Scenarios for a cap beyond 2013

Implications for EU27 agriculture and the cap budget

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Abstract

Helming, J.F.M. & I.J. Terluin (2011). *Scenarios for a cap beyond 2013*; *implications for EU27 agriculture and the cap budget*. Wageningen, Statutory Research Tasks Unit for Nature & the Environment (WOT Natuur & Milieu). WOt-werkdocument 267. 63 p.; 18 Fig.; 16 Tables; 10 Ref.; 2 Annexes.

An *ex ante* analysis of a set of five policy components (proposed post 2013 CAP measures) has been carried out for the 2014-2020 period, based on the EC Communication *The CAP towards 2020* of 18 November 2010. The policy components are defined in such a way that they focus on the contribution of farmers to biodiversity as a public good. The consequences for the distribution of the CAP budget for the period 2014-2020 over EU Member States in the three scenarios are modelled by using the LEI budget model, whereas the shifts in production and income in EU agriculture are modelled by using the regionalised agricultural sector model CAPRI. This report gives background information especially related to the social-economic aspects of the overall report by the Environmental Assessment Agency. Model calculations with CAPRI show that the five policy components have sizeable market and income redistribution effects.

Key words: ex-ante analysis, agriculture, EU-27, sector model, income, production, biodiversity, emissions.

Inhoud

Summary

An *ex ante* analysis of a set of five policy components has been carried out for the 2014-2020 period, based on the EC Communication *The CAP towards 2020* of 18 November 2010. The policy components are defined in such a way that they focus on the contribution of farmers to biodiversity as a public good. The consequences for the distribution of the CAP budget for the period 2014-2020 over EU Member States in the three scenarios are modelled by using the LEI budget model, whereas the shifts in production and income in EU agriculture are modelled by using the regionalised agricultural sector model CAPRI. This report gives background information especially related to the social-economic aspects of the overall report by van Zeijts *et al.* (2011).

Main results described in this report

A reduction of 5% of the Pillar 1 (P1) budget of the EU15 to be redistributed to the P1 in the EU12 increases the P1 budget in the EU12 with about 20%. Agricultural income, including horticulture and fruit activities in the EU15 decreases with about 1% while agricultural income in the EU12 increases with about 6.5%. The impact on total agricultural income in the EU27 is about zero. Other proposed post 2013 CAP measures analysed in this report could potentially have sizeable market and income redistribution effects . In the EU15, winners of these proposed 2013 CAP measures can be found in regions with a large share of permanent grassland land in total cropping plan and a large share of LFA in total agricultural area. Table 1 shows the impact of the possible post 2013 CAP measures on selected variables in the different blocks of the EU27.

Table 1: Impact of the possible post 2013 CAP measures A to E on selected variables in the different blocks of the EU27.

Measure	Grassland		Arable land		Cereals		Milk		GWP[1]	
					Own production					
	ha		ha		kg				kg	
	EU15	EU12	EU15	EU12	EU15	EU12	EU15	EU12	EU15	EU12
A	0	0	0	0	0	0	0	0	0	0
B	+	0	0	0	-	0	0	0	-	0
C	++	+++	-	–	-	-	0	0	0	0
D	–	—	++	++	-	-	0	0	-	-
E	0	0	0	0	0	0	0	0	0	0
Moderate shifts (A+B)	+	0	0	0	-	0	0	0	-	0
Greening (A+B+C+D+E)	+	-	0	0	–	–	0	0	-	-

[1] The CO_2 (Global Warming Potential (GWP)) is referring to the conversion of CH_4 and N_2O to CO_2.

A: 5% shift from P1 in the EU15 to P1 in the EU-12

B: 5% shift from P1 in the EU15 to agri-environmental measures in P2 in the EU15. Note that this measure is only applied in the EU15;

C: a maximum payment per unit of permanent grassland equal to € 100 / ha.

D: a maximum payment per unit of arable land under greening conditions equal to € 100 / ha; condition is 5% ecological set-aside.

E: A payments for natural constraints equal to € 150 / ha.

+ means between 0.5% and 2.5%; ++ means between 2.5% and 5%; +++ means between 5% and 7.5%.

 - means between -0.5% and -2.5%; – means between -2.5% and -5%; –– means between -5% and -7.5%; — means between -7.5% and -10%

Other results

The changes in own production results in changes of agricultural prices and affect imports and exports of agricultural products of the EU27. Changes in agricultural prices in the EU27 range from about +1% for milk in the greening scenario to about +5% for cereals in the greening scenario. At the level of the EU27 as a whole these price changes offset the changes in supply and agricultural income in the EU27 slightly increases in the greening scenario, namely with about +1%. In the greening scenario imports of cereals into the EU27 increases from about 3.4% of the own production in the baseline scenario to about 3.9% of the own production. Due to slightly higher prices on world markets, world production of cereals and oilseeds increases with about 0.2% and 0.65% respectively.

Methodology

The objective of this study is to quantify the effects of different proposed post 2013 CAP measures on the CAP budget and on production and income in the agricultural sector of the EU27 at regional level. Different types of data and models are used, namely the so-called LEI budget model and the Common Agricultural Policy Regional Impact (CAPRI) model. With the LEI budget model changes in the CAP budget (consisting of P1 and P2 budgets) and changes in the distribution of the CAP budget over the EU Member States can be analysed. Changes in the CAP budget and changes in the distribution of the CAP budget might also affect production and production methods and prices and quantities on agricultural markets. This link between the CAP budget and agricultural markets is modelled by the CAPRI model. CAPRI is an EU27 partial equilibrium model for the agricultural sector at different levels of aggregation. In this report the lowest level of aggregation is the activity at the NUTS2 level (aggregated regional farm approach). Limitations of the model are related to the regional farm approach and the accompanying aggregation error, as structural differences between individual farms and differences in individual farm behaviour are not explicitly taken into account. Besides limitations of the model, translation of the different measures to the model variables is sometimes also complicated by the lack of data. This is for example the case with respect of the hectare of land with agricultural measures in the baseline and the impact of agri-environmental measures on yield losses in the different sectors and regions of the EU.

1 Introduction

In November 2010, the European Commission presented three potential paths for the design of the Common Agricultural Policy (CAP) in the programming period 2014-2020 (European Commission, 2010). These three policy options could globally be denoted as an enhancing of the status quo with some minor adaptations, a greening of the CAP and a more radical reform with a phasing out of the direct payments. The rather open nature of the Commission's communication leaves much room for manoeuvre in the debate among Member States, the European Parliament, the Commission and other stakeholders on the future design of the CAP.

In order to contribute to this discussion on the design of the CAP beyond 2013, this study attempts to model three CAP scenarios: a baseline scenario, a moderate shifts scenario and a greening scenario. The baseline scenario assumes a continuation of the present CAP beyond 2013, whereas the other two scenarios build upon the policy options as outlined by the Commission. The scenarios are defined in such a way that they focus on the contribution of farmers to biodiversity as a public good. The consequences for the distribution of the CAP budget for the period 2014-2020 over EU Member States in the three scenarios are modelled by using the LEI budget model, whereas the shifts in production and income in EU agriculture are modelled by using the regionalised agricultural sector model CAPRI.

The plan of this report is as follows. In Chapter 2 we start with a summary of the Commission's communication 'The CAP towards 2020; Meeting the food, natural resources and territorial challenges of the future' is given, followed by some reflections. In the last section of Chapter 2 the three CAP scenarios are introduced. In Chapter 3 the methodology and some selected data are discussed. In Chapter 4 the production and structure of the agricultural sector in the EU27 in 2020 in the baseline scenario is discussed. In Chapter 5 the results of the two scenarios that build upon the policy options are presented for the CAP budget as well as for production and structure of the agricultural sector in the EU27. In Chapter 6 we end with discussion and conclusions. Special emphasis is given to uncertainties with respect of data and results.

2 Policy context and scenario design

2.1 Communication of the European Commission on 'The CAP towards 2020'

In its communication 'The CAP towards 2020; Meeting the food, natural resources and territorial challenges of the future', the European Commission (2010) reflects its ideas on the post-2013 CAP reform. Basically, the future CAP should remain a strong common policy structured around its two pillars, and addressing the three challenges of global food security, environmental protection and climate change, and a territorial balance among rural areas in the EU. Given these challenges, the three objectives of the future CAP are as follows:

1. Viable food production, i.e. to contribute to farm incomes and limit farm income variability, to improve the competitiveness of the agricultural sector and to enhance its value share in the food chain, and to compensate for production difficulties in areas with specific natural constraints.
2. Sustainable management of natural resources and climate action, i.e. to guarantee sustainable production practices and secure the enhanced provision of environmental public goods, to foster green growth through innovation, and to pursue climate change mitigation and adaptation actions.
3. Balanced territorial development, i.e. to support rural employment and maintaining the social fabric of rural areas, to improve the rural economy and promote diversification, and to allow for structural diversity in the farming systems.

In order to address these objectives, the Commission gives some suggestions about how the present CAP instruments for direct payments, market measures and rural development could be adapted.

Adaptations of direct payments

Necessary adaptations of direct payments relate (a) to a redistribution, (b) to make them better understandable to the taxpayer, and (c) to target them to both income support and support for the provision of public goods. Major disruptive changes should be avoided in the evolution of policy towards a more equitable distribution of direct payments. Future direct payments could be based on the following elements:

- basic income support through decoupled direct payments;
- a mandatory 'greening' component for actions addressing climate and environmental goals in the form of simple, non-contractual and annual payments for, for example, permanent pasture, green cover, crop rotation and ecological set-aside;
- area-based payments to promote the sustainable development of agriculture in areas with specific natural constraints, which are additional to the support for Less Favoured Areas (LFA) in the second pillar;
- voluntary coupled support to take account of specific problems in certain regions with particular types of farming;
- simplification of cross compliance rules.

Adaptations of market measures

Despite the overall market orientation of the CAP, some intervention instruments which act as a safety net in case of a price crisis or a market disruption are desirable. The Commission refers to the coming legal proposals for the dairy sector on the basis of the recommendations of the High Level Expert Group on Milk, and reaffirms the removal of the dairy quotas in 2015. The Commission also announces some future proposals for the sugar and isoglucose sectors, whose current regime is set to expire in 2014/15, and refers to its intention to improve the functioning of the food supply

chain, especially the problem of the steadily decreasing share of agricultural value added in the food supply chain. Discussions on proposals to address this problem have already been initiated by the Commission.

Adaptations of rural development

The current rural development policy can be maintained, contributing to the competitiveness of agriculture (axis 1), sustainable management of natural resources (axis 2) and a balanced territorial development (axis 3). Environment, climate change and innovation should be guiding principles. In addition to the current menu of rural development measures, a risk management toolkit should be included.

Three broad policy options

Finally, the Commission presents three potential paths for the future CAP, which reflect the main orientations in the public debate, which are not mutually exclusive and which merit further consideration (Table 2.1).

Table 2.1: Policy options for a future CAP

Option 1		
Gradual change of the current policy framework and more equity in the distribution of direct payments between Member States		
Direct payments (DP)	*Market measures*	*Rural development*
– no change of system. – more equity in DP between Member States.	– strengthen risk management tools. – streamline and simplify existing market instruments.	– maintain Health Check orientation with increased funding for new challenges of climate change, water, biodiversity and renewable energy, and innovation.
Option 2		
A shift towards a more sustainable CAP and a better balance between the different policy objectives, farmers and Member States, to be achieved by targeted payments		
Direct payments (DP)	*Market measures*	*Rural development*

– change in the design of DP; new DP are composed of:
  a) a basic rate serving as income support;
  b) a compulsory additional aid for specific 'greening' public goods;
  c) an additional payment to compensate for specific natural constraints;
  d) a voluntary coupled support component for specific sectors and regions.
– more equity in DP between Member States.
	– improve and simplify existing market instruments.	– more focus on environment, climate change and/or restructuring, innovation, and regional/local initiatives.
		– strengthen existing risk management tools.
		– some redistribution of funds between Member States could be envisaged.

Option 3		
A far reaching CAP reform with a strong focus on environmental and climate change objectives, and moving away from income support and market measures		
Direct payments	*Market measures*	*Rural development*
– phasing out of DP. – limited DP for environmental public goods and specific natural constraints payments.	– abolish all market measures, except for a safety net in times of severe crises.	– measures are mainly focused on climate change and environmental aspects.

Source: EC (2010)

This communication is the Commission's response to the debate on the future CAP. After discussions with the Council, the Parliament and other stakeholders, the Commission hopes to present legislative proposals in 2011 for a future CAP that is 'a more sustainable, more balanced, better targeted, simpler and more effective policy, [and] more accountable to the needs and expectations of the EU citizens' (EC, 2010:13).

