

Welfare distribution between EU Member States through different national decoupling options - Implications for Spain

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ABSTRACT: This paper makes use of an agricultural sector model to analyse welfare effects derived from different national implementation options of the CAP Reform 2003. It shows that agricultural prices developed more favourable in a full premium decoupling scenario, since agricultural production declines more pronounced compared to a partial decoupling scenario. The use of the partial decoupling mechanism helps Member States to distribute income into less favoured areas but is not the optimal policy choice. However, if other Member States follow the same path of reform, a 'prisoner's dilemma' will most likely be observed: partial decoupling appears as the preferred option for individual Member States, since high domestic production and high producer prices would be expected, but this would lead to welfare losses for consumers and taxpayers.

KEY WORDS: Common Agricultural Policy, Partial equilibrium analysis, Modelling, Decoupling, Welfare analysis.

JEL classification: C61, D60, Q18.

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Distribución de bienestar económico entre Estados Miembros ante distintas opciones de desacoplamiento en el marco de la nueva PAC – Consecuencias para España

RESUMEN: Este trabajo modeliza los efectos en el bienestar económico derivados de distintas opciones de desacoplamiento de las primas contenidas en la reforma de la Política Agraria Común aprobada tras los Acuerdos de Luxemburgo en 2003. Se observa como bajo un escenario de pleno desacoplamiento, los precios agrarios evolucionan más favorablemente que bajo un desacoplamiento parcial debido a una caída de la producción más pronunciada. El uso del mecanismo de desacoplamiento parcial permite a los Estados Miembros mantener determinados cultivos en zonas marginales, lo que resulta en una solución no óptima. Si los demás países siguieran el mismo camino de reforma, podría surgir un problema tipo «dilema del prisionero». La opción de desacoplamiento parcial aparecería como la opción preferida desde el punto de vista individual al asegurar una mayor producción doméstica y altos precios de producción. No obstante, a nivel agregado, el resultado sería una reducción de renta de consumidores y contribuyentes.

PALABRAS CLAVE: Política Agraria Común, análisis de equilibrio parcial, modelización, desacoplamiento, análisis de bienestar.

Clasificación JEL: C61, D60, Q18.

1. Introduction

With the decision of the Agricultural Council in Luxembourg in June 2003, the discussion about state and future perspectives of the Common Agricultural Policy (CAP) came to an end. Since nowadays agricultural policy covers much more than only farm policy and food production, the debate was followed by stakeholders from a wide range of groups within European and international organisations.¹ The reform aimed at a stronger market orientation of European agriculture by lowering intervention prices and safety-nets, providing incentives for a more sustainable agriculture, and preserving the characteristics of regional European landscapes and the production of high quality food.

In order to achieve these goals, the reform proposal introduced a payment scheme where a large part of the direct payments were merged into one single premium «decoupled from production» (Council of the European Communities, 2003). Nevertheless, several decisions such as the degree of decoupling and the date of implementation were left open to Member States, which could choose from a restricted number of options according to their national interests. As first modelling studies show, national decisions on the degree of decoupling have a considerable impact on price and supply developments, in particular for commodities strongly supported via direct payment regulations (Britz *et al.*, 2003).² Therefore, the analysis of the welfare distri-

¹ Stakeholders such as COPA, Euronatur, WWF, EU taxpayer's associations, consumer, or international development groups commented on the CAP reform proposals of the European Commission.

² A similar argument was broad forward by ZANIAS 2002 who showed that full decoupling has different redistributive effects among Member States depending on the 'direct subsidisation' and 'price support' received by the commodities produced in a country. Member States with a relatively low GDP but

bution within the EU regarding different degrees of decoupling should reveal important gains and losses for the different Member States.

The main effect expected from «decoupling» is a shrinking of agricultural production. This is due to the fact that unprofitable activities in specific locations will not receive anymore incentives to remain in production. This may lead to higher prices for the products affected and, consequently, provoke welfare gains for producers and losses for consumers. Additional uncertainty about budgetary expenses and welfare changes result from different national premium choices and how total welfare development is related to different degrees of decoupling. Given the interaction of these factors, an impact forecast is only possible within the framework of a complex modelling system able to capture as much of these dependencies as possible.

Several modelling studies have recently addressed some of these issues. The OECD analysed two decoupling scenarios (maximum and minimum) and foresaw an improvement in overall welfare by «full decoupling» with an expansion of pastures and increase of cereal prices (OECD, 2004, p. 44). Furthermore, they appraised the retention of a certain degree of coupling by Member States in order to meet their land management concerns as an economic distortion. Conforti *et al.*, 2003 calculated with the GTAP-5 model (year 1997) the effects on prices and supply of three decoupling scenarios. In this model, decoupling is included through a flat rate ad valorem subsidy on land use equivalent to the total budget expenditure for direct payments in the reference scenario. Fruits and vegetables production are expected to increase specially in Spain and Greece due to the reduction of coupled payments for competing products³. Balkhausen *et al.*, 2005 compare simulation results from different models⁴ and conclude that cereal and silage maize area as well as ruminant production in the EU15 will 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, reference scenario, etc.) and specific assumptions on national decoupling options.

The quantitative analysis presented in this article is based on the CAPRI modelling system and focuses on the implications of agricultural reform for the EU25 and Spain. It compares welfare, agricultural income and production indicators projected to 2012 under adoption of the CAP reform proposal 2003, with a reference scenario

agricultural production of products that mainly benefit from direct subsidisation through the EU budget rather than through market price support, receive overall higher net budgetary transfers from the EU.

³ This effect might change in the final legislation, in particular for Spain and Greece. Fruits and vegetable production may be positively affected by the reduction of coupled payments for competing products and the distribution of the decoupled premium, with fruits and vegetables now eligible. The decoupling of olive oil premiums may have a negative effect for some countries.

⁴ 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, p. 8).

which models the full implementation of the Agenda 2000 proposal continued until 2012. A main determinant of the results lies in the implementation of the new single payment scheme. Two simulation scenarios are here considered: a *full decoupling option*, where all premiums dealt with in the legislation are converted into a flat rate paid to land in all Member States, and a *partial decoupling option*, where the preferred implementation option for each of the Member States as notified to the European Commission is used. Two additional simulation scenarios are modelled in order to analyse the Spanish case: a *full decoupling scenario for Spain*, with the rest of the Member States implementing the policy according to their stated preferences, and a *partial decoupling scenario for Spain*, with the rest of Member States following the full decoupling option. The objective of these simulations is to analyse the impact of the other Member State's decoupling decision on welfare developments in one Member State, using Spain as an example.

The paper is organised as follows: in section 2 the evolution of the 2003 CAP reform is briefly presented, followed by a detailed description of the different decoupling and national implementation options in section 3. Afterwards, in section 4, the analytical approach is described and several assumptions for both reference and simulation run discussed. Sections 5 and 6 analyse selected results for the EU25 and implications of different policy implementation options for Spain. Conclusions are drawn in section 7.

2. Evolution of the CAP Reform 2003

With the decision of the European Council in Berlin in the year 1999, the European Commission was mandated to submit a mid-term review of the Agenda 2000 (MTR). The discussion of the stocktaking report on cereals, oilseeds, and beef markets, and the future of the milk quota system in view of the standstill in the Doha round World Trade Organisation (WTO) negotiations, led not only to certain adjustments of imbalances in the EU markets but to substantial reform proposals for the CAP (Commission of the European Communities, 2002a).

In June 2003, after one year of negotiations between the Member States and the European Commission, a reform compromise for the CAP was decided upon (Council of the European Union, 2003). Important points of reform in order to achieve these goals were the following ones:

- Introduction of a decoupling scheme based on production data in a reference period and paid to a larger extent independent of production choices. Arable land, permanent pasture and permanent crops are considered as eligible activities. Member States have the option to retain certain part of the premiums and grant additional coupled support (Council of the European Communities, 2003; Council of the European Communities, 2004a and Council of the European Communities, 2004b).
- A strengthening of the cross-compliance provisions by allowing the reduction of direct payments when obligations that arise from environmental, food sa-

fety or animal welfare standards are not met. Introduction of a compulsory farm advisory system from 2007 onwards.

