxembourg Compromise.

4.4 The regional dimension of changes in land use

The last part of this section will look at *changes in land use, analysing clusters of regions*. A first major effect can be seen when looking at changes in fallow land, see figure 5. Strong effects can be observed in the new member states and some Mediterranean regions. It is important to stress that, given the limited information on how the Agenda 2000 would have been implemented in the EU-10, the effects shown here have to be interpreted cautiously. In general, a continuation of the Agenda 2000 would have implied that part of the variable production costs in regions with low cereal and oilseed yields would have been covered by coupled premiums, so that decoupled support will reduce production in those marginal areas. The effects in the Mediterranean regions are due to the removal of strong coupled incentives to durum wheat and olive oil, the major effect being the reduction in durum wheat areas as shown in figure 6. Reductions in areas for olive oil production are generally lower, due to quite small supply elasticities.

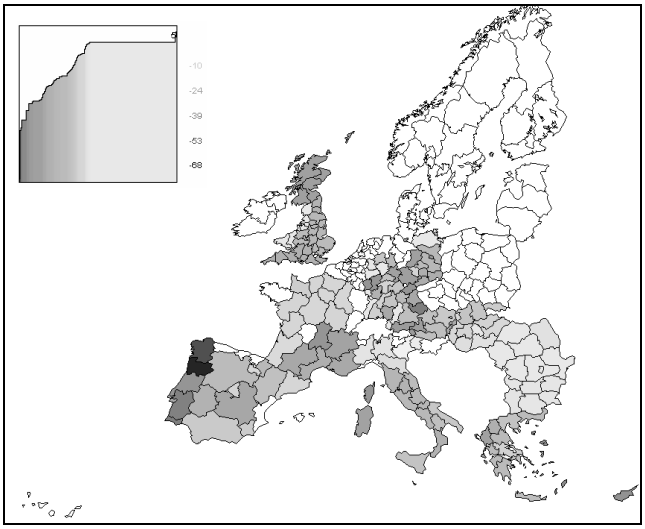
In the cases discussed so far, the Luxembourg Compromise leads to an increase in fallow land. Increases in fodder areas with no changes in fallow land, or even slight reductions, can be found in regions with extensive grazing systems (e.g. UK, Ireland, Austria, Portugal, northern Spain and some regions in France). There are two major effects responsible for these results. On arable land, areas devoted to fodder production are expanded, as the profitability increases relative to cereals, oilseeds and fodder maize production, which benefited greatly from coupled support in Agenda 2000. That expansion is accompanied with a reduction in silage maize which is replaced by less intensive fodder production. A major determining factor for the extent of changes at the regional level is the share of fodder maize on arable land (see figure 7). As we assumed that fodder maize was receiving cereal premiums under the Agenda 2000 (and was hence not used to increase the "fodder area" in order to comply with stocking density restrictions), removal of coupled support strongly increases the relative competitiveness of other types of fodder produced on arable land, as this is now eligible under the Luxembourg Compromise. In many regions with considerable shares of fodder maize, it can be observed

Figure 5. Fallow land and set-aside areas in European Nuts 2 regions (Luxemburg Compromise / Agenda 2000 in %; year 2010)



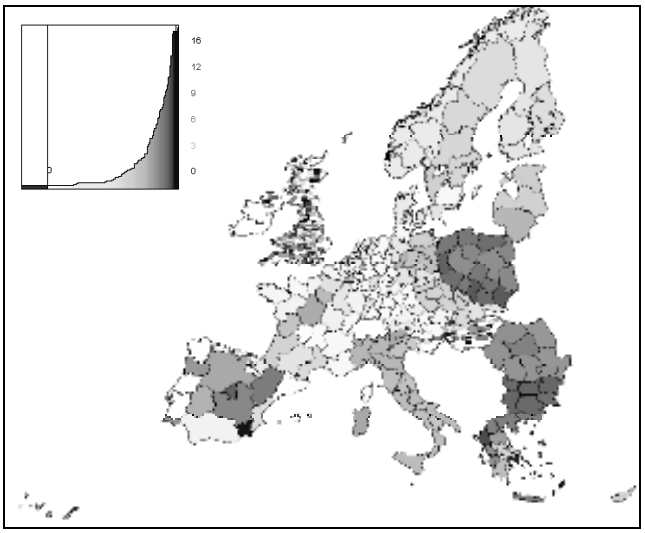
Source: CAPRI Modelling System

Figure 6. Changes in durum wheat areas (Luxemburg compromise / Agenda 2000 in %; year 2010)