2.2 Reflections on the communication of the European Commission

The communication of the European Commission provides no detailed blueprint for a future CAP, but can rather be denoted as a cautious and global contribution to the debate on the CAP beyond 2013. The three outlined policy options for a future CAP cover a wide range of potential paths, varying from maintenance of the status quo with some slight adaptations, to shifts towards a greening of the CAP and a more radical reform with a phasing out of direct payments. In addition, no reference to the size of a future CAP budget or the distribution of the budget over the first and second pillar is made. Perhaps the clearest indicators for the future design of the CAP are the wishes of the Commission:
- to maintain the two pillar structure;
- to continue the emphasize on the new challenges of the Health Check Agreement (2008) of climate change, water management, biodiversity and renewable energy, and innovation;
- to strive after more equity in direct payments between Member States; and
- to use direct payments for environmental support as well, thereby making them better understandable for the taxpayer.

However, details of a redistribution of direct payments over Member States or the level of payments for public goods are not given. As such, the communication leaves much room for manoeuvre for designing scenarios for a future CAP.

Change in the base of the direct payment needed, but complicated
Given the fact that the origin of the current direct payments granted to farmers refers to a compensation for price decreases in the beginning of the 1990s, the justification of continuing these payments after two decades can be questioned (Meester, 2010). On the other hand, many farmers will no longer manage to get a reasonable income without these payments. In that case, parts of the agricultural land will likely to be abandoned which could have undesired effects for the landscape and the associated biodiversity. This is generally not desired in broad societal circles, in particular in marginal areas. This dilemma reveals why a redesigning of the direct payments is needed. In the Health Check Agreement (2008) it is decided to decouple income payments for all agricultural products in 2012, except for suckler cows and sheep, and Member States are invited to introduce regional flat rates.

A logical further step in this adaptation process of the direct payments would be to grant direct payments to the farmer as payment for the maintenance and improvement of landscape and nature values. However, to specify details for such payments is difficult, as landscape is a public good for which markets are missing to trade such commodities. Moreover, such payments have to be compatible with the requirements of the so-called green box of the WTO. Moreover, if a change of direct payments to payments for public services results in a shift of payments from the one farmer to the other, or in shifts of payments among regions, disruptive effects for some (groups of) farmers may also arise. That is why such a change in the base of the direct payment – desirable from the viewpoint of the justification of the payment – should be implemented gradually, leaving farmers sufficient time to adapt their farm strategy to the new situation without large risks for continuity of farming.

New Member States strive after more equity in the level of direct payments

Currently, direct payment per ha rather varies among Member States. The average direct payment in the EU15 is 295 euro p.a. against 187 euro in the new Member States (Figure 2.1). Within both groups of countries, fluctuations around this average can be perceived. These differences in the level of direct payments per ha are related to the size of the CAP budget for each Member State, largely determined by historical developments and political agreements, which is not an unambiguous distribution key. Moreover, the distribution of the CAP budget over the first and second pillar largely varies between Member States, in which EU15 Member States tend to have a relatively large share of the budget spent on Pillar 1 (P1) while the new Member States spend most of the budget in Pillar 2 (P2). The disparities in the level of direct payments per ha in the old and new Member States have provoked a debate – especially in the new Member States headed by Poland – on getting more equity in the level of direct payments per ha in the EU Member States. More equity in the levels of direct payments is likely to be accompanied by a redistribution of the budget from the old to the new Member States, which impinges with the interests of those EU15 Member States who strive after maximum receipts from the CAP budget.
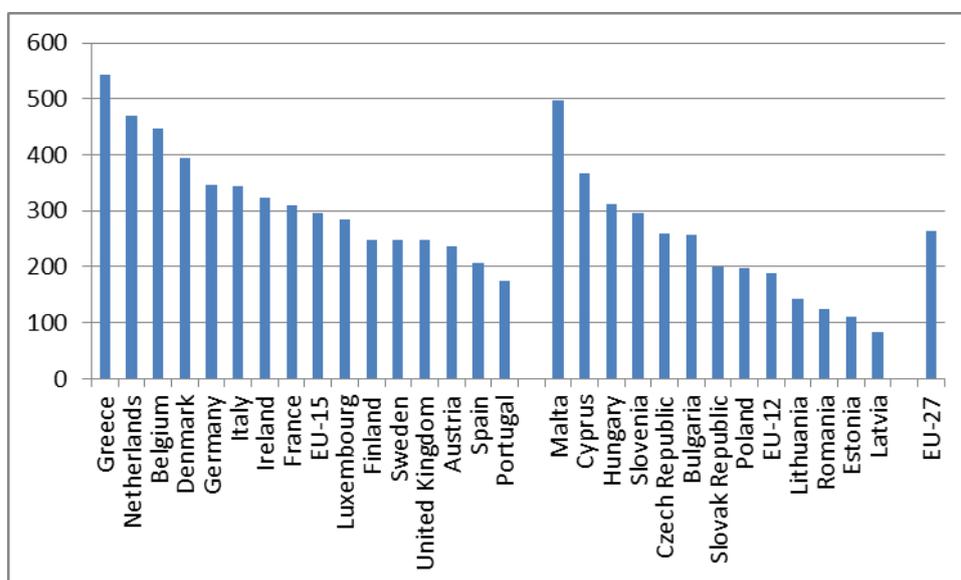
Source: LEI budget model.

Figure 2.1: Direct payments in the EU Member States, 2014-2020 (euro per ha p.a.)

LFA payments in two pillars?

The Commission suggest to grant direct payments in P1 to farmers in areas with natural constraints in addition to the LFA support already be given in P2. It could be wondered why there should be compensatory payments for natural handicaps in both pillars. The impression arises that this would increase the complexity of the CAP. Given the intention of both the Commission and the Member States to simplify the CAP, the attachment of LFA payments to one of the two pillars has to be preferred. Whether LFA payments should be included in P1 or P2 is a political matter with consequences for the budget, as the current LFA payments in P2 are cofinanced by Member States, whereas direct payments in P1 are not cofinanced.

The same situation of overlap arises to some extent to the suggested mandatory greening direct payments in P1 and the agri-environmental payments in measure 214 in P2. However, the suggested greening direct payments are annual and non-contractual payments, whereas the agri-environmental payments in measure 214 are made on a contractual and multi-annual base.

Expectations on the size of the CAP budget 2014-2020
The size of the CAP budget for the financial period 2014-2020 is not yet exactly known. This complicates the design of a future CAP, as this is also dependent on the available budget. Given experiences in past negotiations on the CAP budget and the current financial crisis, it seems not likely that the CAP budget 2007-2014 will exceed that in the period 2007-2013 in nominal terms, and probably it will be slightly less.

2.3 Design of scenarios for a future CAP

In this section, we design three scenarios for a CAP in the period 2014-2020. A baseline scenario is the first scenario, while the other two scenarios are derived from policy options 1 and 2 as outlined in the communication by the European Commission. As these policy options are described in rather global terms without any indication of the size of the CAP budget and its distribution among the first and second pillar and among Member States, this leaves many degrees of freedom in the design of the scenarios. On the other hand, as we intend to estimate the results of the scenarios with the model CAPRI, the degrees of freedom are restricted to some extent as the scenarios have to be designed in such a way, that they can be modelled by CAPRI. This implies that the scenarios have to use variables that are known in CAPRI. Given the wish of PBL to explore the environmental impacts of a future CAP, our scenarios in particular emphasize environmental elements, leaving items like innovation and competitiveness largely outside consideration. The impact of investments in innovation and competitiveness are discussed in more qualitative terms in Chapter 6.

Baseline scenario
The baseline scenario assumes business as usual, which implies that the CAP beyond 2014 is similar to the contents of the CAP in 2013. As a result of the Health Check Agreement, this means that milk quota will be abolished in 2015. With respect to the P1 payment, the baseline scenario assumes a regional flat rate at NUTS2 level with all payments decoupled from production.

Scenario 1: Moderate shifts scenario
Policy option 1 in the Commission's communication is translated in terms of the moderate shifts scenario in this study. This scenario assumes continuation of the system of direct payments, more equity in the level of direct payments per ha between EU Member States and increased funding for the new challenges of the Health Check agreement (i.e. climate change, water, biodiversity and renewable energy, and innovation). In order to reduce the disparities in the direct payments per ha in the EU15 and EU12 Member States, the budget for P1 in the EU15 is reduced by 5% (Table 2.2). These funds are redistributed over P1 of the new Member States. In order to foster the new challenges of the Health Check, 5% of the P1 budget in the EU15 Member States is also shifted to their P2 budget and spent on agri-environmental payments (i.e. measure 214). This measure is only applied to the EU15 as the share of P2 payment in total of P1 and P2 payment is already relatively high in the EU12.

Table 2.2: P1 and P2 in the old and new EU Member States in the moderate shifts scenario

	P1
EU15 Member States	Reduction of 5%, to be redistributed to P1 in the EU12
	Reduction of 5%, to be shifted to P2
	In conclusion P1 budget in EU15 is reduced by 10%
EU12 Member States	Increase in P1 by (share Member State in total P1 EU12) * (total reduction P1 EU15 Member States)

Scenario 2: Greening scenario

The greening scenario is an extension of the moderate shifts scenario and includes the following elements:

1. The assumptions on P1 and P2 as in the moderate shifts scenario; plus:
2. A (maximum) payment per unit of permanent grassland in P1 equal to € 100 / ha. Contrary to the current system of decoupled payments, this is a coupled payment;
3. A (maximum) payment per unit of arable land under greening conditions in P1 equal to € 100 / ha; conditions are 5% ecological set-aside (to make it worthwhile for biodiversity), crop rotation requirements and winter cover (the latter two not being part of the CAPRI calculations and therefore excluded from this study). Contrary to the current system of decoupled payments, this is a coupled payment;
4. The sum of the payments for permanent grassland and arable land is ≤ 30% of a member states' new P1 budget (after redistribution P1 in the moderate shifts scenario). If the sum of the payments for permanent grassland and arable land exceeds the threshold of 30% of the P1 budget; the payment per unit land is decreased proportionally);
5. A (maximum) payment for natural constraints per ha LFA in P1 equal to € 150 / ha;
6. The sum of the payments for natural constraints is ≤ 30% of a member states' new P1 budget (after redistribution P1 in the moderate shifts scenario). If the sum of the payments exceeds the threshold of 30% of the P1 budget; the payment per ha LFA is decreased proportionally);
7. The remaining P1 budget is used for basic income support and granted to farmers as a flat rate payment per ha The budget for these flat rate payments is ≥ 40% of the new P1 budget.

Ad 3. Payment to arable land

It is assumed that this payment is eligible for all arable crops, except for permanent and horticultural crops and fruits (as we assume high gross margins restrain market gardeners from participation). The 5% ecological set-aside should be seen as a sort of buffer zones for environmental reasons.

Ad 5 Natural constraints payment

A main difference with the baseline scenario is that all ha LFA receive an extra (maximum) payment of € 150 per ha. This payment is given in addition to the payment of € 150 per ha already granted via P2 in the baseline scenario. The existing LFA support is currently granted to only a small part of farms in LFA.

Ad 7 Flat rate payments

The remaining P1 budget is spent on regional flat rate payments. The application of a regional flat rate system should be interpreted as 'no change in the system of the direct payments' (EC, 2010) in such a way that just like in the baseline scenario it is assumed that those Member States currently using historical payments have accepted the invitation of the Commission in the Health Check agreement to apply a regional flat rate. It should be noted that the agricultural sector model used in this study, namely CAPRI employs a regional farm and a regional flat rate system in the baseline scenario (see also Section 5.2). So the results of the modelling of the greening scenario with CAPRI do not include the impact of a switch from historical to flat rate payments on production and income.

3 Methodology and data

3.1 The LEI budget model

To enable a detailed understanding of the redistribution effects of changes in the CAP budget, the Budget Model has been developed by LEI. This model consists of:
- Budget data relating to Direct Payments (DP) 2007-2016 in P1 for the EU27 Member States. Budget data are specified by the EU until 2016 in relation to the phasing in of Bulgaria and Romania.
- Budget data relating to the European Agricultural Fund for Rural Development (EAFRD), national and private funding 2007-2013 per rural development measure in P2 for the EU27 Member States and/or regions.
- A set of calculation rules for the transfer of funds between the two pillars.

By using the Budget Model, changes in the P1/P2 budgets and changes in the distribution of the CAP budget over EU Member States in the moderate shifts scenario and the greening scenario can be presented.