- Transfer of financial resources from the direct payment schemes under the first pillar of the CAP to rural development (second pillar). Under this «modulation» mechanism, up to 5% of farm direct payments can be affected.
- The market regulations undergo major changes in the rice and dairy markets where intervention prices will be further reduced compared to the Agenda 2000 and the abolishment of the monthly increments for cereals. Moreover, the use of intervention instruments will be restricted. These intervention price cuts will only be partially offset by the introduction of compensatory direct payments. These newly introduced direct payments will be included in the single farm payment (SFP).
- Prolongation of the milk quota system until 2014/2015.
- In a second step, the Common Market Organisations (CMOs) for tobacco, hops, olive oil, and cotton were reformed with a stronger emphasis on the decoupling of production premiums and the integration in the SFP scheme (Council of the European Communities, 2004a).

In the Agenda 2000, Spain was assigned 52 Bio € for the period 2000-2006 in form of structural and cohesion funds and therewith is the highest net receiver of agricultural funds. This high subsidisation has allowed many agricultural regions to invest in technology and catch up economically with their northern neighbours but at the same time has led in several cases to less market-oriented sectors than in other Member States, with some farms being «artificially» maintained. Moreover, the current reform falls upon highly sensitive CMOs for several Spanish regions: *decoupling of olive oil payments* (Andalucía), *reduction of durum wheat premiums* (Extremadura), *reduction of intervention prices for paddy rice* (Comunidad Valenciana and Murcia), and *intervention price cuts for the dairy sector* (mainly in Galicia, Asturias, Cantabria and País Vasco). Although the premium decoupling mechanism should not affect agricultural income, since total premium payments are mostly maintained, it has important political and economic implications in Spain. Local production re-orientation, for example through the conversion of arable land into fallow land, and land abandonment due to the lack of competitiveness in rural regions may appear.

3. Implementation of the CAP reform across Member States

As previously mentioned, the horizontal regulation of the CAP reform 2003 allows each Member State a certain degree of freedom in the implementation of the decoupling mechanism. According to the last governmental decisions and national expert data, it is possible to distinguish three decoupling systems to be applied:

1. *Full decoupling*: disconnecting of direct payments from production to the largest extent allowed by the regulation. This option is most likely to be

chosen by Germany, Italy (with the exception of 60% of tobacco premiums until 2010), Ireland, and the United Kingdom. Whereas Italy and Ireland will probably plead for uniform farm premiums, Germany and the United Kingdom have expressed their preferences for a dynamic hybrid model, where farm premiums are regionalised over time and distributed on a hectare basis (independently of the land allocated to animal or crop activities).

2. *Minimum decoupling*: retention of direct payments in their existing form according to the legislation. In particular southern European countries have positioned themselves against the decoupling mechanism and will try to keep premiums coupled (with the exception of Italy). France, Greece⁵, Portugal, and Spain will probably keep 25% of cereal premiums coupled to avoid the abandonment of this activity in less developed regions. All these countries voted for a uniform farm premium rather than the hybrid variant or a differentiation of arable and grassland flat rate premiums.
3. *Partial decoupling*: decoupling of direct payments except for animal premiums, either suckler cows, slaughtering or male beef premiums (different combinations). This option is most likely to be taken by the rest of EU15 Member States: Belgium, Luxembourg, Netherlands, Austria, Denmark, Finland, and Sweden. All these countries prefer the SFP, apart from Denmark and Sweden who will probably introduce a fixed regionalisation of premiums (simple hybrid model), and Finland, who goes for a progressive regionalisation of premiums (dynamic hybrid model).

The current national decisions on coupling options and premium models, with their expected implementation date, are resumed for the EU25 Member States in table (1).

4. Analytical approach

4.1. The CAPRI modelling system

For the purposes of this study the CAPRI model is chosen as the instrument of analysis. It is a spatial economic model that makes use of non-linear mathematical programming tools to maximise regional agricultural income with explicit consideration of the CAP instruments of support in an open-economy where price interactions with other regions of the world are taken into account. Its main characteristics are explained in detail in this section⁶.

⁵ The decision parameters for Greece are estimated.

⁶ In addition to the information presented here, further information is available on the CAPRI web page: http://www.agp.uni-bonn.de/agpo/rsrch/capri/capri_e.htm.

TABLE I
**Most probable implementation by EU25 Member States of the policy options approved
 in the Luxemburg compromise**

Member state	Arable crops partial decoupling				Livestock 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% suckler cow + 40% slaughter premium	or 100% slaughter 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	---

Source: Arts. 66 and 68 of Council of the European Communities 2003; Art. 110 Council of the European Communities 2004a; information based on the compilation made by Massot Martí 2005.

¹ Belgium and Luxemburg are modelled together in the CAPRI Model.

² Within the United Kingdom, England has chosen a dynamic hybrid model, Wales and Scotland a historical farm 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).

4.1.1. General system layout

This model is as a complex projection and simulation tool for the agricultural sector based on:

- An activity-based breakdown of regional agricultural production (39 crop and 19 animal activities) and farm and market balances (60 products and 35 inputs).
- A physical consistency framework covering balances for agricultural area, young animals, feed requirements for animals and nutrient requirements for crops. These requirement functions are modelled as constraints in the regional supply models.
- Economic accounting principles according to the definition of the European Accounts of Agriculture (EAA). All outputs and inputs in the national agricultural accounting systems are included, and revenues and costs are broken down consistently by regions and by production activities.
- A detailed policy description. The regional supply models capture all relevant payment schemes with their respective ceilings as well as set aside obligations

and sales quotas. The market component includes tariffs, tariff rate quotas, intervention purchases, and subsidised exports.

- *Behavioural functions and allocation mechanisms strictly in line with micro-economic theory.* Functional forms are chosen to be globally well-behaved, allowing for a consistent welfare analysis.

4.1.2. Supply module

In the supply component of CAPRI, regional agricultural supply of crops and animal outputs⁷ is modelled by an aggregated profit function approach under a limited number of constraints: land, policy restrictions, grass and arable land⁸, crop fertiliser restrictions, and feeding restrictions based on requirement functions. The underlying methodology assumes a two-stage decision process. In the *first stage*, producers determine optimal variable input coefficients per hectare or head for given yields. Nutrient requirements enter the supply models as constraints and all other variable inputs, together with their prices, define the accounting cost matrix. In the *second stage*, the profit-maximising mix of crop and animal activities is determined simultaneously with cost-minimisation of feed and fertiliser use in the supply models.

The supply module follows a «template approach», where the optimisation models can be seen as representative farms maximising their profit by choosing the optimal composition of outputs and inputs at given prices for the final products and variable inputs:

$$\begin{aligned} \max \pi &= \sum_{i=1}^n mg_i x_i \\ \text{s.t.} \quad \sum_{i=1}^m a_{ij} x_i &\leq b_j \quad [\lambda] \end{aligned}$$

⁷ Activities in the model: soft wheat, durum wheat, rye, barley, oats, grain maize, other cereals, paddy rice, rape, sunflower, soya, olives for oil, other oils, pulses, potatoes, sugar beet, flax & hemp, tobacco, other industrial crops, tomatoes, other vegetables, apples & pears & peaches, other fruits, citrus fruits, table grapes, table olives, wine, nurseries, flowers, other crops, fodder maize, fodder root crops, other fodder on arable land, non-food production on set-aside, fallow land, obligatory set-aside, voluntary set-aside, grass & grazings extensive, grass & grazings intensive, suckler cows, heifers breeding, calves fattening male, calves fattening female, calves raising male, calves raising female, pigs for fattening, sows, sheep and goats for milk, sheep and goats for fattening, laying hens, poultry fattening, other animals, dairy cows low yield, dairy cows high yield, male adult fattening low final weight, male adult fattening high final weight, heifers fattening low final weight and heifers fattening high final weight.

⁸ Agricultural land is considered a fixed resource in the model and is divided in arable land and grassland. It is distributed according to cropping shares. Crop rotations are not explicitly considered a restriction in the model, however, there is a steering mechanism for land allocation: land rents react to prices prevailing in a certain scenario. Fallow land is included as «closure» activity (e.g. if soft wheat premiums decrease, soft wheat area will decrease and other substitutive activities and non-cultivated land will increase).

Where:

π = objective function (agricultural income).

x_i = production level of activity i .

b_l = level of constraint l (physical or economic).

mg_i = gross margin of activity i (revenues plus premiums minus costs).

n, m = number of activities and constraints respectively.

a_{li} = matrix of coefficients which link constraints and activities.

λ_l = marginal value or «price» associated with the constraint l .

A mixed Maximum Entropy/Positive Mathematical Programming (ME/PMP) approach is used to calibrate the non-linear profit functions of each region to the observed base year allocation (Heckeleei, 2002).