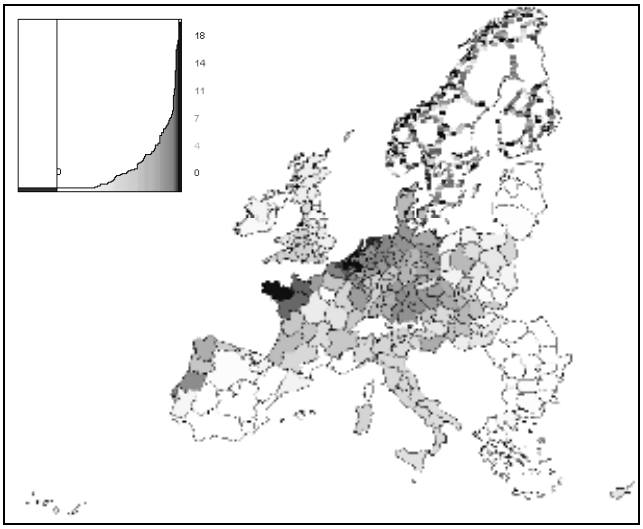
Source: CAPRI Modelling System

Figure 8. Share of fallow land on total land (Agenda 2000; year 2010)



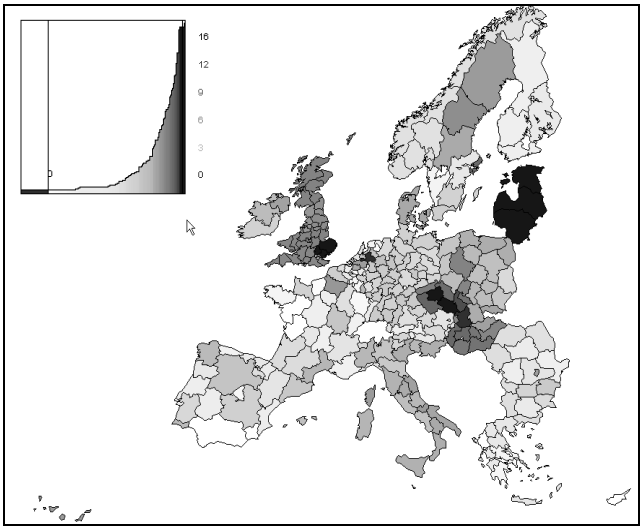
Source: CAPRI Modelling System

Figure 7. Share of silage maize on total land (Agenda 2000; year 2010)



Source: CAPRI Modelling System

Figure 9. Changes in extensive grazing, (Luxemburg Compromise / Agenda 2000 in %; year 2010)



Source: CAPRI Modelling System

that fallow land increases slightly or even decreases (compare figure 5 and figure 7).

Additionally, the production intensity on grassland is reduced. As CAPRI currently does not model idling of grassland, these results are best interpreted as a combination of increases both in extensive grazing systems and in idling grassland. The fact that statistical information on fallow land seems not to be homogeneous across Europe remains as a specific problem. On the one side, our data base shows, for example, no fallow land in the UK and, accordingly, the model cannot simulate a variation (see figure 8). On the other hand, larger parts of Spain or the new member states are declared as idling Utilizable Agricultural Land in statistics. In many regions where the model shows no change in fallow land or even reductions (e.g. England), stronger extensification effects in grassland production are simulated (compare figure 5 and figure 9).

5. Conclusions

In this paper, a quantitative analysis of the impacts of the Luxembourg agreement compared to the Agenda 2000 policy is presented for the year 2010. Specific focus is on land allocation. The main results at the European level confirmed earlier analyses projecting decreases in cereal and oilseed acreage, an increase in land allocated to fodder and fallow land/set aside, as well as a reduction in beef fattening activities. Corresponding output prices generally increased. The specific contribution of this paper is a rather detailed analysis of national and regional differences in adjustment, based on the national policy implementation. For example, the smaller adjustments in cereals simulated for Germany can be explained with larger than average cereal shares at the outset in combination with the decoupling effect and the strong effects on durum wheat produc-

tion in other countries. Furthermore, regional changes in premiums paid per hectare at Nuts 2 level could be explained by a combination of redistribution within larger regions relevant for the uniform flat rate premium, the relevance of milk production activities in the respective regions and the observed effect of underutilized envelopes in case of remaining coupled support.

Although the analysis proved that regional differentiation provides a useful tool for understanding land allocation effects at national and European level, there are also limitations associated with the chosen modelling approach. The representative farms at regional level do not allow to fully represent the farm specific premium schemes with potentially differentiated effects between farm types. Also, the lacking distinction between eligible land and premium rights limits the interpretability of the impact of different premium schemes on land rents. Furthermore, missing farm structure information within the regions does not allow to properly address special small farmer regulations, for example in connection to modulation. The latter is currently addressed in research activities exploiting information on farm types at the regional level.

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