3.2 CAPRI

We apply the Common Agricultural Policy Regional Impact (CAPRI) model to analyse the impact of the different scenarios described above on agricultural production and income in the EU27. CAPRI is an EU27 partial equilibrium model for the agricultural sector at NUTS2 level (aggregated regional farm approach). It consists of a supply module and a global market model:
- The supply module of CAPRI comprises around 280 regional farm models (one farm model for each NUTS2 region in the EU27, Norway, Western Balkans and Turkey) covering about 50 crop and animal activities for each of the regions and including about 50 inputs and outputs. Each regional farm model optimizes regional agricultural income at given prices and subsidies, subject to constraints on land, policy variables and feed and plant nutrient requirements in each region. An interesting feature of the supply module of CAPRI is that agricultural activities are divided into an extensive (low input, low yield) and an intensive type or variant (high input, high yield). In CAPRI it is assumed that yield per hectare of an extensive technology of a specific crop is 20% below the average yield per hectare of that crop, while that of the intensive technology is 20% above the average yield. The variable input use per hectare of the extensive technology is assumed to be 25% below the average, while that of the intensive technology is 25% above the average. This does not apply for the use of plant protection per ha: this is 40% below or above the average.
- The CAPRI global market model is a comparative static Multi-Commodity model. It covers 47 primary and secondary agricultural products.

The supply module and the global market model of CAPRI are iteratively linked. Equilibrium ensures cleared markets for products and young animals, match of feeding requirements of national herd (www.capri-model.org).

Modelling the three scenarios
For modelling the scenarios with CAPRI, it should be taken into account that four conditions may vary in the scenarios. These are:
- The budget for agri-environmental (AE) payments in P2 (measure 214);
- The payment for permanent grassland in P1;
- The payment for arable land in P1;

- The payment for natural constraints in P1;

Below we briefly explain how these conditions are dealt with in CAPRI.

Modelling AE measures in P2

Both in the moderate shifts and in the greening scenario, the budget for AE measures in P2 is increased relative to that in the baseline scenario. In CAPRI, the total AE budget in the 2020 baseline scenario is first distributed to grassland and arable crop activities per NUTS2 region. At this stage we have no information about the exact measures that are applied on the farm and what crops are targeted. Therefore we assume a number of different agri-environmental packages with various changes in yields and input costs per ha of grassland and arable crop. We assume that the agri-environmental packages are not applied to permanent and horticultural crops and fruits. This is again due to limited knowledge about the distribution of the AE budget over the different crops. Here it is assumed that the relative high gross margins per ha of permanent and horticultural crops and fruits make it less attractive for farmers to apply for AE premiums and the accompanying environmental measures. Given the definition of the packages, the yield loss (and variable input costs savings) per hectare grassland with AE measures is assumed equal to 37.5% per ha, while the yield loss per hectare of arable land with AE measures is assumed equal to 68.9% per ha. These percentages are applied to all member states and regions. Given average gross margin per hectare of grassland and arable crop in 2020 in the baseline scenario, yield losses and input costs savings, we can calculate the gross margin loss. This in turn is an indicator for the AE premium per hectare of grassland and arable land. Given the total budget for AE measures for grassland and arable land, we can calculate the hectares of grassland and arable land with AE measures. Results with respect of the baseline scenario are presented in Table 3.1. The hectare of grassland and arable land with AE measures can be different in the baseline and in the two policy scenarios, depending on the budget available for agri-environmental measures (see Annex 2 for a more detailed description).

Table 3.1: Hectare under AE support in 2020 in the baseline and budget for AE measures in P2 in 2020 in the baseline scenario

	Hectare under AE in baseline			Annual budget[1] for AE measures in P2 (mln Euro)
	Total (1000 ha)	Grassland (1000 ha)	Arable land (1000 ha)	
Belgium	144	111	32	49
Denmark	410	36	374	31
Germany	2440	1781	659	537
Austria	1149	862	287	503
Netherlands	102	95	7	76
France	3989	3653	337	441
Portugal	425	342	83	59
Spain	6001	4457	1543	276
Greece	700	557	143	121
Italy	1988	1652	336	547
Ireland	1430	1394	36	337
Finland	1153	257	896	296
Sweden	642	225	417	284
United Kingdom	4664	4311	352	551

[1] EAFRD budget plus national cofinancing.
Source: Rural Development Programmes 2007-2013 (updated versions after Health Check Agreement and European Recovery Plan) of the EU Member States/regions; adaptation LEI.

Modelling the payment for permanent grassland in P1

The greening scenario includes a maximum payment per unit of permanent grassland equal to € 100 / ha. This payment is given as a lump sum to the income per ha permanent grassland. However, as CAPRI does not distinguish permanent grassland as a separate activity, this payment is linked to all grassland in CAPRI in such a way that the greening payment per ha permanent grassland is multiplied by the share of permanent grassland in total grassland in a NUTS2 region.

Table 3.2: Acreage of permanent grassland and total utilised agricultural area per member state in 2007 (1000 ha)

	Utilised agricultural area (1000 ha)	Total: Permanent grassland and meadow (1000 ha)	Permanent grassland and meadow as % UAA
Belgium	1374	511	37
Denmark	2663	201	8
Germany	16932	4839	29
Greece	4076	820	20
Spain	24893	8650	35
France	27477	8105	29
Ireland	4139	3130	76
Italy	12744	3452	27
Luxembourg	131	68	52
Netherlands	1914	821	43
Austria	3189	1730	54
Portugal	3473	1781	51
Finland	2292	38	2
Sweden	3118	487	16
United Kingdom	16130	10080	62
EU15	124546	44713	36
Cyprus	146	2	1
Czech Republic	3518	909	26
Estonia	907	273	30
Hungary	4229	504	12
Lithuania	2649	819	31
Latvia	1774	640	36
Malta	10	0	0
Poland	15477	3271	21
Slovenia	489	288	59
Slovak Republic	1937	551	28
Bulgaria	3051	280	9
Romania	13753	4540	33
EU-12	47939	12078	25
EU27	172485	56791	33

Source: FSS

Table 3.2 presents the acreage of permanent grassland in 2007. In CAPRI it is assumed that these acreages are constant in the baseline scenario. This means that if the total acreage of temporary and permanent grassland decreases in the baseline scenario as compared to basis of CAPRI, in this case the average situation in 2003, 2004 and 2005, the ratio between permanent grassland and total grassland increases.

Modelling the payment for arable land in P1

The greening scenario also includes a maximum payment per unit of arable land under greening conditions equal to € 100 / ha. All arable crops (including tomatoes, other vegetables and fallow land, but excluding permanent and horticultural crops and fruits) are assumed eligible for this payment –it is assumed that all arable farmers participate, which means that the greening measures are de facto mandatory. The greening payment is conditional upon 5% ecological set-aside. In CAPRI this is translated into a 5% yield reduction and 5% reduction of variable input use per hectare of eligible crop per extensive (low input, low yield) and intensive (high input, high yield) technology. The premium of € 100 / ha per arable crop per technology works in favour of the farmers with relatively extensive and low margin crop activities. Hence, under this measure the area allocated to these farmers and crops will increase, at least compared to the baseline in 2020. In other words, the autonomous decrease of extensive and low margin farming systems will at least slow down.

Modelling the payment for natural constraints in P1

Natural constraint areas are assumed equal to the LFA areas. The greening scenario assumes a payment of maximum 150 euro per ha LFA. As CAPRI works at NUTS2 level, the share of LFA in a NUTS2 region is crucial for the distribution of the LFA budget among NUTS2 regions: average LFA payment (€ per ha per crop per NUTS2 region) is relatively high in NUTS2 regions with relatively high shares of LFA in total utilised agricultural area. Moreover, the average LFA payment in a NUTS2 region can be different for arable crops and grassland. This reflects the observed situation that the share of arable crops and grassland in total agricultural area in an LFA area can be different from the average share in the corresponding NUTS2 region as a whole. Basically, the LFA payments support grassland farms more than arable farms. Details concerning the modelling of natural constraints or LFA payments in CAPRI can be found in Annex 2.

4 Results of the baseline scenario

The CAP budget 2014-2020 in the baseline scenario

If the CAP would not be changed, we assume that the CAP budget 2014-2020 is composed as follows: annual direct payments in P1[1] in the period 2014-2020 are equal to those in 2013[2], while the P2 budget for 2014-2020 is similar to that in the period 2007-2013 (Table 4.1). As a result of the phasing in of the direct payments in the new Member States, their baseline P1 budget for the period 2014-2020 is about 30% above that in the period 2007-2013 (Annex 1, Table A1). It has to be noted that the shares of the budget for P1 and P2 in the total budget rather differs among Member States; EU15 Member States tend to have a relatively large share of the P1 budget in the total budget (81%), whereas the new Member States tend to have a relatively large share of the P2 budget in the total budget (48%) (Annex 1, Table A2). These different shares result in different impacts of the scenarios on the size of the CAP budget in each Member State.

Table 4.1: CAP budget 2007-2013 and estimate of the baseline CAP budget 2014-2020, EU27 (10^9 euro)

	2007-2013	2014-2020
First pillar (direct payments)	286	320
Second pillar (EAFRD)	94	94
Total first and second pillar	380	413

Source: budget direct payments 2007-2013 from Council Regulation 1782/2003 (consolidated version – 5 August 2006) en Agra Europe (2007), 'Threat of SFP cuts rises as NMS accede', Agra Europe Weekly, 12 January 2007; P2 (= EAFRD) budget 2007-2013 from Rural Development Programmes 2007-2013 of the EU Member States /regions (updated versions 2009/2010); budget direct payments 2014-2020 (HC agreement) from Council Regulation 73/2009, Annex VIII; adaptation LEI.

The agricultural sector in the EU27 in the baseline scenario

Below we describe some selected developments in the baseline scenario, going from the historical base period '2004' (which is an average of 2003, 2004 and 2005) to 2020.

The development of prices of agricultural products and yield per agricultural activity going from our historical base period '2004' until 2020 according to our baseline scenario in CAPRI is derived from extrapolation of trends in the past and price developments as projected by the different outlooks (OECD-FAO, 2009). An important source of data is the own CAPRI database that includes time series for a large number of variables from 1984 to 2005. It is important to take changes in prices and yields into account as the changes in relative prices and revenues importantly affect the behaviour of the farmers in relation to policy changes in the moderate shifts and greening scenario.

Table 4.2 shows the price development. Table 4.2 shows that in the baseline scenario price developments between the EU15, EU10 and EU2 (Bulgaria and Romania) are quite different. This is especially the case for the selected livestock products.

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[1] For convenience sake we disregard the relatively small budget for market interventions and export refunds in P1.

[2] For Bulgaria and Romania we take account of the phasing in of the direct payments till 2016.

Table 4.2: (Nominal) Price development of some selected agricultural products and variable inputs in different regional blocks of the EU27 in the baseline scenario, 2020 (index '2004' =100)

	EU15	EU10	EU2
Cereals	116	105	99
Oilseeds	126	129	137
Other arable field crops	110	106	128
Vegetables and Permanent crops	131	126	127
Beef	104	132	123
Pork meat	101	81	80
Sheep and goat meat	120	117	118
Poultry meat	101	76	75
Cow and buffalo milk	107	126	111
Sheep and goat milk	72	82	69
Eggs	104	81	82
Fertilizer	142	127	141
Feeding stuff	127	131	146
Other variable inputs	135	135	135

Source: CAPRI

Average changes in yield per ha per arable crop over the period '2004 to 2020 in the EU27 varies from about +20% for cereals to +10% for sugar beets. Grassland production increases with about 10%. Milk production per dairy cow increases with about 10%.

Table 4.3 shows the cropping plan and the size of the livestock in 2020 in the baseline scenario in the EU15, EU12, EU10 and EU2 (Bulgaria and Romania). Shares of the different crops in total utilized agricultural area are mentioned in percentages below. In the EU12 the share of cereals in total cropping plan exceeds the share of cereals in total cropping plan in the EU15. From the other hand, in the EU15 the share of fodder crops is relatively large. Utilized agricultural area in the EU15 in 2020 in the baseline scenario equals about 134 million (mio) hectare, whereas in the EU12 this is about 51 mio hectare in 2020. In the EU12 the share of set-aside and fallow land is also relatively high compared to the EU15. The number of dairy cows in the EU15 exceeds the number of dairy cows in the EU12 with almost a factor 4. Also the number of animals in other livestock sectors in the EU15 is much bigger compared to the EU12.

Table 4.3 also shows the development in hectares or heads of some selected agricultural activities. Again the development in the EU15 and in the EU12 can be quite different in the baseline. As explained above the trends included in the baseline (hectare, heads, yield per unity in '2004'and in the 2020 baseline scenario) result from the combined use of agricultural outlook data (OECD-FAO) and trends found in the CAPRI database.

In general agricultural production in 2020 in the baseline scenario in the EU27 increases as compared to 2004. The increase in production in the EU27 ranges from about +10% to +20% for cereals, vegetables and permanent crops, pork and poultry meat, eggs and dairy products to about +60% for oil seeds and about -10% for beef and sugar. Table 4.4 shows that in 2020 in the baseline scenario the share of the EU27 in the world production of agricultural products ranges from less than 10% for oilseeds, vegetables and permanent crops and sugar to almost 50% for cheese. The share in world imports and exports is also considerable (Table 4.4). The share of the EU27 in world imports or exports exceed the share in production by far. This shows a) the importance of the EU27 on world markets and b) the relative limited volume of world trade as compared to world production.