There are two sources for interactions between activities in simulation experiments: the objective function and the constraints. In the CAPRI version used (September, 2005), the objective function does not comprise inter-activity terms, i.e. no marginal cross-cost effects, so that the major interplay is due to constraints. The interaction is best understood by looking at the first order conditions of a programming model including PMP terms:

The left hand side (mr_i) shows the marginal revenues, which are typically equal to prices times yields plus premiums. The right hand side shows the different elements of the marginal costs. The variable or accounting costs (mc_i) are fixed since they are based on the Leontief assumption. The term ($ac_i + bc_i x_i$) shows the marginal non-linear costs (increasing in the activity levels). The non-linear term (bc_i) covers the effect of all factors not explicitly handled by any restriction or included in the accounting costs (ac_i), such as risk aversion (e.g. non-observable costs related to managerial skills, rotations, etc.) and ensures calibration of activity levels in the base year and a reaction of the simulation system according to the economic theory. The remaining term captures the marginal costs linked to the use of exhausted resources and is equal to the sum of the shadow prices λ_l multiplied by the per unit demand of that activity i for resource l , the matrix A being again based on the Leontief technology coefficients. The shadow values of binding resources are therefore the drivers linking the activities.

Production costs for each activity are calculated using the information contained in the FADN and EAA databases⁹. The EAA provide information about the national input demand whereas the FADN data base is used to gather information about regional distribution of the input use and related costs. The final cost coefficients are estimated using Bayesian Highest Posterior Density estimation and cross-entropy frameworks. In doing so, additional restrictions ensure that the national accounts for input expenditures are met (Heckeleei *et al.*, 2005). The feed input requirements of animals are calibrated by using entropy estimation techniques (Britz *et al.*, 1999) and are ba-

⁹ The European Accounts of Agriculture can be freely accessed at the EUROSTAT web site: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=2353,47212687&_dad=portal&_schema=PORTAL (accessed on 19.07.2006). Data on farm typologies are released by the FADN unit only for specific purposes and under strict contractual conditions.

sed on yield and age variables derived from animal production engineering knowledge (see Nasuelli *et al.*, 1997). Crude protein and net energy intake model estimates are validated in Pérez, 2006, pp. 54-59.

The market module, a constrained equation system, comprises of a spatial world trade model based on the Armington assumption (Armington, 1969). According to Armington's theory, the composition of demand from domestic sales and different import origins depends on price relationships resulting from bilateral trade streams¹⁰. This allows the model to reflect trade preferences for certain regions (e.g., Parma or Manchego cheese) that cannot be observed in a net trade model¹¹. A two stage Armington system is adopted: on the *top level*, total demand for product j is divided into total imports and domestic sales from origins r ($r = r'$) ($Arm1_{j,r}$) and, on the *lower level*, different import shares from different origins are determined ($Arm2_{j,r}$).

$$Arm1_{j,r} = sp1_{j,r} [dp_{j,r,r'}, Arm2_{j,r}^{-\rho1} + dp_{j,r,r'} DSales_{j,r}^{-\rho1}]^{1/\rho1}$$

$$Arm2_{j,r} = sp2_{j,r} \left[\sum_s dp_{j,r,r'}, Streams_{j,r,r'}^{-\rho2} \right]^{1/\rho2}$$

Where:

Arm1 = Armington 1 aggregate for product j and region r (r alias r').

Arm2 = Armington 2 aggregate (aggregate of imported products).

DSales = Domestic production sold.

Streams = Imports from different origins.

sp1, sp2 = shift parameters.

dp = share parameters.

$\rho1, \rho2$ = parameters related to substitution elasticities the respective Armington aggregates.

The market module breaks down the world into several country aggregates or trade blocks¹², each one featuring systems of *supply, human consumption, feed, and processing* functions¹³. The parameters of these functions are derived from elasticities used in other studies and modelling systems and are calibrated to projected quantities and prices in the simulation year (for demand elasticities see Witzke *et al.*, 1998 and Witzke, 2002).

¹⁰ In the market model there is a connection between domestic prices in the EU and in the rest of the World (trade blocks). This means that world prices react to changes in the CAP, since the EU is an important trade partner.

¹¹ Data on bilateral trade streams are borrowed from the FAO world's agricultural trade matrix: <http://www.fao.org/es/ess/watm.asp> (accessed on 19.07.2006).

¹² Trade blocks in the model are: EU15, EU10, 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 EU15, EU10, MERCOSUR and Mediterranean countries feature behavioural equations at single country level.

¹³ Data on supply and demand (human, feed and processing) can be found in the FAO Supply Utilisation Accounts (SUAs), see <http://www.fao.org/es/ess/suafbs.asp> (accessed on 19.07.2006) for a detailed description.

Supply for each agricultural output and region r (EU Member State or world regional aggregate) is modelled by a supply function derived from a normalised quadratic profit function via the envelope theorem. Supply ($supply_{j,r}$) depends on producer prices ($Ppri_{j,r}$) normalised with a price index ($Pindex_r$):

$$supply_{j,r} = as_{j,r} + \sum_k bs_{j,k,r} \frac{Ppri_{k,r}}{Pindex_r}$$

where $as_{j,r}$ and $bs_{j,k,r}$ are the constant and slope terms of the function (the latter captures own and cross-price effects, $k = j$ and $k \neq j$, respectively).

The system for *feed demand* is identically structured. However, not producer prices but raw product prices determined by the Armington top level aggregator ($ArmI P_{k,r}$) combined with changes in the supply of animal products ($supply_j$) weighed with feed use factors w_j determine feed demand ($feed_{j,r}$):

$$feed_{j,r} = (af_{j,r} + \sum_k bf_{j,k,r} \frac{ArmI P_{k,r}}{Pindex_r}) \sum_{j(=anim)} w_j \frac{supply_j}{supply_j^{cal}}$$

where $af_{j,r}$ and $bf_{j,k,r}$ are the constant and slope terms of the function, and $supply_j^{cal}$ is the supply of animal products at the calibration point.

Marshallian demand functions for products j (alias j') in region r are derived from a Generalised Leontief indirect utility function and used to represent *human consumption* ($hcom_{j,r}$). The demand functions depend on own and cross consumer prices ($cpri_{j,r}$), and *per capita* income (y_r). As these demand functions are calibrated on per head consumption they must be multiplied with the population (pop_r) in each region in order to represent total demand.

$$hcom_{j,r} = pop_r \left[d_{j,r} + \frac{\sum_{j'} bd_{j,j',r} \sqrt{cpri_{j',r}/cpri_{j,r}}}{\sum_{j'} \sum_k bd_{j',k,r} \sqrt{cpri_{j',r} cpri_{k,r}}} \left(y_r - \sum_{j'} d_{j',r} cpri_{j',r} \right) \right]$$

Regularity of the demand functions is ensured in the calibration process with restrictions enforcing adding-up, homogeneity of degree zero in prices, symmetry and the correct curvature of the parameter matrix bd . d represents a shift parameter.

Processing of oilseeds is modelled using behavioural functions that are derived from a normalised quadratic profit function under the assumption of a fixed input/output relationship between seeds, cakes and oils. *Processing of dairy products* is also based on a normalised quadratic function that is driven by the regional differences between the market price and the value of its fat and protein content. Additionally, balancing equations for fat and protein are included in order to ensure that the processing sector makes use of the exact amount of fat and protein contained in the raw milk.

Policy instruments in the market module include bilateral tariffs. Tariff rate quotas (TRQs), intervention sales and subsidised exports under the World Trade Organisation (WTO) commitments are explicitly modelled for the EU25 (see Junker *et al.*, 2003). The policy of non-EU regions is based on data from the OECD.

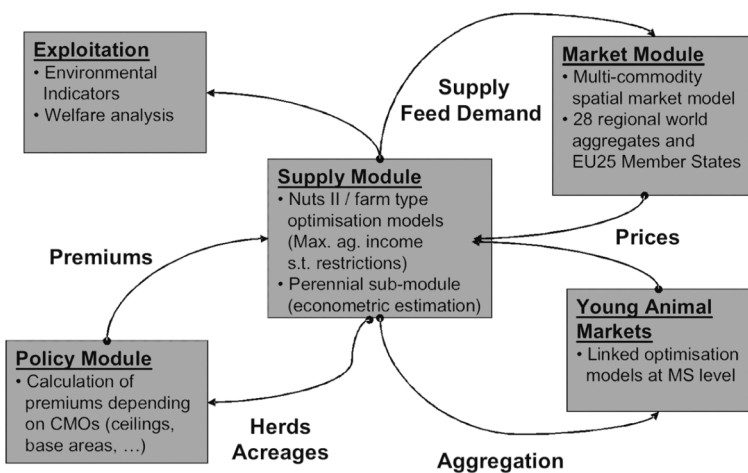
4.1.3. Link between the supply and market modules

As previously mentioned, the equilibrium in CAPRI is obtained by iterating over the supply and market modules. In the first iteration, the regional aggregate programming models (one for each Nuts 2 region) are solved with exogenous prices. Regional agricultural income is therefore maximised subject to several restrictions. After being solved, the regional results of these models (crop areas, herd sizes, input/output coefficients, etc.) are aggregated to Member State level models, which are then calibrated using PMP estimation techniques. Young animal prices are determined by linking these calibrated Member State models into a non-spatial EU trade model with market balances for young animals, as shown in figure (1).