Table 4.3: Hectare or head of some selected activities in EU15, EU12, EU10 and EU2 (Bulgaria and Romania) in 2020 in the baseline scenario and development (index '2004' =100)

	Hectares or head of selected activities							
	mio				index			
	EU15	EU12	EU10	EU2	EU15	EU12	EU10	EU2
Cereals	34283	22268	16167	6101	93	95	105	76
	26%	43%	50%	32%				
Oilseeds	8453	3570	2138	1433	188	90	106	74
	6%	7%	7%	8%				
Pulses	1478	179	94	86	85	48	41	57
	1%	0%	0%	0%				
Potatoes	930	633	307	326	77	52	33	112
	1%	1%	1%	2%				
Sugar Beet	1215	318	293	25	75	62	60	89
	1%	1%	1%	0%				
Vegetables and permanent crops	17044	4120	1681	2439	134	187	134	258
	13%	8%	5%	13%				
Fodder activities	62037	16029	8868	7160	94	87	82	94
	46%	31%	27%	38%				
o.w. grassland	48485	13990	7325	6665	95	96	91	100
	36%	27%	23%	35%				
o.w. other feed on arable land	9925	1239	779	460	91	45	41	55
	7%	2%	2%	2%				
Set aside and fallow land	8678	4318	3001	1317	104	164	145	232
	6%	8%	9%	7%				
Dairy cows	17003	4602	3017	1585	89	73	68	85
Other Cows	11480	144	96	48	96	58	42	235
Male adult cattle	9499	1431	787	643	88	67	50	92
Pig fattening	209471	40591	36525	4066	107	92	98	60
Pig Breeding	11865	3364	3022	341	98	97	103	67
Milk Ewes and Goat	66326	12707	2480	10227	93	110	104	112
Sheep and Goat fattening	45642	1044	454	591	85	32	66	23
Laying hens	354	104	75	29	99	78	83	69
Poultry fattening	5290	1391	1175	215	118	120	126	94

Source: CAPRI

Agricultural production, imports and exports of the EU27 and the world as a whole in the 2020 baseline scenario of CAPRI can be compared with the average situation in the period 2008-2010 (OECD-FAO, 2011). In general the share of the EU27 in world production in 2020 in the baseline scenario increases slightly, with the exception of butter and whole milk powder. From the other hand, the shares of the EU27 in imports and exports in 2020 in the baseline scenario is in general much higher than average in the period 2008 to 2010. Possibly import and export figures in 2020 in the baseline scenario are overestimated and as a result the effects of the different scenarios on world markets might also be slightly overestimated.

In the 2020 baseline scenario agricultural income (revenues plus premiums minus variable costs) in the EU27 is in nominal terms about 5 to 10 % below agricultural income in the '2004' base. This results from the 2020 baseline calculations of CAPRI. As agricultural income decreases in nominal terms, the number of farms must decrease sharply and the size and labour productivity of the farm should grow, to allow for a reasonable farmers income in real terms.

Table 4.4: Production, imports and exports and shares in world production, imports and exports of the EU27 in 2020 in the baseline scenario

	EU-27			Share EU-27 in World		
	Production	Imports	Exports	Production	Imports	Exports
	mio t	mio t	mio t	%	%	%
Cereals	310.9	10.57	41.83	15.6	7.0	28.3
Oilseeds	34.1	26.97	6.36	8.6	25.7	6.1
Veg. and Perm. crops	142.7	18.62	5.03	8.8	33.3	9.0
Meat	46.5	2.10	5.53	15.2	13.0	34.3
Beef	7.9	0.85	0.57	11.5	29.8	20.1
Pork meat	24.3	0.56	2.76	22.0	9.5	46.7
Poultry meat	13.3	0.31	2.15	11.9	4.9	34.3
Eggs	7.5	0.54	0.65	10.7	65.1	79.2
Butter	1.8	0.19	0.03	18.8	50.9	9.2
Skimmed milk powder	0.8	0.09	0.12	29.4	20.2	26.5
Cheese	9.7	0.68	0.83	46.7	42.5	52.1
Whole milk powder	0.7	0.06	0.25	17.4	8.8	38.7

mio t = million tonnes
Source: CAPRI

Table 4.5 shows that in 2003 there are about 10 mln farms in the EU25 (excluding Bulgaria and Romania) (Nowicki *et al.*, 2006). More than 50% of these farms are classified as arable or vegetables and permanent crop farms. The number of farms per sub-sector in the 2020 baseline is also presented in Table 4.5. Table 4.5 is the result of extrapolation of observed trends and is not part of the CAPRI database. In some cases the trends in the number of farms per sub-sector are adjusted to avoid unrealistic results in the baseline in 2020. In this study it is assumed that the development of the number of farms going from 2003 to 2020 baseline in Nowicki *et al.* can be compared to the development of the number of farms in our baseline. This is a reasonable assumption as the development of the number of farms is largely determined by variables at macro-level that are outside the scope of this study. Table 4.5 also shows that in the baseline the number of farms will decrease in all sub-sectors. The only exception is the other animals sub-sector. The latter is especially explained by the increase in the EU10. In the baseline the decrease in the number of farms is especially strong in the mixed livestock and the mixed crop sub-sectors. This could be explained by the tendency to specialise in a limited number of production lines as showed, for example, by the increase in the number of other animal farms. In the baseline the total number of farms in the EU25 decreases by about 25%.

Table 4.5: Number of farms per sub-sector in 2003 and in 2020 in the EU25 in the baseline scenario (in mln farms).

	2003	**2020**	
		Baseline	Baseline vs. 2003
Arable crops	2.3	1.4	-37.4
Vegetables and permanent crops	2.8	2.6	-7.9
Cattle activities	1.8	1.5	-19.6
Other animals	0.4	0.6	74.3
Mixed livestock farms	0.7	0.2	-64.4
Mixed crop farms	0.8	0.1	-88.1
Other livestock and crop farms	1.2	1	-15.3
Total	10	7.5	-25.4

Source: Nowicki *et al.* (2006)

5 Results of the moderate shifts and greening scenario

5.1 The CAP budget

In this section, we discuss the consequences of the three scenarios for the P1 and P2 budget and its distribution over Member States.

The CAP budget 2014-2020 in the moderate shifts scenario

In the moderate shifts scenario, the CAP budget in the period 2014-2020 in the EU15 Member States decreases by 4% relative to the baseline scenario, whereas the CAP budget for the new Member States increases by 13% (Annex 1, Table A3). In the EU15 Member States, the 5% shift of the P1 budget to their P2 budget results in an increase of the P2 budget varying from about 5% in Portugal and Austria to about 130-160% in France, Belgium, The Netherlands, the UK, and Denmark. In the baseline situation, the last group of Member States has a relatively small P2 budget. On average, P1 direct payments per ha p.a. in the new Member States increase by about 20%, revealing a narrowing of the gap in the level of direct payments per ha between the old and new Member States from on average 295 euro in the EU15 versus 187 euro in the EU12 in the baseline scenario to on average 265 euro in the EU15 versus 226 euro in the EU12.

In the moderate shifts scenario 5% of the P1 budget of the EU15 is shifted to the P1 budget of the EU12 and 5% of the P1 budget of the EU15 is shifted to their P2 budget. This narrows the gap between P1 direct payments per ha in the EU15 and the EU12. The narrowing of the gap between direct payments per ha in the old and new Member States in the moderate shifts scenario provokes the question which percentage reduction of the P1 budget in the EU15 Member States results in an equal direct payment per ha in old and new Member States. Thinking along the same lines as the moderate shifts scenario, it appears that when 8% of the P1 budget of the EU15 is shifted to the P1 budget of the EU12 and 8% of the P1 budget of the EU15 is shifted to their P2 budget, the P1 direct payments per ha in the EU15 equals the P1 direct payments per ha in the EU12 (Table 5.1). In that case, the P1 direct payment amounts to 248 per ha p.a. both in the EU15 and the EU12.

Table 5.1 Direct payments per ha in the EU with alternative rates of reduction of the P1 budget in the EU15 EU12, 2014-2020 (euro p.a.)

Reduction baseline P1 budget EU15 with [1]	New budget in EU15, 2014-2020 (mln euro)		New P1 budget in EU12, 2014-2020 (mln euro)	P1 direct payment per ha (euro p.a.)			P1 direct payment per ha EU12 as % direct payment EU15
	P1	P2		EU15	EU12	EU27	
20%	205669	76914	88589	236	264	244	112
16%	215952	71772	83447	248	249	248	100
15%	218523	70486	82161	251	245	249	98
10%	231377	64059	75734	265	226	254	85
5%	244232	57632	69307	280	207	260	74
2%	251944	53776	65451	289	195	263	67
0%	257086	51205	62880	295	187	265	63

[1] Half of the reduction of the P1 budget in the EU15 is used for increasing the P1 budget in the new Member States (e.g. halve of 16% is 8%), whereas the other half is used for an increase of the P2 budget in the EU15 (e.g. halve of 16% is 8%).
Source: LEI budget model.

The CAP budget 2014-2020 in the greening scenario

The ceilings for the maximum payments for permanent grassland/arable crops and for LFA payments under the greening scenario provoke the question which Member States clash with the ceilings. It appears that about half of the EU Member States – both in the EU15 and EU12 - face this situation (Annex 1, Table A6). As a consequence, farmers in some Member States receive a full payment for permanent grassland/arable crops and for LFA, while those in other Member States receive considerably less.

The remaining P1 budget for granting a flat rate payment per ha as basic income support after deduction of the budget for greening and LFA payments from the total P1 budget varies per Member State, ranging from 40% to 80% of the total P1 budget (Annex 1, Table A4). The average flat rate in the EU15 amounts to 132 euro per ha (Annex 1, Table A5), but in some EU Member States like The Netherlands, Belgium and Greece, it is about 300 euro or even more, while it amounts to only about 70 euro per ha in Spain and Portugal. Farmers in the EU15 with greening payments for permanent grassland or arable crops receive on average a P1 payment of 222 euro per ha, and when these farmers are situated in LFA, the average P1 payment amounts to 340 euro per ha. The average flat rate payment in the EU12 is 101 euro per ha; the P1 payment increases to 176 euro per ha for EU12 farmers via additional greening payments for permanent grassland or arable crops, and to a total of 312 euro per ha for LFA farmers.

The payment for permanent grassland or arable crops (conditional to ecological set-aside) or for natural constraints in addition to the flat rate payment in this scenario is insufficient to keep up with the direct payment in P1 in the baseline scenario in the EU15 Member States (Annex 1, Table A5), as 5% of the P1 budget is shifted to the EU12 in both policy scenarios. Only EU15 LFA farmers with permanent grassland or arable crops are in a more favourable position than in the baseline scenario. In the EU12, the sum of the flat rate payment plus the payment for permanent grassland or arable crops is also somewhat below the P1 payment in the baseline scenario, except for Cyprus, Malta, Bulgaria and Hungary. LFA farmers in the EU12 receive a P1 payment which is above that in the baseline scenario.

5.2 The agricultural sector in the EU27

In this section the moderate shifts and the greening scenario are referred to as scenario 1 and scenario 2. Scenario 1 and scenario 2 consist of different individual measures. These measures could have opposite effects on supply, trade, income and environment. The economic and environmental effects of the individual measures should be made visible, to better understand the total effects of the two scenarios. For this reason scenario 1 and 2 are decomposed into the following individual measures:

A: 5% shift from P1 in the EU15 to P1 in the EU-12.

B: 5% shift from P1 in the EU15 to agri-environmental measures in P2 in the EU15. The payment for agri-environmental measures goes at the expense of the regional flat rate payment in P1. Note that this measure is only applied in the EU15.

C: a maximum payment per unit of permanent grassland equal to € 100 / ha. Maximum budget for permanent grassland is 30% of a member states' P1 budget. The payment for permanent grassland goes at the expense of the regional flat rate payment.

D: a maximum payment per unit of arable land under greening conditions equal to € 100 / ha; condition is 5% ecological set-aside. Maximum budget for arable land under greening conditions is 30% of a member states' P1 budget. The payment for arable land under greening condition goes at the expense of the regional flat rate payment.

E: payments for natural constraints are set at a maximum of € 150 / ha; maximum budget is set
       at 30% of the member states' budget. Again, note that the payment for natural constraints goes
       at the expense of the regional flat rate payment.

Scenario 1:   A+B

Scenario 2:   A+B+C+D+E

For the decomposition we assume that the maximum budget for measure C is equal to 30% of the member states' P1 budget. The same assumption we also apply for measure D. However, in scenario 2 we assume that the maximum budget for measure C and D together is equal to 30% of the member states' P1 budget. So the payment per hectare of grassland or arable land under measure C and D taken separately is higher than taken together. This means that effects of scenario 2 as a whole might be different from the sum of the effects of the individual measures. Moreover, also through the interaction of individual measures, the impact of the scenarios as a whole might be different from the sum over the individual measures.