The next step is the calibration of the supply and feed demand functions of the market module to the feed and production results from the supply module. Finally, the market module is solved and the resulting producer prices at Member State level are transmitted back to the supply models for the following iteration. In between iterations, premiums for activities are adjusted if ceilings defined in the CMOs are overshoot.

CAPRI is a comparative-static model, i.e. we compare equilibrium solutions for different plausible scenarios. This approach has some drawbacks (e.g., lack of price dynamics) and benefits (e.g., in terms of calibration). In order to compare the deve-

FIGURE 1
Link of modules in CAPRI



Source: CAPRI Modelling System.

lopment path towards the equilibrium solution among scenarios, a recursive-dynamic version of the model would be necessary¹⁴.

An optimisation approach is only used in the supply part of the model (template programming models for the EU25 at Nuts 2 level). Final welfare effects are estimated within a spatial multi-commodity model, which is a conventional tool for welfare analysis. The multi-commodity model uses widely accepted supply and demand functions that could be estimated econometrically. However, given the high number of parameters (it must be done for all trade blocks and products) these functions have been calibrated according to microeconomic conditions, a method that is generally accepted in academic circles.

4.1.4. CAP policy module

Due to its activity based layout, the CAPRI supply module is well suited to deal with the representation of decoupled premiums. A detailed modelling component [see figure (1)] allows for the definition of payment schemes linked to output (based on current or historic yields) or activity levels in combination with ceilings in physical (hectare or head) and/or value terms, as covered by the legislation. If the updating of the premiums between iterations result in a premium sum or number of eligible hectares/heads that overshoot the ceilings, premiums are cut in order to meet the obligations. Further details on each premium category and their technical implementation in the model can be found in Junker *et al.*, 2003.

4.1.5. Welfare calculation

The welfare measure in CAPRI is based on production and consumption shifts of agricultural primary goods due to endogenous prices. An aggregate of «all other goods» is additionally included in order to close the demand balance. Changes in welfare are endogenously driven by price changes. Following a standard welfare analysis, total welfare is decomposed into the sum of *agricultural income* (welfare gain of producers), *money metric* (welfare gain of consumers), *profits by processing activities* (welfare gain of the agro-industry), and *tariff revenues* (welfare gain of the public sector), minus *budgetary expenditure* (welfare loss from taxpayers):

- *Agricultural income* is calculated according to the gross value added concept of the EAA (EUROSTAT, 2000). Costs for crop, animal, and other variable inputs, as reflected in the EAA, are deducted from the income of agricultural producers (agricultural gross value added at market prices). Income from premiums in a respective region is added to the producers' market income.
- *Consumer surplus* is calculated by using the money metric indirect utility function (Varian, 1992, p. 110). In the model, the money metric measure is the minimal expenditure needed for consumers to reach the utility level of the simulation scenario at prices of the reference scenario.

¹⁴ This is beyond the scope of this project but is currently addressed by the CAPRI-Dynaspat project (http://www.agp.uni-bonn.de/agpo/rsrch/dynaspat/dynaspat_e.htm).

- *Profits of the processing industry.* Production of processed products in the dairy and oilseed industry is evaluated with the derivative of the normalised quadratic profit function. As an exception, production of milled rice is calculated through fixed processing factors.
- *Budgetary expenditure* comprises all direct payments for agricultural commodities, export subsidies, costs for intervention purchases, and processing, feed industry, and consumption aid¹⁵. This corresponds to the FEOGA budgetary costs included in the first pillar for each of the supported production programs.
- *Tariff revenues* result from the application of import tariffs. They are calculated by multiplying tariffs with valued import flows, and summing over all product lines. The administrative costs of the tariff system (including TRQs) are not considered in the analysis.

4.2. Scenario definitions

The base year period considered is a three-year average around 2001, which means that for the base year the Agenda 2000 policy package is fully implemented. The *reference scenario* for comparison is a continuation of the Agenda 2000 policy reform in year 2012:

- Intervention prices, set aside obligations and milk quota expansion are implemented according to the Agenda 2000 legislation. Exogenous development of yields are based on trend analysis at Member State level, including years 1980-2002. For cereals, yields result from the latest Market Outlook of the European Commission (Commission of the European Communities 2002b). Variable inputs are first shifted proportionally with yields and then reduced by input saving technical progress of -0.2% p.a. Exceptions are nutrient needs of crops (NPK) and animals (energy, protein, fibre etc.), which are driven by yield-dependent engineering functions.
- The base year data of the market module are shifted to the year 2012 based on results of other studies. Main data source for the shifters in supply and demand for non-EU regions is the @2030 framework of the FAO global perspective unit (FAO, 2003). The price framework is based on representative long-term time series for world market prices of major raw and processed agricultural products, which are trend forecasted. These trends have been compared and partially revised to medium term forecasts by OECD, FAPRI and the EU Commission. The demand systems for the EU Member States are calibrated to per capita consumption changes, income, and population levels, in most cases in line with the data found in the publication «Prospects for Agricultural Markets» (Commission of the European Communities 2002b;

¹⁵ These positions are reported in the yearly FEOGA budget report «Agriculture in the European Union, Statistical and Economic Information» (Directorate-General for Agriculture, Brussels.) The regional dimension will depend on the view selected, from national (Member State) to European level (EU25).

¹⁶ EC 1251/1999, EC 1253/1999, EC 1254/1999, EC 1255/1999, EC 1256/1999.

Commission of the European Communities 2004; Commission of the European Communities 2005). Prices are assumed to increase by +1.9% p.a. and nominal GDP growth for the EU is set to +2.7% p.a. GDP growth is used as a proxy for consumers' available income. The assumptions for the EU as a whole are taken over to the individual Member States. Population growth at Member States level is provided by EUROSTAT.

The following *impact scenarios* are simulated for the year 2012:

- a) *Most probable implementation of the CAP reform proposal 2003 in EU25.* This implies the modelling of intervention prices, milk quota increases, and modulation¹⁷ in line with the 2003 Luxemburg compromise, as explained above. Moreover, partial decoupling is assumed to be adopted by Member States as described in table (1) and the SFP is gradually introduced according to the legislation¹⁸.
- b) *Full decoupling of premiums in EU25.* In this scenario, the Luxemburg compromise is modelled as in scenario (a), but all Member States are assumed to fully liberalise premiums (no partial decoupling option considered). The rest of model parameters remain unchanged.
- c) *Full decoupling with most probable implementation option for Spain.* In this case, the most likely partial decoupling decision is assumed by the Spanish government [as stated in table (1)] in a scenario of full decoupling of premiums by the rest of European countries.
- d) *Most probable implementation with full decoupling for Spain.* Opposite to the previous scenario, in this case Spain decouples premiums completely in a scenario of most probable implementation (partial decoupling) by the rest of the European countries.

Several critical points in the implementation of the CAP 2003 reform proposal into the modelling system apply. The smallest regional unit considered in the model, is the Nuts 2 region, so that the uniform premium per farm equals a uniform premium per Nuts 2 region. Additionally, the uniform premium scheme leads to more transparency of the CAP and may reduce administrative costs which may imply welfare gains not covered by the model. Furthermore, some elements of the proposal, such as compulsory farm audits or the rural policy measures, cannot be modelled within the current modelling system.

5. Results for the EU25

The above mentioned simulation scenarios cover the main reform points of the Luxemburg compromise. The analysis shows income and production distributional

¹⁷ The MTR proposal foresees a modulation of premiums depending on certain farm indicators. As the impact of the modulation on a region depends on the farm size distribution, we used EU Commission information to find the appropriate level of money to be subtracted from the eligible payment in each region.