Results of scenario 1 and scenario 2 are compared to the 2020 baseline. The meaning of this is further demonstrated in text box 1.

Text box 1: Comparison of alternative policy scenario to baseline

Prices and quantities in European agriculture in 2020 in scenario 1 and scenario 2 are presented as percentage changes compared to the 2020 baseline. This should be interpreted as demonstrated in the figures below. The first figure below shows that the scenario results into an increase in the price of cereals as compared to the baseline in 2020. This is on top of the increase in the price of cereals from '2004' to 2020 in the baseline scenario. The second figure below shows that if a scenario results into an increase in the number of farms as compared to the baseline in 2020. This means less reduction in the number of farms as compared to '2004'.

Land use

Allocation of land to the different activities and types per activity (intensive, extensive) per region is steered by profit maximizing behaviour of the regional farmer in the supply part of CAPRI. If, compared to a calibrated baseline position, a land based activity becomes more profitable e.g. through a coupled premium, the land allocated to this activity will increase. At the same time the marginal production costs, the costs of producing one unit of output extra, of the increasing activity will increase. This continues until marginal production costs and marginal revenue are in equilibrium again for all activities, types (intensive, extensive) and regions. At this point, the allocation of land over the different activities is optimal and the objective function of the regional farmer is at its maximum level.

Figure 5.1 shows that the impact of the individual measures on the hectares of grassland and arable land (including fallow land and horticultural activities) can be very different per measure, scenario and per region. To further understand these impacts, it is important to know that CAPRI features a upward sloping land supply curve. This allows for land leaving and entering the agricultural sector and transformation between arable and grass land in response to relative price changes (Jansson *et al.*, 2010). A reduction of the P1 payment as a subsidy to agriculture, would lead to a reduction of the marginal returns from agriculture. Due to the reduction of the subsidy, part of the land ceases to be economically viable. The amount of land in agriculture will decrease. The reduction in the amount of land in agriculture depends on the slope of the land supply curve and size of the P1 shift.

Figure 5.1 shows that the impact of the 5% shift from P1 in the EU15 to P1 in the EU-12 (measure A) on hectares of grassland and arable land is very limited. This is explained by the fact that in the baseline all P1 payments are decoupled from production and rather in-elastic land supply (steep slope of the land supply curve).

Measure B, a 5% shift from farm specific payments in the EU15 to agri-environmental measures, increases acreage of grassland and decreases the acreages of arable land in the EU15 with about 2% and 1% respectively. This is mainly explained by the lower grassland yields due to the agri-environmental measures which in turn require extra grassland to keep up the supply to feed the (dairy) cattle.
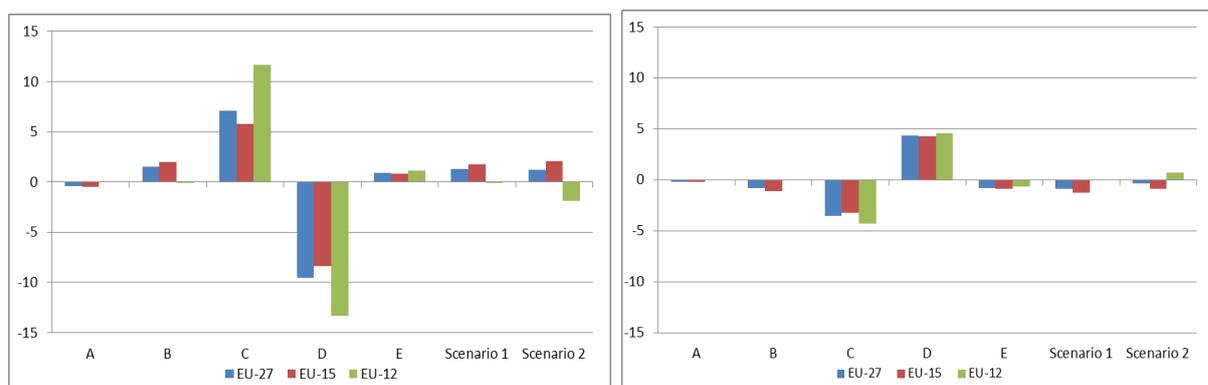
Figure 5.1: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on hectares of grassland (left figure) and hectares of arable land (right figure) (% change compared to the baseline scenario)

Measure C, a permanent grassland payment in all member states of the EU27, increases the acreages of grassland strongly, especially in the EU-12. The extra land allocated to grassland goes at the expense of arable land, especially fallow land.

Measure D, a payment per unit of arable land conditional on 5% ecological set-aside, has the opposite effect of measure C. Under measure D the total acreage of arable land in the EU15 and EU-12 increases with about 4%. This increase in land allocated to arable crops dampens the impact of the ecological set-aside on total supply. Especially the acreage of fallow land increases strongly, namely with almost 12% in the EU27. This is explained by the € 100 / ha, while the impact of the accompanying ecological set-aside on yield per ha is very limited on fallow land.

Measure E can be considered as a budget shift from the general regional flat rate payment towards a specific payment for farmers in an LFA area. The LFA payments are mainly captured by grassland farms and compared to the baseline they are able to stay into production. Compared to the baseline acreage of fallow land and arable land are substituted for grassland. Under measure E the total acreage of grassland in the EU27 increases with about 1%, while the acreage of arable land decreases with about 0.8%. The acreage of fallow land decreases with 2.5% under measure E.

Scenario 1 (moderate shift scenario) consists of measures A and B. Figure 5.1 shows that the acreage of grassland in the EU15 increases with about 1.7% while the acreage of arable land decreases with about 1.3%. In the EU-12 the net effect of measure A and B on allocation of land over grassland and arable crops is very limited. The hectares of arable crops increases with about +0.2%. At regional level, the effects might be much bigger, both in the EU15 as in the EU-12. Acreage of grassland will especially increase in NUTS2 regions in the EU15 with a relatively high share of the extra budget for agri-environmental measures and a relatively low regional flat rate payment in the baseline situation.

Scenario 2 consists of measures A, B, C, D and E. Figure 5.1 shows that hectares of arable land in the EU15 decreases with about 1%, while the hectares of arable land in the EU-12 increases with about 1.25%. At regional level the results can of course be very different. Compared to the baseline, land allocated to grassland will increase in regions with a high share of the extra budget for agri-environmental measures, with a large share of permanent grassland in total grassland, with a large share of LFA in total utilised agricultural area and with a relatively low regional flat rate payment in the baseline. Moreover, land allocated to arable land will especially increase in regions with a high share of arable land in total utilised agricultural area and with a relatively low regional flat rate payment in the baseline. The total payment per ha of arable land increases relatively strongly in these regions under scenario 2.

Figure 5.2 shows the impact of the different measures on the total acreage of utilised agricultural area. The individual measures each result into a decrease of the utilised agricultural area in the EU15 as whole. This is explained by the fact that the different measures go at the expense of the regional flat rate. This negatively affects the amount of land used by the agricultural sector. The reduction in the utilised agricultural area per region is especially strong in regions with a relatively high regional flat rate payment in the baseline.

Remarkable enough, scenario 2 shows an increase in utilised agricultural area in the EU15 as compared to the 2020 baseline. This is especially explained by the combined impact of the individual measures on supply and prices of agricultural products. Extra land is taken into agricultural production as a result of higher prices for agricultural products and to dampen the impact on supply of scenario 2 (greening scenario).
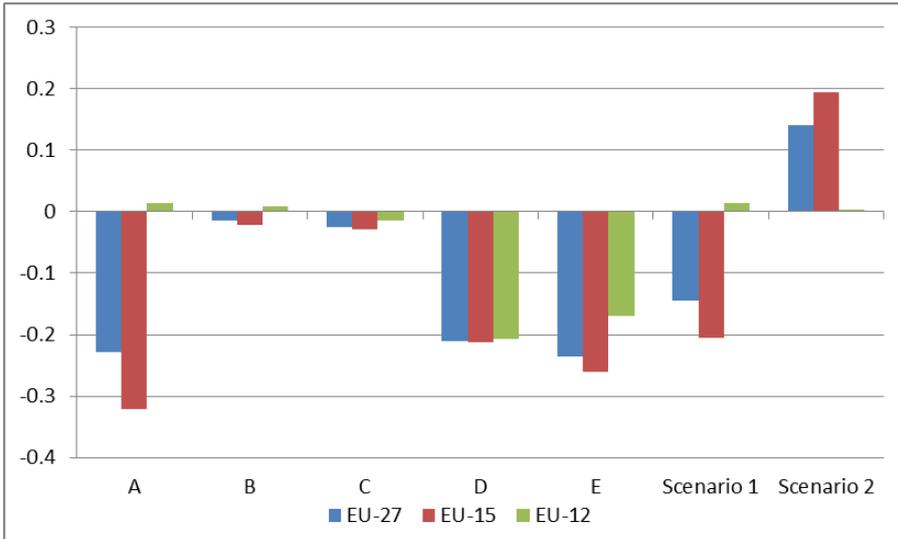
Figure 5.2: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on acreages of utilised agricultural area (% change compared to the baseline scenario)

Supply (or production) of agricultural products

Figure 5.3 shows that the impact of the individual measures on the supply of cereals and oilseeds can be very different per measure, scenario and per region. The impact of the 5% shift from P1 in the EU15 to P1 in the EU-12 (measure A) on supply of cereals and oilseeds is limited. This is explained by the fact that in the baseline all P1 payments are decoupled from production. A small supply effect might occur due to a decline of land used for agricultural production.

Measure B, a 5% shift from farm specific payments in the EU15 to agri-environmental measures, decreases supply of cereals and oilseeds in the EU15 with 1.2% and 1.6% respectively. This is mainly explained by the extra budget for environmental measures that increase the number of hectares with AE measures and lower yields. Also, arable land is substituted for grassland. The decrease in supply in the EU15 due to measure B is dampened by the shift of the remaining agricultural land towards more intensive technologies. In the EU27 as a whole the impact of measure B on supply of cereals and oil seeds is also dampened by the increase in supply in the EU-12 due to higher producer prices for cereals and oil seeds in the EU-12.
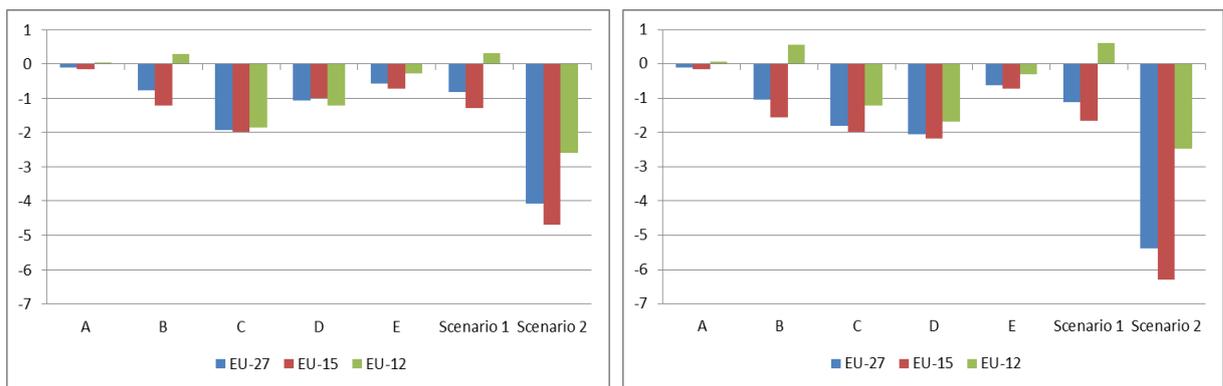
Figure 5.3: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on supply of cereals (left figure) and oilseeds (right figure) (% change compared to the baseline scenario)

Measure C, a permanent grassland payment in all member states of the EU27, has a negative impact on supply of cereals and oilseeds in the EU15 and in the EU-12. Supply of cereals and oilseeds in the EU15 and in the EU-12 decreases with about 2%. This is mainly explained by the extra land used for grassland as compared to the baseline.

Measure D, a payment per unit of arable land conditional on 5% ecological set-aside, also has a negative impact on supply of cereals and oilseeds. However, due to an increase of the hectares of cereals and oilseeds, the supply effect is below the 5% ecological set-aside. In the EU15 the supply of cereals and oilseeds decreases with about 1% and 2% respectively. In the EU-12 the supply of cereals and oilseeds both decreases with about 1.5%.

Measure E can be considered as a budget shift from the general regional flat rate payment towards a specific payment for farmers in an LFA area. The LFA payments are mainly captured by grassland farms and compared to the baseline they are able to stay into production. Compared to the baseline, some acreage of fallow land and arable land is substituted with grassland. This explains the (limited) decrease of cereals and oilseeds supply in the EU-12 and EU15 under measure E, namely with about 0.5% (see Figure 5.3).

Scenario 1 (moderate shift scenario) consists of measures A and B. Figure 5.3 shows that the supply of cereals in the EU15 decreases with about 2% while the supply of cereals in the EU-12 slightly increases (+0.3%). The supply of oilseeds in the EU15 and in the EU-12 changes with about -1.7% and +0.7% respectively. The explanation of these effects, as about the sum of measures A and B, are discussed above.

Scenario 2 consists of measures A, B, C, D and E. Figure 5.3 shows that the changes in the supply of cereals and oilseeds in the EU15 and EU-12 exceeds the corresponding supply effects of scenario 1 by far. The effect on cereals and oilseeds supply in the EU15 exceeds the corresponding supply effect in the EU-12. In the EU15 the supply of cereals and oilseeds decreases with 5.5% and 6% respectively. While in the EU-12 the supply of cereals and oilseeds both decreases with about 2.5%.
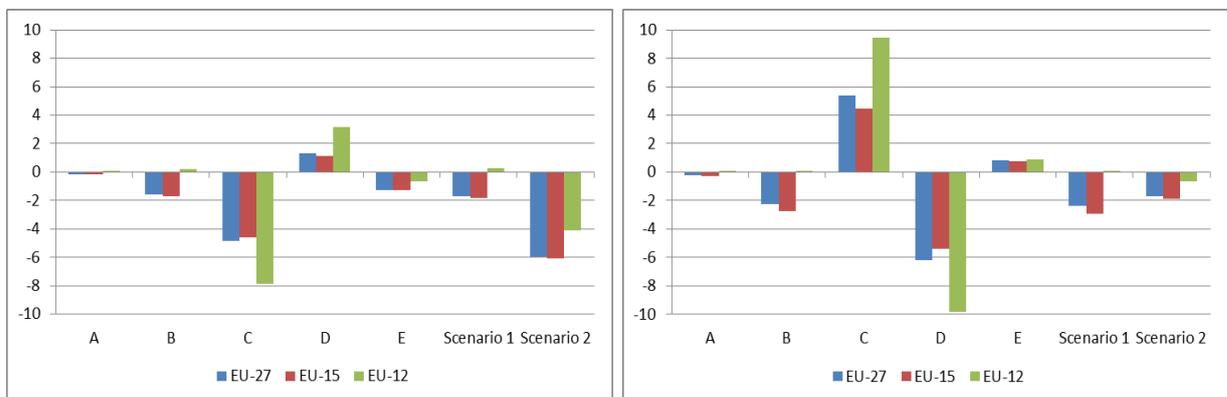
Figure 5.4: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on supply of other feed on arable land (left figure) and grassland (right figure) (% change compared to the baseline scenario).

Figure 5.4 shows the impact of the different individual measures and scenarios on the supply of 'other feed on arable land' and grassland. The agricultural activity 'other feed on arable land' is categorised under arable crops and produces feed for the livestock industry that is not traded between regions and internationally. The impact of measure B (extra agri-environmental payments) on grass supply in the EU15 is about -3% as compared to the baseline scenario. The permanent grassland premium (measure C) increases the supply and acreage of grassland both in the EU15 as

in the EU-12. This increase goes at the expense of the hectares of land allocated to arable crops, including the activity 'other feed on arable land'. Figure 5.4 shows that the premium for permanent grassland (measure C) especially increases the grass supply in the EU-12, namely with about 10%. The impact on the supply from grassland of measure D (arable premium conditional on 5% ecological set-aside) is about the opposite of the impact of measure C (permanent grassland premium). Under measure D the grass supply in the EU15 decreases with about 5%. The impact of measure E on supply of arable crops and grassland is already discussed above. Figure 5.4 shows that in the EU15 the impact of scenario 1 on the supply from grasslands is about equal to the corresponding impact of scenario 2.
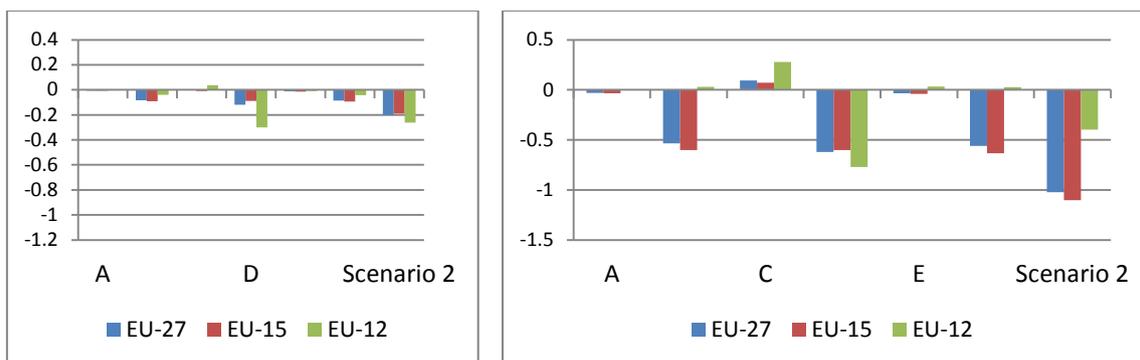
Figure 5.5: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on milk supply (left figure) and beef supply (right figure) (% change compared to the baseline scenario)

Figure 5.5 shows that the impact of the individual measures and of the different scenarios on the milk supply from dairy cows is rather limited. Of the individual measures, measure D (arable premium conditional on 5% ecological set-aside) has the largest impact on milk supply, namely about -0.3% in the EU-12 and about -0.1 % in the EU15. This is explained by the decreased availability of fodder crops and higher prices for fodder crops. The impact of the different measures and the scenarios on the supply of beef is somewhat bigger compared to the effects on milk supply. The beef cattle gains from the permanent grassland premium (measure C), via lower feeding costs. Other measures and scenarios will increase feeding costs and given the relatively low gross margins of beef cattle activities in general, the corresponding supply will decrease relatively sharply. The impact of scenario 2 on the supply of beef is about -1% in the EU15 and about -0.4% in the EU-12 (see Figure 5.5).

Table 5.2 gives an overview of the impact of scenario 1 and scenario 2 on the supply of a larger number of agricultural products. The (negative) impact of scenario 2 on the supply of cereals and oilseeds (and other relatively high margin crops) is relatively large compared to other agricultural products. This is explained a) by the increase in the amount of land allocated to marginal arable crops and fallow land (especially induced by measure D); this leaves less land available for extra ha of cereals and oilseeds b) the substitution for grassland as a result of measure B and C and to a lesser extent measure E and c) by the decrease of the acreage of utilized agricultural area in the EU15 due to measure A.

The impact of scenario 1 and scenario 2 on the supply of the group of vegetable and permanent crops and all other crops is limited. This is explained by the in-elastic supply of agricultural activities as nurseries, flowers, fruits (aples, pears and peaches), citrus fruits, other fruits, table grapes, table olives and wine. Moreover, measure D (arable premium conditional on 5% ecological set-aside), part of scenario 2, is not applied to the above mentioned activities. The reason is that it is assumed that farmers specialised in these activities will not apply for the payment per unit of arable land.

Translated to the farm level, measure D under scenario 2 results into a tendency that farmers with a large share of extensive and low margin arable crops who would go out of business in the baseline scenario, are now more able to compete on the land market and are therefore more able to keep their production plan and to stay in business. At regional and sector level this results into an increase of supply and ha of extensive and low margin crops, including fallow land, as compared to the baseline in 2020.

Table 5.2: Impact of the different scenarios on the supply of agricultural products (Percentage changes compared to 2020 baseline)

	Scenario 1			Scenario 2		
	EU-27	EU-15	EU-12	EU-27	EU-15	EU-12
Cereals	-0.8	-1.3	0.3	-4.1	-4.7	-2.6
Oilseeds	-1.1	-1.7	0.6	-5.4	-6.3	-2.4
Other arable field crops	-1.2	-1.5	0.0	-1.6	-2.1	0.8
Vegetables and Permanent crops	0.0	0.0	0.0	-2.5	-2.4	-3.3
All other crops	0.0	0.0	0.0	-0.9	-0.9	-1.9
Fodder	-2.0	-2.4	0.1	-2.8	-3.1	-1.3
o.w. Fodder maize	-0.2	-0.2	-0.3	-0.6	-0.9	1.4
o.w. Fodder root crops	-0.1	-0.2	0.4	-4.8	-4.9	-3.7
o.w. Other fodder from arable land	-1.7	-1.8	0.5	-5.9	-6.1	-4.1
o.w. Gras	-2.4	-2.9	0.1	-1.7	-1.9	-0.7
Meat	-0.3	-0.3	-0.1	-0.8	-0.8	-0.7
o.w. Beef	-0.6	-0.6	0.0	-1.0	-1.1	-0.4
o.w. Pork meat	-0.2	-0.2	-0.1	-0.6	-0.6	-0.7
o.w. Sheep and goat meat	-0.4	-0.5	-0.1	-0.6	-0.6	-0.8
o.w. Poultry meat	-0.3	-0.4	-0.1	-1.0	-1.1	-0.7
Other Animal products	-0.2	-0.2	0.0	-0.3	-0.3	-0.3
o.w. Cow and buffalo milk	-0.1	-0.1	0.0	-0.2	-0.2	-0.3
o.w. Sheep and goat milk	-0.1	-0.1	-0.1	-0.3	-0.2	-0.9
o.w. Eggs	-0.1	-0.2	0.1	-0.3	-0.3	-0.5

Trade balance of the EU27 and world production

Table 5.3 presents the share of imports and exports of selected agricultural products in *world imports and exports* in the EU27 in the baseline scenario in 2020. Imports in the EU27 as percentage of world imports are relatively large for oilseeds, the group of vegetables and permanent crops, beef, butter and cheese. For most agricultural products the exports share of the EU27 in total worlds export exceed the share of imports. Table 5.3 also shows the impact of scenario 1 and scenario 2 on the above mentioned import and export shares. In general the import shares increases while the export shares decreases. This is explained by the changes in supply of agricultural products as explained above. Changes in scenario 2 exceeds the changes in import and exports in scenario 1 by far. Nevertheless, even in scenario 2 the changes in the trade positions are relatively limited.

Table 5.4 gives the share of imports and exports of selected agricultural products in *own production* the EU27 in 2020 in the baseline scenario and in scenario 1 and scenario 2. Again, for most agricultural products exports in the EU27 exceed imports (as percentage of own production). This changes slightly under scenario 1 and scenario 2 as imports of agricultural products increases while exports decreases.

Table 5.3: Imports and exports shares of the EU27 in world imports and exports in 2020 in the baseline scenario and in scenario 1 and scenario 2 (%).

	baseline		scenario 1		scenario 2	
	imports	exports	imports	exports	imports	exports
Cereals	7.0	28.3	7.3	27.7	7.8	25.6
Oilseeds	25.7	6.1	25.9	6.0	26.6	5.7
Veg. and Perm. crops	33.3	9.0	33.3	9.0	33.8	8.8
Meat	13.0	34.3	13.1	33.9	13.3	33.2
Beef	29.8	20.1	30.3	19.5	30.5	18.9
Pork meat	9.5	46.7	9.4	46.3	9.6	45.7
Poultry meat	4.9	34.3	4.9	33.9	5.1	33.0
Eggs	65.1	79.2	65.1	78.9	65.9	78.4
Butter	50.9	9.2	51.0	9.0	51.2	8.7
Skimmed milk powder	20.2	26.5	20.2	26.4	20.2	26.2
Cheese	42.5	52.1	42.5	52.1	42.6	52.2
Whole milk powder	8.8	38.7	8.8	38.5	8.7	38.4

Table 5.4: Import and export shares in own production of selected agricultural products in the EU27 in 2020 in baseline scenario and in scenario 1 and scenario 2.

	Baseline		Scenario 1		Scenario 2	
	Import	Export	Import	Export	Import	Export
Cereals	3.4	13.5	3.5	13.3	3.9	12.5
Oilseeds	79.2	18.7	81.1	18.9	87.4	18.8
Vegetables and Permanent crops	13.0	3.5	13.1	3.5	13.7	3.5
Meat	4.5	11.9	4.6	11.8	4.6	11.5
Beef	10.8	7.3	11.0	7.1	11.2	6.9
Pork meat	2.3	11.4	2.3	11.3	2.3	11.1
Poultry meat	2.3	16.2	2.3	16.0	2.4	15.6
Eggs	7.2	8.7	7.2	8.7	7.4	8.8
Dairy products	1.8	4.6	1.8	4.6	1.8	4.6
Butter	10.1	1.8	10.2	1.8	10.2	1.7
Skimmed milk powder	11.0	14.4	11.0	14.3	11.0	14.2
Cheese	7.0	8.5	7.0	8.5	7.0	8.6
Whole milk powder	8.3	36.6	8.3	36.6	8.3	36.5

Figure 5.6 and Figure 5.7 shows changes in imports in the EU27 of selected agricultural products per measure and for scenario 1 and scenario 2. Especially measure D provokes a strong increase in the imports of cereals and oilseeds (Figure 5.6). Imports of dairy products are hardly affected, while imports of beef in the EU27 as a whole increase strongly due to measure B and D (Figure 5.7).