¹⁸ The full implementation of reform should be achieved in 2014. This has some implications for the transfer of regional premiums into the SFP in the case of 'dynamic regionalisation systems' (e.g. Germany).

effects due to changes in several *policy variables* (new premium schemes, set aside policy and quota regimes) for a simulation year. In the following sub-sections, these different policy scenarios are analysed by comparing them with the «Agenda 2000» reference scenario.

TABLE 2

Welfare analysis: welfare changes with respect to the Agenda 2000

	Most probable implementation	Full decoupling
Money metric	-1370.1	-2654.2
Agricultural income	2411.5	3817.7
Premiums	1636.7	1582.5
EAA Output	-2217.2	-356.4
EAA Input	-2992.0	-2591.6
Profit processing industry	1031.6	939.5
Tariff revenues	280.6	310.1
FEOGA budgetary outlays	646.2	607.5
Total	1707.4	1805.6

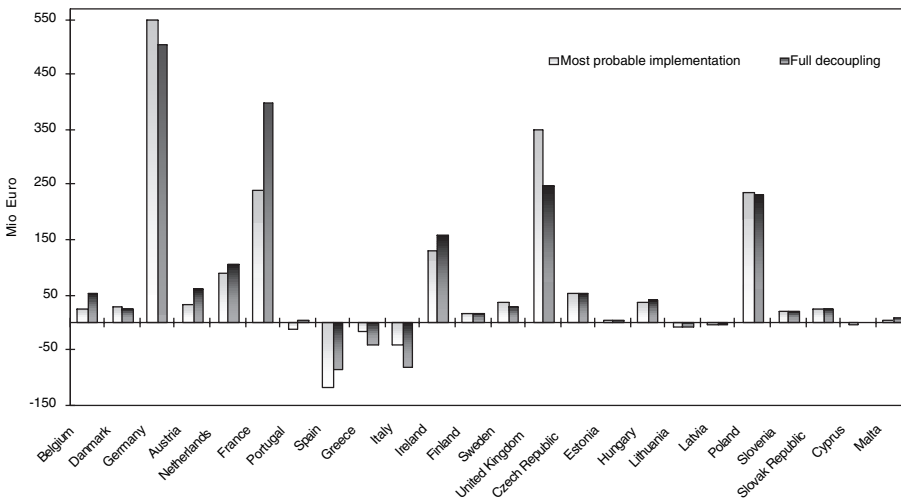
Source: own calculations; Mio Euro; changes with respect to the reference scenario «Agenda 2000» (in year 2012).

Total welfare is simulated to increase slightly in both scenarios compared to the reference scenario [table (2)], but as expected, the welfare increase is lower under a *most probable implementation* option (increase of +1.7 Bio Euro with respect to the reference run) than when Member States adopt the *full decoupling* decision (+1.8 Bio Euro). This is mainly due to increases in agricultural income (+2.4 and +3.8 Bio Euro respectively), which compensate consumer losses (-1.4 and -2.7 Bio Euro). Premiums and FEOGA budgetary costs for the first pillar of the CAP also increase slightly in the EU25, since premium ceilings are estimated not to be fully exhausted in the Agenda 2000 reference scenario.

Welfare gains of producers are higher in the full decoupling scenario due to the fact that production falls and agricultural prices rise in the EU25, a consequence of the important import barriers which isolate the European agricultural markets from the rest of the world. Assuming a continuation of the current trade policy and similar budgetary costs for the planned agricultural reform, the decoupling of premiums leads to welfare gains by farmers which outweigh losses from consumers.

In figure (2), we present welfare changes for Member States. In both simulation scenarios, welfare changes with respect to the reference scenario are positive for all, with major exceptions for Greece, Italy and Spain, and some very small negative developments for Portugal, Lithuania, Latvia, and Cyprus. In the three southern countries, expected increases in agricultural income through the implementation of the Luxemburg agreement cannot compensate consumer losses, breaking the general trend observed for the EU25 as an aggregate. Several reasons can explain this effect:

FIGURE 2
Welfare analysis: distribution between Member States



Source: own calculations; Mio Euro; changes with respect to the reference scenario «Agenda 2000» (year 2012).

(a) higher land share allocated to activities affected by the policy reform (e.g. suckler cows and sheep and goats) and (b) high pressure on cereal markets from the demand side. In Italy, where full decoupling is modelled in both scenarios, welfare losses are lowest in the most probable implementation scenario because prices are not projected to increase as much as in the full decoupling scenario and, hence, consumers are able to benefit and overcompensate losses suffered by producers.

Ireland, Germany, France, Poland, and United Kingdom gain considerably from the CAP reform regardless of the scenario implementation and benefit the most from other countries' behaviour in a decoupled system. France and Ireland are better-off in a full decoupling scenario: as net suppliers in the EU they are able to achieve higher welfare gains from the production side. For Poland it does not make any difference to choose one or the other system, since supply is equally affected in both scenarios. In the United Kingdom and Germany, the opposite situation is observed: supply of cereals is not very much affected but the cattle sector suffers severe production losses under a full decoupling scenario (around -6%) and hence welfare increases are higher in the *most probable scenario*.

5.2. Internal markets: supply responses for the major agricultural aggregates

For *cereals* we observe that the «full decoupling» scenario leads to a higher decrease in production than the «most probable implementation» scenario (table 3). Durum wheat, soft wheat, and barley mainly contribute to this reduction. The production size of the *oilseeds* aggregate is not very much affected by the two different policy imple-

mentation options. In the *fodder* aggregate, containing all fodder production activities on arable land, the developments show divergent trends: fodder maize loses much profitability and is replaced by root crops or alfalfa production on arable land. The aggregate containing hectares of *set aside and fallow land* shows the strongest size increase due to the fact that a higher share of marginal land is taken out of production given the removal of the production obligation related to the premium payments.

TABLE 3
Supply details for activity aggregates (EU25)

	Most probable implementation				Full decoupling			
	Income	Hectares or herd size	Yield	Supply	Income	Hectares or herd size	Yield	Supply
Cereals	428.03 -2.15%	50461.39 -3.42%	5667.87 0.88%	286008.77 -2.57%	430.17 -1.66%	50514.76 -3.32%	5661.22 0.77%	285975.15 -2.58%
Oilseeds	466.19 9.85%	7658.76 -0.40%	2762.22 -0.11%	21155.2 -0.51%	474.22 11.75%	7671.23 -0.24%	2760.08 -0.19%	21173.18 -0.42%
Other arable crops	916.78 2.75%	11662.03 1.25%	23704 1.53%	276436.67 2.80%	928.18 4.03%	11660.91 1.24%	23755.9 1.76%	277015.41 3.01%
Vegetables and Permanent crops	5131 -0.69%	12673.79 -1.49%	21480.37 1.30%	272237.82 -0.21%	5138.87 -0.54%	12654.22 -1.64%	21509.62 1.44%	272187.44 -0.22%
Fodder activities	164.99 571.78%	74494.1 1.62%	21625.24 -2.18%	1610952.36 -0.59%	188.63 668.04%	74417.7 1.52%	21505.66 -2.72%	1600402.03 -1.24%
Set aside and fallow land	203.08 17.46%	15033.28 5.86%	218.5 -6.32%	3284.71 -0.83%	211.09 22.09%	15064.87 6.08%	218.32 -6.39%	3288.98 -0.70%
All cattle activities	319.42 -17.95%	85623.45 -0.98%	90.55 -0.07%	7753.63 -1.03%	320.25 -17.73%	83699.31 -3.20%	91.29 0.75%	7640.95 -2.47%

Source: own calculations; % changes with respect to the reference scenario «Agenda 2000» (year 2012).
Income in €/ha or €/head; hectares in 1,000 ha; herd sizes in 1000 heads; yield in kg/ha or kg/head, and heads/1,000 heads for young animal activities; supply in 1,000 tonnes.

Within the *cattle* aggregate, we observe an important drop in the total herd size (-3.2%) in the full decoupling scenario, mainly resulting from production activities supported via the direct premium payments: suckler cow herds are reduced by -9.3% and extensive cattle fattening processes (heifers/male adult cattle low weight) by -4% to -6%. Dairy cow herd sizes face nearly no change with respect to the reference scenario. But since their direct premiums will also be included in the SFP we observe a slight intensification of the production processes.

5.3. Competitiveness: net trade positions of the major production aggregates

In table 4 product balances and prices for the EU are depicted. Whereas the supply for *soft wheat* drops in both scenarios by around -1.8%, prices increase by +2.4% in the «most probable implementation» scenario and +2.1% in the «full decoupling» scenario. For *beef*, a product strongly affected by the decoupling decision, supply decreases in the «most probable implementation» scenario by around -1.0%

against a -2.5% in the «full decoupling» scenario. This is due to the higher increase in producer prices for beef in the latter ($+10\%$). At the same time *pork and poultry* production remains rather stable.

TABLE 4
Product balances for selected products in the EU25

	Most probable implementation				Full decoupling			
	Supply	Net trade	Demand	Producer Price	Supply	Net trade	Demand	Producer Price
Soft wheat	123165.75 -1.83%	13774.09 -5.25%	108237.16 -1.19%	107.31 2.39%	123202.51 -1.80%	13995.1 -3.73%	108035.02 -1.37%	107.05 2.14%
Grain maize	56776.65 -2.81%	-974.33 -4959.50%	57578.88 -1.00%	117.53 1.24%	56573.62 -3.16%	-918.15 -4679.30%	57318.01 -1.45%	117.24 0.99%
Oilseeds	22821.38 -0.59%	-29777.14 -0.33%	52598.51 -0.44%	228.18 0.56%	22843.63 -0.49%	-29710.84 -0.55%	52554.47 -0.52%	227.93 0.45%
Potatoes	57540.12 0.26%	2783.58 5.25%	54756.54 0.02%	89.09 -2.40%	57474.12 0.15%	2743.69 3.75%	54730.43 -0.03%	89.2 -2.28%
Sugar beet	136327.68 5.76%	-175.15 9.10%	136502.84 5.77%	40.52 -1.91%	136987.75 6.27%	-175.26 9.17%	137163.02 6.28%	40.4 -2.20%
Tobacco	275.99 -12.26%	-52.15 302.39%	328.14 0.19%	1895.58 2.45%	275.97 -12.27%	-52.19 302.70%	328.16 0.20%	1895.59 2.45%
Fodder	1865082.75 -0.87%	203349.74 -3.41%	1661733.01 -0.55%	8.15 1.62%	1854712.58 -1.42%	205872.55 -2.21%	1648840.03 -1.32%	8.13 1.37%
Beef	7753.63 -1.03%	-489.64 9.28%	8243.27 -0.47%	2065.4 4.32%	7640.95 -2.47%	-527.11 17.64%	8168.06 -1.38%	2179 10.06%
Pork meat	21204.15 0.07%	338.41 -3.82%	20865.74 0.13%	1397.26 0.71%	21244.09 0.25%	333.36 -5.26%	20910.74 0.35%	1399.97 0.90%
Poultry meat	11211.16 0.13%	92.28 -9.07%	11118.88 0.22%	1202.33 0.81%	11242.96 0.42%	87.68 -13.61%	11155.28 0.55%	1205.78 1.10%
Butter	2038.84 -0.42%	-77.51 29.36%	2116.35 0.43%	3381.23 -4.78%	2037.81 -0.47%	-78.22 30.54%	2116.02 0.41%	3385.63 -4.66%
Skimmed milk powder	2047.94 -3.53%	-747.3 -2.30%	2795.24 -3.21%	2022.29 -2.04%	2045.08 -3.67%	-748.11 -2.19%	2793.19 -3.28%	2022.5 -2.03%
Cheese	8576.95 0.21%	201.57 2.98%	8375.38 0.15%	5159.91 -1.01%	8576.14 0.20%	201.2 2.79%	8374.95 0.14%	5162.8 -0.95%

Source: own calculations; % changes with respect to the reference scenario «Agenda 2000» (year 2012). Supply, net trade and demand in 1000 tonnes, prices in €/tonne.

6. Results for Spain

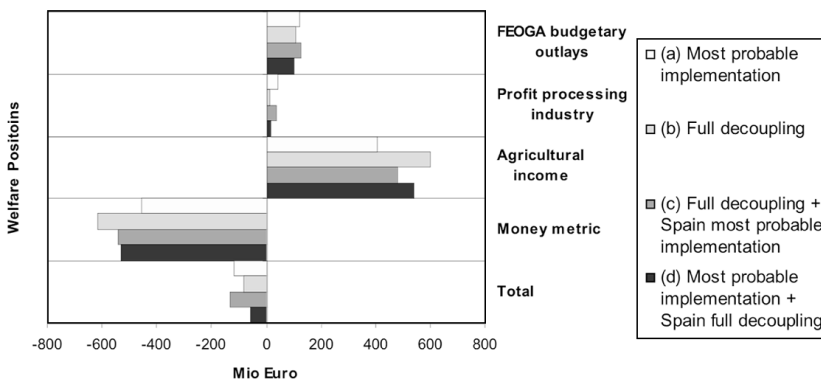
In the following sections we analyse welfare, supply, income, and land use effects for Spain as a result of the Luxembourg Agreement on CAP reform. We specifically focus on the coupling and decoupling of production activities in Spain as the central question. With this purpose two additional comparison scenarios are modelled, scenarios c) and d) as described in section 4.2.

6.1. Welfare effects: comparison across scenarios

In figure 3 the different welfare components, presented as deviations from the reference scenario, are analysed for Spain. The FEOGA budgetary outlays in Spain slightly increase in all scenarios, since the overall amount of premiums paid to farmers is estimated to increase with respect to the reference scenario. This is due to a further exhaustion of premium ceilings and the appearance of some new premiums or premium components (e.g. payments for energy crops or monthly increments for cereals). Total welfare is projected to decrease driven by negative consumer transfers, not being offset by the increases in agricultural income. Profits from the dairy and oilseed processing industry do not change significantly.

FIGURE 3

Welfare variations for Spain under the different scenarios



Source: own calculations; in Mio Euro; changes with respect to the reference scenario «Agenda 2000» (year 2012).

From an economic perspective, Spain clearly profits from the «full decoupling» option as simulated in scenarios (b) and (d). Spain achieves the lowest total welfare loss compared to the reference scenario, -84 and -57 Mio Euro respectively, mainly due to higher increases in agricultural income as producers profit from higher prices. On the contrary, if all Member States adopt the «most probable implementation» option (Spain included), as modelled in scenario (a), or if they introduce full decoupled payments whereas Spain keeps premiums partially coupled, scenario (c), welfare would decrease by around -117 Mio Euro and -130 Mio Euro respectively.

It is interesting to see that Spain achieves higher welfare gains in scenario (d), where all Member States introduce partial decoupling and Spain decouples completely. In this case, Spanish farmers profit from moderate higher prices (mainly driven by a reduction in supply of fodder and cattle production activities). An additional indicator to look at is domestic agricultural supply. It is argued, that partial decoupling

helps retaining domestic production, in particular in economically lagged regions, enabling producers to adapt more easily to market demands (Commission of the European Communities 2003). The lowest reductions in supply are estimated for Spain in scenario (c): farmers will profit most in terms of agricultural supply by coupling premiums, since in this situation production is kept «artificially» on marginal land and, at the same time, output reductions in the other Member States provoke an increase in agricultural prices, which renders production more profitable. This argument is sustained by national farmer lobbies, which exert some pressure on governments to maintain agricultural production rather than agricultural income, at the cost of consumers.

6.2. Internal markets: supply responses for selected activities

In Spain the supply effects follow a different pattern than the European average (see table 5). This results from the specific production structure, partially described by a lower share of cereals and lower crop yields than the European average. Soft wheat benefits in both scenarios (+3.9% and +4.6% increase in hectares respectively) from the redistribution of decoupled animal premiums, in particular in the «full decoupling scenario». A similar effect can be observed for barley (+5.5% and +6.4%) and oilseeds (+3.2% and +3.8%). Receiving the new premium of 55.6 €/ha for protein crops, pulses react even stronger (+19.9% and +18.9%) compared to the reference scenario. In general, the decoupling of cereal premiums in Spain has low income effects due to the low reference yields of these activities.

Two important activities to mention in the Spanish case are tobacco and olive oil. Whereas tobacco loses all «Agenda 2000» premiums, which go into the single farm premium, olive oil keeps only 5% of them coupled to production. This has important effects on income and supply for these activities. The number of hectares for tobacco in Spain is predicted to shrink by ca. -90% (35% more than the average for the EU) and the area dedicated to olives for oil by ca. -4%.

The total animal herd size remains more or less stable in the «most probable implementation» scenario, like in the case of the EU25. However, in Spain the coupling of suckler cow premiums invokes a shift to this activity (+6.6%). In the «full decoupling» scenario this situation does not persist, with losses in suckler cow herd size (-9.6%) in line with the European average.