Figure 5.8 and Figure 5.9 shows changes in exports of selected agricultural products per measure and for scenario 1 and scenario 2 as a whole. Especially measure D provokes a strong decrease in the exports of cereals and oilseeds (Figure 5.8). Exports of dairy products are hardly affected, while exports of beef in the EU27 as a whole decrease strongly due to measure B and D (Figure 5.9).
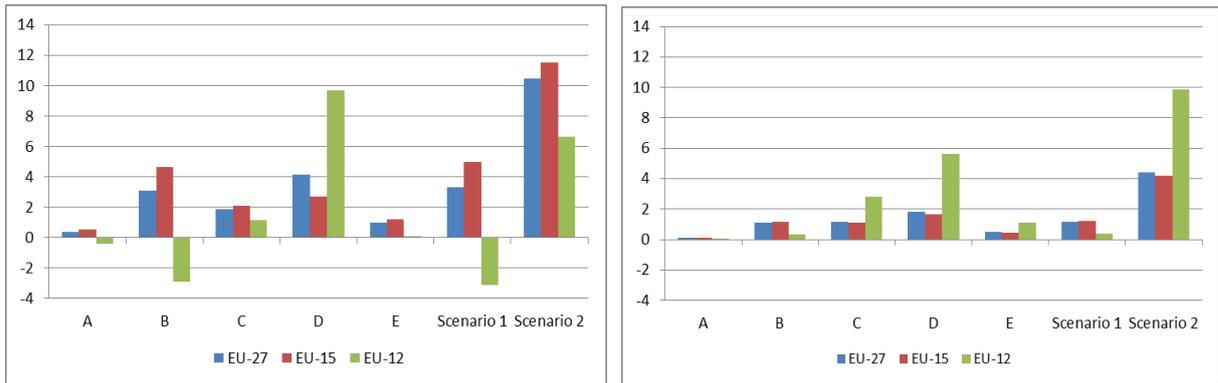
Figure 5.6: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on import quantities of cereals (left figure) and oil seeds (right figure) in the EU27 (% change compared to the baseline scenario)
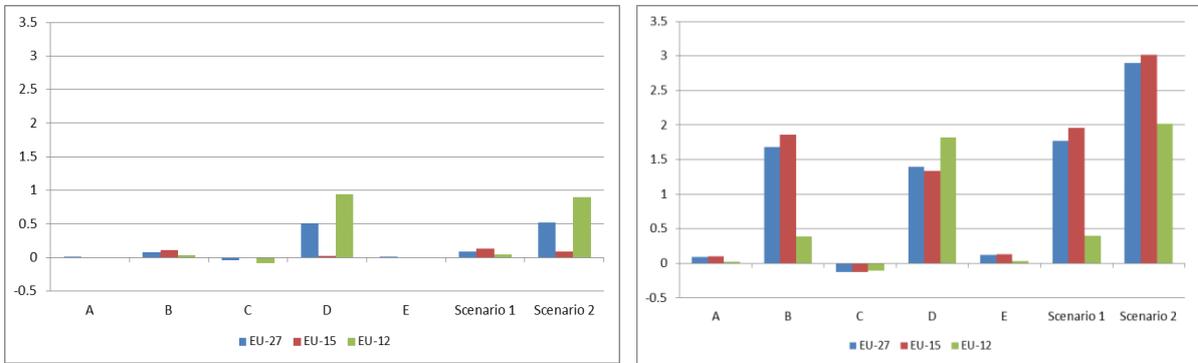
Figure 5.7: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on import quantities of butter (left figure) and beef (right figure) in the EU27 (% change compared to the baseline scenario)
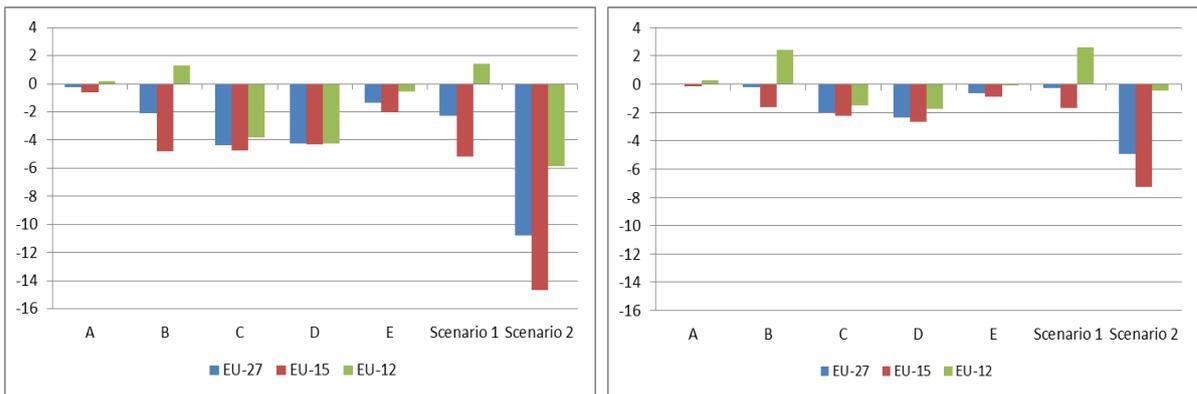
Figure 5.8: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on export quantities of cereals (left figure) and oil seeds (right figure) of the EU27 (% change compared to the baseline scenario)
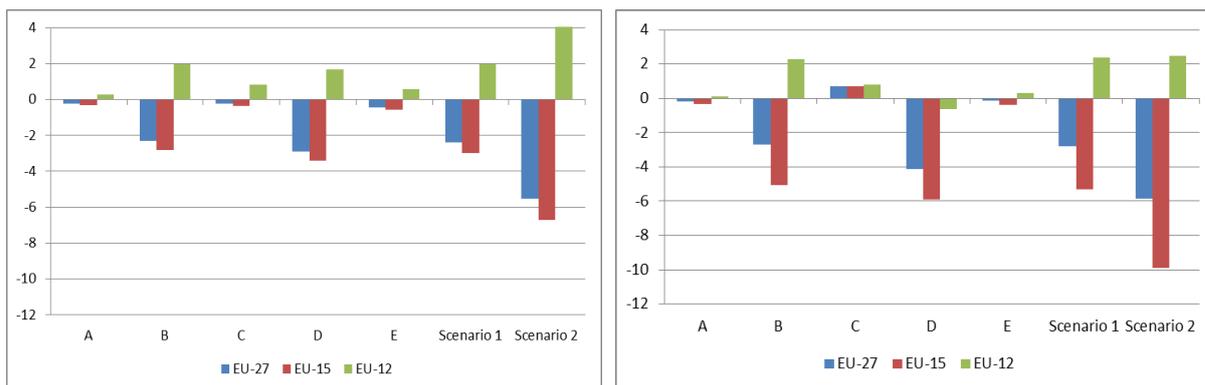
Figure 5.9: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on export quantities of butter (left figure) and beef (right figure) of the EU27 (% change compared to the baseline scenario)

The increase in imports and decrease in exports of most agricultural products of the EU27 (see also Table 5.3), will increase world prices and this in turn will increase agricultural production in the rest of the world. The largest impact on world production, excluding the EU27, are found for cereals and oilseeds. In scenario 1 world production, excluding the EU27, of cereals and oilseeds will increase with about 0.04% and 0.19% respectively. In scenario 2, cereals and oilseeds production in the rest of the world (world, excluding EU27) will increase with 0.20% and 0.65% respectively.

The impact of scenario 1 and scenario 2 on changes in own production, imports and exports of the EU27 as compared to the baseline is rather uncertain. Uncertainties are related to limitations of CAPRI as well as limitations of the available data. Ecological set-aside under measure D will especially affect the less productive borders of a parcel. This is not included in CAPRI. Measure D is also implemented as a mandatory measure affecting all farmers with arable crops. If the measure would be voluntary, highly efficient farmers might not participate. Another short-coming of CAPRI is that changes in farm structure and re-allocation of land to more efficient farmers, that might affect the regional average yield per crop per hectare, is not fully captured. Supply behaviour of the regional farmer in the EU27 is partly based on own estimates, using the CAPRI database (Jansson, 2007). However, behavioural parameters used in the market model and used to model land supply are also taken from the literature and other models and might not fully match the specifications used in CAPRI. Given the uncertainties with respect of the land supply function, especially the supply effect of the shift of the P1 payment from the EU15 to the EU-12 (measure A) is uncertain.

Another source of uncertainty is the impact of the AE measures in P2 on yield losses. At this stage there is little data available about the exact AE measures that are applied on the farm and what crops are targeted. In this study it is assumed that the yield loss of one hectare of grassland with AE measures equals 37.5 %, while the yield loss of a hectare of arable land with AE measures equals 68.9%. For reasons of simplicity these percentages are applied to all regions in the EU27. In reality yield losses could be bigger or smaller and as a result production and import and export effects could be different as well.

From the discussion above, it can be concluded that the impact of scenario 1 and scenario 2 on own production, imports and exports, could be different from the results presented in the tables and figures presented above. It is believed that the directions and the magnitude of the impacts presented in Table 5.2 are correct. However, the impacts on cereals and oilseeds should be considered as maximum effects in the medium to longer term. Whereas the supply effects of especially other arable field crops could be bigger.

Prices

Figure 5.10 shows that, corresponding to the supply effects, the impact of the individual measures on the prices of selected agricultural outputs can be very different per measure, scenario and per region. The impact of the 5% shift from P1 in the EU15 to P1 in the EU-12 (measure A) on agricultural output prices is limited. This is explained by the fact that in the baseline all P1 payments are already decoupled from production.

Measure B, a 5% shift from farm specific payments in the EU15 to agri-environmental measures, increases prices of cereals and oilseeds in the EU27 with about 1%. The increase in prices under measure B is dampened by the shift of the remaining agricultural land towards more intensive technologies. In the EU27 as a whole the impact of measure B on agricultural output prices is also dampened by the increase in supply in the EU-12.
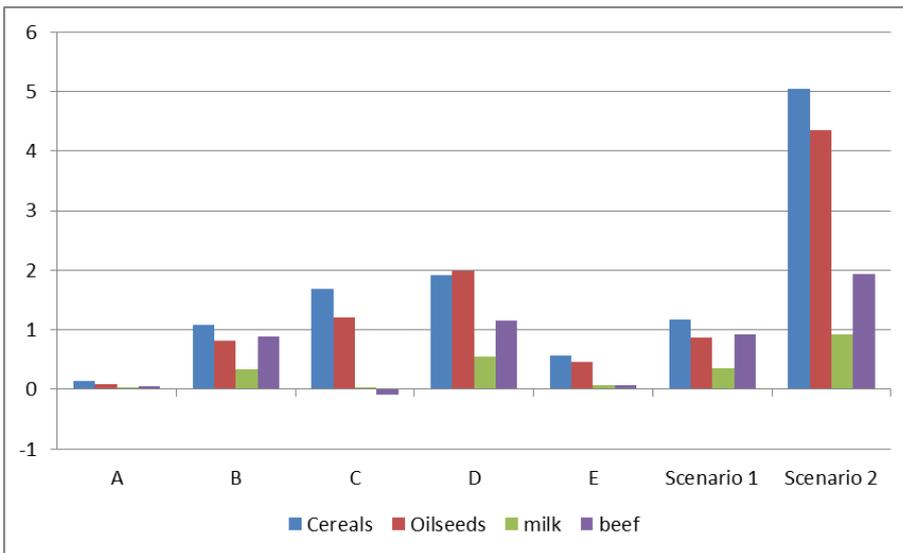
Figure 5.10: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on producer prices of cereals, oilseeds, milk and beef (% change compared to the baseline scenario)

Measure C, a permanent grassland payment in all member states of the EU27, increases prices of cereals and oilseeds in the EU27, namely with about 1.5% and with about 1% respectively. These price effects are mainly explained by the decrease in the acreage of land used for cereals and oilseeds and the corresponding decrease in supply of cereals and oilseeds.

Measure D, a payment per unit of arable land conditional on 5% ecological set-aside, also has a positive impact on prices of cereals and oilseeds. The impact on prices is dampened by the increase of the hectares of cereals and oilseeds. In the EU27 the prices of cereals and oilseeds increases with about 2%.

Measure E can be considered as a budget shift from the regional flat rate towards LFA payments. It is included in CAPRI that the LFA payments are mainly captured by grassland farms, with a (limited) decrease in the acreage and supply of arable crops as a result. Corresponding to this, Figure 5.10 shows a limited increase in the prices of cereals and oilseeds in the EU27.