6.3. Income effects: regional distribution

Income per hectare (measured as gross value added plus premiums) is affected by the decoupling decision through the endogenous supply and prices changes. Moreover, according to the specifications of the reform, animal producers shift premiums to fodder activities, which remain attached to land. In the following two maps we analyse the income changes for Spain.

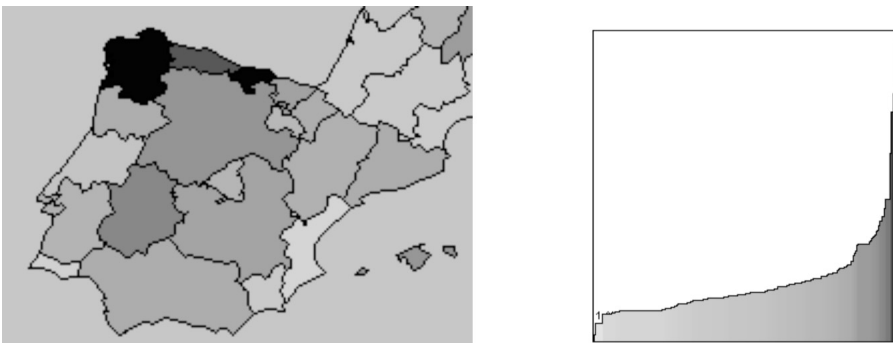
TABLE 5
Supply details for selected crop activities (Spain)

	Most probable implementation				Full decoupling			
	Income	Hectares or herd size	Yield	Supply	Income	Hectares or herd size	Yield	Supply
Soft wheat	370.72 22.52%	1281.7 3.91%	3326.82 0.26%	4264 4.18%	384.14 26.96%	1290.13 4.59%	3320.51 0.07%	4283.89 4.67%
Durum wheat	425.36 15.61%	1037.99 -13.88%	2093.03 1.16%	2172.54 -12.89%	457.21 24.27%	1044.93 -13.31%	2092 1.11%	2185.99 -12.35%
Barley	328.81 13.92%	2616.34 5.53%	3687.75 -1.34%	9648.42 4.12%	342.55 18.69%	2637.76 6.39%	3680.2 -1.54%	9707.5 4.76%
Pulses	287.58 77.49%	572.18 17.96%	813.66 1.62%	465.56 19.87%	299.24 84.68%	563.33 16.13%	819.41 2.34%	461.6 18.85%
Sugar Beet	2910.78 7.14%	89.34 -0.45%	87642.3 -0.03%	7829.77 -0.48%	2962.58 9.05%	89.76 0.02%	87580.97 -0.10%	7861.25 -0.08%
Tobacco	581.48 -38.87%	8.8 -89.85%	3964.68 857.91%	34.88 -2.81%	586.95 -38.30%	8.74 -89.92%	3987.67 863.46%	34.87 -2.84%
Olives for oil	561.82 -33.99%	2380.99 -3.81%	2443.77 -0.18%	5818.58 -3.99%	546.71 -35.77%	2370.67 -4.23%	2445.15 -0.13%	5796.65 -4.35%
Table Olives	10911.69 0.35%	115.66 -0.18%	3803.61 0.01%	439.92 -0.17%	10914.41 0.38%	115.62 -0.22%	3803.76 0.01%	439.8 -0.20%
Table wine	1107.98 0.88%	1090.28 -0.73%	3627.86 -0.02%	3955.37 -0.75%	1109.61 1.02%	1088.35 -0.91%	3628.38 0.00%	3948.94 -0.91%
Suckler Cows	103.49 15.05%	2025.17 6.55%	458.7 -0.11%	928.95 6.43%	12.27 -86.36%	1718.79 -9.57%	459.66 0.10%	790.05 -9.48%
Sheep and Goat fattening	44.89 -2.88%	20356.49 -0.98%	10.89 0.00%	221.74 -0.98%	43.59 -5.69%	20161.36 -1.93%	10.89 0.00%	219.62 -1.93%

Source: own calculations; % changes with respect to the reference scenario «Agenda 2000» (year 2012).

Income in €/ha or €/head; hectares in 1000 ha; herd sizes in 1000 heads; yield in kg/ha or kg/head, and heads/1000 heads for young animal activities; supply in 1000 tonnes.

FIGURE 4
Income effects of a full decoupling decision for Spain



Source: own calculations; income measured in Euro/ha; % changes between *scenario (d)*, Spain decouples premiums and the rest of Member States adopt the most probable implementation, and *scenario (a)*, all Member States adopt the most probable implementation (year 2012).

Gini Diagram from -1% (light grey) to +8% (dark grey) income change.

Given the scenario where all Member States adopt the most probable partial decoupling scenario, income increases in northern regions of Spain and remains stable or slightly decreases in central-eastern regions if Spain implements full decoupling. This is a beneficial situation for mountainous regions, since fallow and fodder land gain value. This can be observed for example in «Cornisa Cantábrica», a representative mountainous Nuts 2 region. Cereal producers see the level of production affected but gain income through increases in prices that is additionally sustained by the premiums.

FIGURE 5
Income effects of a partial decoupling decision for Spain



Source: own calculations; income measured in Euro/ha. % changes between *scenario (c)*, Spain adopts the most probable partial decoupling option and the rest of Member States decouple premiums fully, and *scenario (b)*, all Member States adopt full decoupling.

Gini Diagram from -13% (light grey) to +11% (dark grey) income change.

By holding premiums partially coupled with other EU countries following a full decoupling option, Spanish regions are expected to lose some income with respect to a situation of full decoupling for all Member States (-0.3% in average). The absolute effect is much lower than in the previous analysis, since Spain does not have enough weight to significantly affect European markets or put pressure on prices. In the previous map it can be observed that regions with high suckler cow herd sizes (principally Castilla-León and Galicia) are expected to lose more income than the typical cereal areas. This activity remains completely coupled, and some inefficiencies still take place.

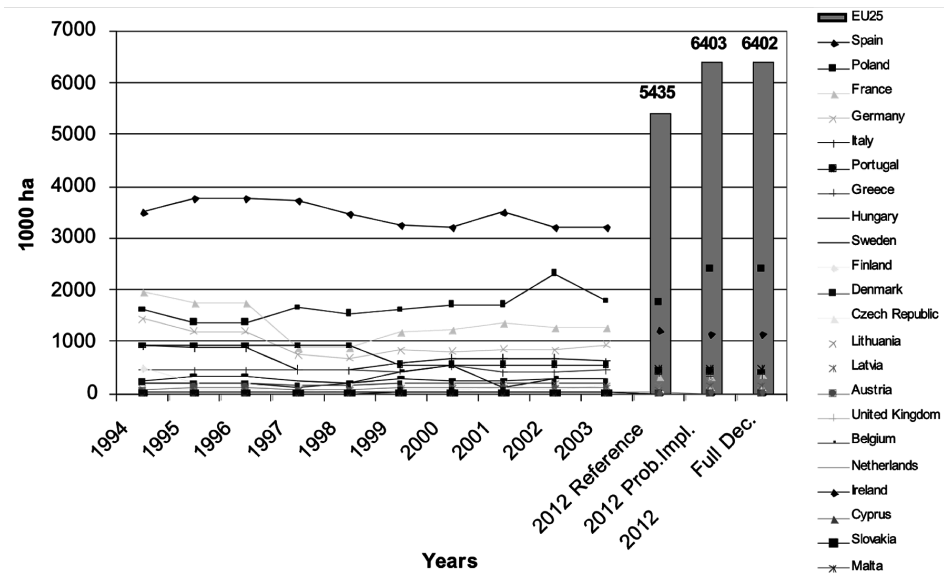
6.4. Land use: changes expected in fallow land

One of the crucial points in the implementation of the single payment scheme is the development of land use, especially the problem of production abandonment in less favoured areas. This is mainly a source of concern in the southern regions of Europe. Therefore partial coupling options were included in the CAP reform and should

contribute to the maintenance of agricultural production in these areas. A second provision is that land eligible for the decoupled payments must be kept in good agricultural conditions, thus introducing a further degree of coupling. Figure 6 shows the development of fallow land in the Member States between 1994 and 2000 as well as the forecasted levels in 2012 under the different simulation proposals.

FIGURE 6

Fallow land area per Member State and EU25



Source: CAPRI Data Base, based on statistical data from EUROSTAT (1994-2002); results for the reference scenario «Agenda 2000», scenario «most probable implementation» and «full decoupling» (year 2012).

As reported in EUROSTAT, already in the years before the Agenda 2000, Spain has with ca. 30% the highest share of fallow land (see figure 6). Compared to the reference scenario, the fallow land and set aside area is foreseen to increase in the EU25 by ca. 6% due to a general decline in cereal and fodder production. In Spain, however, fallow land and set aside hectares decrease against the reference run by -1.15% and -0.92% in the «most probable implementation» and «full decoupling» scenarios respectively. This lower expansion results from the cross-compliance costs attached to this activity and the parallel expansion of fodder activities and other arable crops.

7. Conclusions

In this paper an agricultural sector model is used to analyse endogenously welfare effects of different national implementation options of the CAP Reform 2003. The presented optimisation approach for the regional analysis is justified against other

methodological options through the advantage of having a detailed representation of the policy instruments introduced since the Agenda 2000. Some results related to welfare, price, and quantity developments are highlighted for the EU25 as an aggregate and Spain in particular. It is shown that agricultural prices develop more favourable in scenarios where a full decoupling of premiums is assumed. This is due to the fact that pressure on agricultural markets decreases as agricultural production declines more pronounced in a full decoupling scenario than with partial decoupling, where Member States try to retain agricultural production in marginal areas. Hence, the use of the partial decoupling mechanism helps Member States to distribute income into less favoured areas but is not the optimal policy choice from an overall perspective, since higher welfare gains can be achieved with the more market-oriented full decoupling option. However, these higher welfare gains are based on the assumption that current border protection and trade policy are maintained so that farmers reap higher incomes from the (partially) isolated markets of the EU.

For Spain, full decoupling of premiums is identified as the rational choice, since only production up to the economic optimum will take place. «Partial decoupling» of premiums in Spain with other Member States premiums fully decoupled will certainly help to retain agricultural production in the country, but at a welfare cost of 46 Mio Euro. However, the partial decoupling option will be chosen if the focus of agricultural policy lies on the maintenance of the status quo in terms of agricultural production. If other Member States follow the same path of reform, a «prisoner's dilemma» will most likely be observed: partial decoupling appears as the best option for individual Member States, since high domestic production and high producer prices are expected, but from the overall perspective this leads to price depression and higher welfare losses.

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Appendices

TABLE 6
Demand elasticities for Spain in CAPRI

SPAIN	Demand				
	Rape	Sunflower	Table grapes	Beef	Cheese
Wheat	5.8800E-03	7.6500E-03	1.3300E-03	4.2000E-04	3.6680E-02
Rye	-1.4217E-07	-1.6568E-07	5.0607E-06	2.0754E-06	-2.3548E-07
Barley	-4.7339E-07	-5.5169E-07	2.0000E-05	6.9107E-06	-7.8411E-07
Oats	-1.1507E-07	-1.3410E-07	4.0961E-06	1.6798E-06	-1.9060E-07
Maize	-6.0600E-07	-7.0623E-07	2.0000E-05	8.8466E-06	-1.0038E-06
Other cereals	1.8500E-03	2.9000E-04	1.0000E-04	7.5257E-06	7.8966E-06
Rape	-2.0000E-01	1.3700E-03	4.8000E-04	3.0000E-05	4.0000E-05
Sunflower	6.7400E-03	-2.0000E-01	2.7200E-03	1.3000E-04	2.2000E-04
Soya	6.5600E-03	7.6400E-03	3.6700E-03	1.6000E-04	3.2000E-04
Pulses	6.0100E-03	8.0000E-03	5.7600E-03	2.0000E-05	1.4300E-03
Potatoes	5.9000E-03	7.6800E-03	4.1900E-03	6.0000E-05	5.2300E-03
Textile crops	6.2100E-03	8.3300E-03	5.5300E-03	9.0000E-05	7.4000E-04
Tobacco	7.0000E-03	3.8200E-03	1.3300E-03	8.0000E-05	1.0000E-04
Tomatoes	5.8000E-03	7.1900E-03	3.4100E-03	7.0000E-05	4.7800E-03
Other vegetables	4.6000E-03	1.3400E-03	1.1149E-01	2.3000E-04	-3.0000E-05
Apples, pears, peaches	6.2300E-03	9.3200E-03	1.0281E+00	8.7000E-04	2.7800E-02
Other fruit	4.8800E-03	2.7200E-03	8.8680E-02	7.0000E-05	-8.4853E-06
Citrus fruits	6.0300E-03	8.3600E-03	6.3100E-03	1.3000E-04	2.6660E-02
Table grapes	5.8900E-03	6.7400E-03	-1.2970E+00	1.0000E-05	2.6000E-04
Table olives	5.7600E-03	7.0400E-03	3.7100E-03	8.0000E-05	4.4500E-03
Table wine	5.7400E-03	6.9500E-03	3.8100E-03	1.2000E-04	7.5000E-03
Beef	5.1800E-03	4.1600E-03	4.0000E-04	-7.2659E-01	-2.0000E-05
Pork	5.4200E-03	5.4100E-03	1.0300E-03	2.1692E-01	-5.0000E-05
Sheep and goat meat	3.9100E-03	-6.8699E-06	2.1000E-04	1.9535E-01	-9.7642E-06
Eggs	5.8500E-03	7.4500E-03	3.9900E-03	8.0000E-05	7.3300E-03
Poultry meat	5.7200E-03	6.8400E-03	2.1400E-03	3.1392E-01	1.3240E-02
Rice	5.2100E-03	4.1000E-03	4.0000E-05	2.0000E-05	-1.9679E-06
Sugar	5.7800E-03	7.1400E-03	3.7900E-03	2.1000E-04	1.6160E-02
Rape oil	2.7600E-03	9.0000E-05	3.0333E-06	1.2440E-06	-1.4114E-07
Sunflower oil	5.5600E-03	6.0000E-03	1.2400E-03	4.0000E-05	-4.4140E-06
Soya oil	5.3300E-03	4.7700E-03	6.0000E-05	2.0000E-05	-2.7124E-06
Olive oil	5.6400E-03	6.4600E-03	6.5000E-04	2.4000E-04	2.7300E-03
Butter	5.9500E-03	6.8700E-03	3.1500E-03	1.0000E-05	3.0000E-04
Skimmed milk powder	5.0300E-03	1.1800E-03	2.8000E-04	3.7439E-06	2.0000E-05
Cheese	5.7300E-03	6.9100E-03	3.7200E-03	1.6000E-04	-2.0000E-01
Fresh milk products	5.8300E-03	7.3500E-03	3.7300E-03	2.7000E-04	2.3880E-02
Cream	6.0600E-03	8.1400E-03	5.8300E-03	2.0000E-05	1.1700E-03
Concentrated milk	6.4900E-03	7.8900E-03	4.0100E-03	1.6000E-04	3.6000E-04
Whole milk powder	5.9300E-03	1.5300E-03	5.3000E-04	4.0000E-05	4.0000E-05

Note: Price in rows, demand in columns.

Source: CAPRI Modelling System. Additional references in Witzke *et al.* (1998).

TABLE 7
Input/output table in CAPRI for a selected region: Castilla y León

	Unit	Male cattle fattening	Dairy cows	Rape	Sunflower	Table grapes
Nitrogen	kg/ha			27.79	63.76	19.24
Phosphate	kg/ha			21.29	30.53	21.29
Potassium	kg/ha			25.92	102.22	18.67
Seed	Euro/ha			4.05	9.88	14.76
Plant protection	Euro/ha			16.47	18.74	310.86
Cereals	kg/head	2.93				
Protein	kg/head	0.11	429.08			
Gras	kg/head	10648.96	10342.48			
Maize	kg/head	1281.89	7476.95			
Fodder from arable land	kg/head	4.49	5811.93			
Root crops	kg/head	0.04	0.04			
Straw	kg/head	121.45	6829.22			
Pharamceutical inputs	Euro/head	29.09	59.20			
Maintenance machines	Euro/ha or Euro/head	27.72	44.27	4.91	13.29	334.45
Maintenance buildings	Euro/ha or Euro/head	6.21	11.49	1.26	3.42	81.07
Electricity	Euro/ha or Euro/head	7.00	0.00	0.82	1.01	0.78
Heating costs	Euro/ha			1.63	2.03	267.94
Fuel costs	Euro/ha			59.99	92.23	74.25
Lubricants	Euro/ha			2.59	3.78	2.94
Other input costs	Euro/ha or Euro/head	14.67	26.29	2.05	7.36	174.31
Milk for feeding	Euro/head	10.87	0.02			

Note: Nitrogen, phosphate, and potassium are in kg active ingredient per hectare. N is really low per hectare. Gras and fodder maize are in kg fresh harvested product.

Source: CAPRI Modelling System.