Scenario 1 (moderate shift scenario) consists of measures A and B. Figure 5.10 shows that the average price of cereals and oilseeds in the EU27 increases with about 1.0%.

Scenario 2 consists of measures A, B, C, D and E. Figure 5.10 shows that the changes in the prices of cereals and oilseeds exceed the corresponding price effects of scenario 1 by far. In the EU27 the price of cereals and oilseeds increases with about 5% and 4.5% respectively.

Figure 5.10 shows that the impact of the individual measures and of the different scenarios on the average producer price of cow milk is rather limited. Measure D (arable premium conditional on 5% ecological set-aside) is causing the largest impact on milk prices, namely about 0.5% in the EU27. This is explained by the decreased availability of fodder crops, higher prices for fodder crops and the resulting decrease in milk supply. Due to the in-elastic demand for cow milk, the price changes exceed the changes in the supply by far.

Beef prices decreases under measure C (permanent grassland premium). This is explained by the increased supply via lower feeding costs. Other measures will increase beef prices, compensating for higher feeding costs and lower beef supply. The impact of scenario 2 on beef prices is about 2% in the EU27 (Figure 5.10).

Table 5.5 gives an overview of the impact of scenario 1 and scenario 2 on the producer prices of primary and processed agricultural products. In general the prices increase due to reduced supply in the EU and increased production costs. The relative large increase in prices of intensive livestock products in scenario 1 and scenario 2 is explained by the increased feeding costs. For example, the permanent grassland premium (measure C) reduces the supply of arable crops for the production of pigs and poultry feed.

Table 5.5: Impact of the different scenarios on the producer prices of agricultural products in the EU27 (Percentage changes compared to 2020 baseline)

	Scenario 1	Scenario 2
Cereals	1.2	5.0
Oilseeds	0.9	4.4
Other arable field crops	1.5	0.7
Vegetables and Permanent crops	0.1	3.6
All other crops	0.0	0.4
Fodder	0.2	0.7
Meat	0.7	1.9
Beef	0.9	1.9
Pork meat	0.7	2.2
Sheep and goat meat	0.6	1.4
Poultry meat	0.5	1.7
Other Animal products	0.4	1.0
Cow and buffalo milk	0.4	0.9
Sheep and goat milk	0.3	1.0
Eggs	0.6	2.5
Dairy products	0.1	0.4
Butter	0.4	1.0
Skimmed milk powder	0.2	0.5
Cheese	0.1	0.4
Concentrated milk	0.1	0.3
Whole milk powder	0.3	0.8

The effects of scenario 1 and scenario 2 on average producer prices of agricultural products in the rest of the world are limited. This is explained by the rather limited trade effects and the size of the own production in relation to imports and exports in the rest of the world. The largest effects on average producer prices are found in scenario 2 and range from about +1.5% for cereals and oilseeds, +0.6% for meat and +0.4% for dairy products, as compared to prices in 2020 in the baseline.

Consumer prices in the rest of the world

The increase in average producer prices in the rest of the world also result in higher average consumer prices in the rest of the world. Given the limited share of primary agricultural products in consumption of processed food products, the changes in the average consumer prices of food consumption is limited as well. At maximum the change is about 0.8% in scenario 2 for oilseeds in the Mediterranean countries including Turkey and Morocco. At average the change in consumer prices in scenario 2 in the rest of the world range from about +0.4% for oilseeds and about +0.25% cereals, meat and dairy products.

Just like uncertainties with respect of own production, imports and exports, discussed above, the impact on producer and consumer prices are also rather uncertain. If the impact of the scenarios on own production, imports and exports would be less/more, the impact on prices could be smaller/bigger as well. Given the discussion on effects of scenario 1 and scenario 2 on own production, imports and exports, it is believed that the impact on producer prices of cereals and oilseeds in the EU27 and the rest of the world are overestimated, while the impact on especially producer prices of other arable field crops are underestimated. Moreover, imports and export shares of the EU27 in world imports and exports in 2020 in the baseline scenario seems to be rather high. This might also positively contribute to price changes on world markets due to changes in agricultural production in the EU27.

Agricultural income

Figure 5.11 shows the impact of the individual measures and scenario 1 and scenario 2 on agricultural income. Agricultural income in CAPRI is defined as revenue plus subsidies minus variable costs. As such it reflects the return to the fixed costs capital, land and labour. It should be noted that agricultural income in CAPRI includes income from horticulture and that horticulture is hardly affected in the different scenarios.

Measure A (5% shift from P1 in the EU15 to P1 in the EU-12) increases agricultural income in the EU-12 by about 5.5%, while agricultural income in the EU15 decreases by about 1%. Agricultural income in the EU27 as a whole is about constant.

Measure B, a 5% shift from farm specific payments in the EU15 to agri-environmental measures, increases agricultural income in the EU15 and the EU-12 with about 0.2%. This is explained by the positive impact of the price changes, changes in cropping plan and intensities on agricultural land without AE measures and changes in variable costs on agricultural income. At the level of the EU15 and EU-12 these positive effects more than offset the negative yield per unity and total supply effect.

Measure C, a permanent grassland payment in all member states of the EU27, also has a positive impact on agricultural income. This increase in total agricultural income as compared to the baseline is among other things explained by the substitution of fallow land for grassland. Measure C, also affects the distribution of subsidies and agricultural income within member states. The P1 budget increases in regions with a relatively large share of permanent grassland in their regional cropping plan and decreases in regions with a relatively low share of permanent grassland in there cropping plan. For example, in France agricultural income decreases in the North-West of France and increases in the South-East. In the UK and in Ireland, agricultural income decreases in the South and increases in the North.

Measure D, a payment per unit of arable land conditional on 5% ecological set-aside, increases agricultural income in the EU15 with about 0.5%. This is mainly explained by the increase in prices of agricultural outputs in the EU27 as whole. From the other hand Figure 5.11 shows that agricultural income is lower in the EU-12, namely with about -1% under measure D as compared to the baseline scenario. At the level of the EU10 the decrease in income (that means less reward of the fixed inputs labour, capital and land) is explained by a relatively large share of fallow land in total utilised agricultural area in the baseline scenario and a relatively large increase in fallow land under measure D. Again, measure D is relatively profitable for extensive arable production technologies. Compared to the baseline more capacity is allocated to these type of low labour and low capital input activities in 2020. The coupled arable payment under measure D slows down the restructuring of the EU agricultural sector towards more intensive and more profitable production systems.

The changes in agricultural income at regional level can be very different from the national average. For example in Poland agricultural income increases in regions in the West of Poland, while it decreases in the Centre and East of Poland. The decrease in income (that means less reward of the fixed inputs labour, capital and land) in the Centre and East of Poland as compared to the baseline, is again explained by a relatively large share of fallow land in total utilised agricultural area in the baseline scenario and a relatively large increase in fallow land due to measure D.

In Germany agricultural income increases especially in Eastern Germany, while agricultural income decreases in most other NUTS 2 regions in Germany.

Measure E (a partly shift from the regional flat rate payment towards LFA payments) increases income in the EU15 and EU-12 as a whole. Besides higher prices for especially arable crops this is also explained by the substitution of fallow land for grassland. Agricultural income increases especially in NUTS2 regions with a relatively high share of LFA in total agricultural area. Within France, again agricultural income increases in the South-East while it decreases in the North-West. In Sweden agricultural income increases in the North, while it decreases in the South.

Under scenario 1 (moderate shift scenario) agricultural income decreases in the EU15 by about 0.7%, while it increases in the EU-12 by about 5.6%. Agricultural income in the EU27 increases by about 0.3%. Under scenario 2 agricultural incomes in the EU15 is about constant as compared to the baseline, while agricultural income in the EU27 as a whole increases by about 1% (Figure 5.11 and Table 5.6).
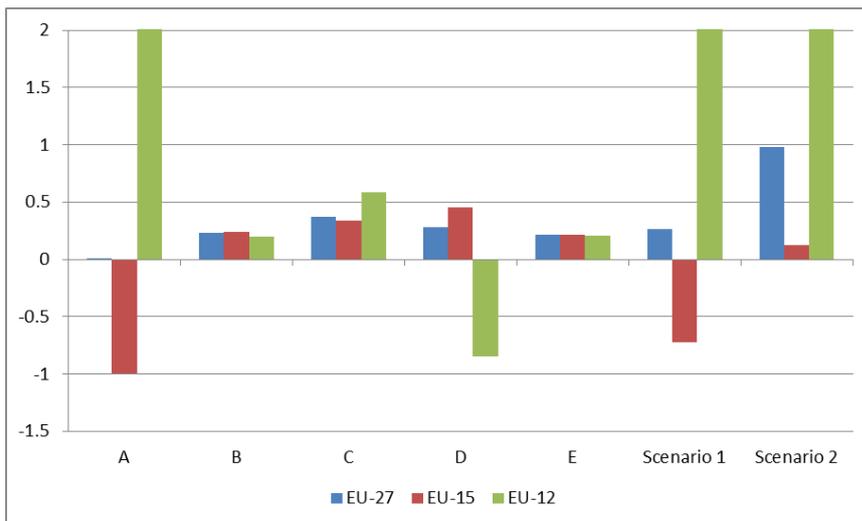
Figure 5.11: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on total agricultural income (% change compared to the baseline scenario: total agricultural income in the EU-12 in A, scenario 1 and scenario 2 increases with 6.5%, 6.6% and 6.5% respectively)

Table 5.6 shows the impact of the different scenarios on total agricultural income in the different regions and member states of the EU27 as compared to the baseline. Scenario 1 decreases agricultural income in the EU15, while it increases agricultural income in the EU10 and in Bulgaria and Romania (EU2). This is almost fully explained by the re-distribution of P1 budget from the EU15 to the EU10. The impact of the re-distribution of P1 budget on agricultural income is especially strong in Ireland, Sweden and the United Kingdom. These countries are characterised by a relatively high share of P1 premiums in agricultural income in the initial situation.

In the EU15, the largest impact of scenario 1 on agricultural income is found in Austria. In the baseline scenario a large share of total agricultural area in Austria is already under AE measures. The extra budget for AE measures cannot be spend due to the fact that not enough hectares are 'free' (not yet under AES) and as a result the total P1 and P2 budget paid to farmers in Austria decreases. This is the result of the assumptions made while implementing the scenarios in model inputs. In case the left-over budget were used as direct payments in P1, the income changes in Austria would have been 0% and 0.1% in Scenario 1 and 2 respectively.

In some other countries of the EU15 (e.g. Belgium and the Netherlands) the impact on agricultural income is very close to zero. This is explained by the relatively low share of direct payments in total agricultural income in these countries. For example in the Netherlands the horticultural sector has a large share in agricultural income, but receives almost no direct payments from the CAP. Moreover, the positive effect of scenario 1 and 2 on prices of agricultural products dampens the effect on agricultural income. This is especially the case in scenario 2 (see Table 5.6). On the other hand, crop rotation, winter cover and extra costs (e.g. seeds) for ecological set-aside are not included in scenario 2. Therefore the positive impacts on incomes should be interpreted with care.

Table 5.6: Impact of the different scenarios on total agricultural income in the different regions and member states of the EU27 (Percentage changes compared to 2020 baseline)

	Scenario 1	Scenario 2		Scenario 1	Scenario 2
EU-27	0.3	1.0	Finland	-0.4	1.0
EU-15	-0.7	0.1	Sweden	-1.2	-1.6
EU-10	8.2	8.4	United Kingdom	-1.8	-0.9
EU-2	4.5	3.9	Czech Republic	10.4	9.2
Belgium	-0.6	0.2	Estonia	8.5	10.0
Denmark	-0.4	0.7	Hungary	9.5	10.6
Germany	-0.7	0.3	Lithuania	8.9	10.0
Austria	-2.8	-2.3	Latvia	9.2	10.2
Netherlands	-0.3	0.5	Poland	7.4	7.5
France	-0.8	0.3	Slovenia	4.2	3.8
Portugal	-0.6	0.2	Slovak Republic	10.2	10.6
Spain	-0.5	0.3	Cyprus	6.3	6.0
Greece	-0.7	-0.4	Malta	1.4	1.2
Italy	-0.4	0.6	Bulgaria	7.2	7.1
Ireland	-2.5	-2.3	Romania	3.9	3.2

Figure 5.12 shows the impact of scenario 1 and scenario 2 on regional agricultural income. Results of scenario 1 are dominated by the 5% shift from P1 in the EU15 to P1 in the EU-12 (measure A). The impact of scenario 2 on the distribution of agricultural income over the different NUTS2 regions within a member states is much bigger compared to scenario 1. In the EU15, winners can be found in regions with a large share of permanent grassland land in total cropping plan and a large share of LFA in total agricultural area. For example in France P1 payments are re-distributed from the north-west of France to the south-east, as already was stated earlier.

More than -5%	-5% to 0%	0% to 5%	5% to 10%	More than 10%
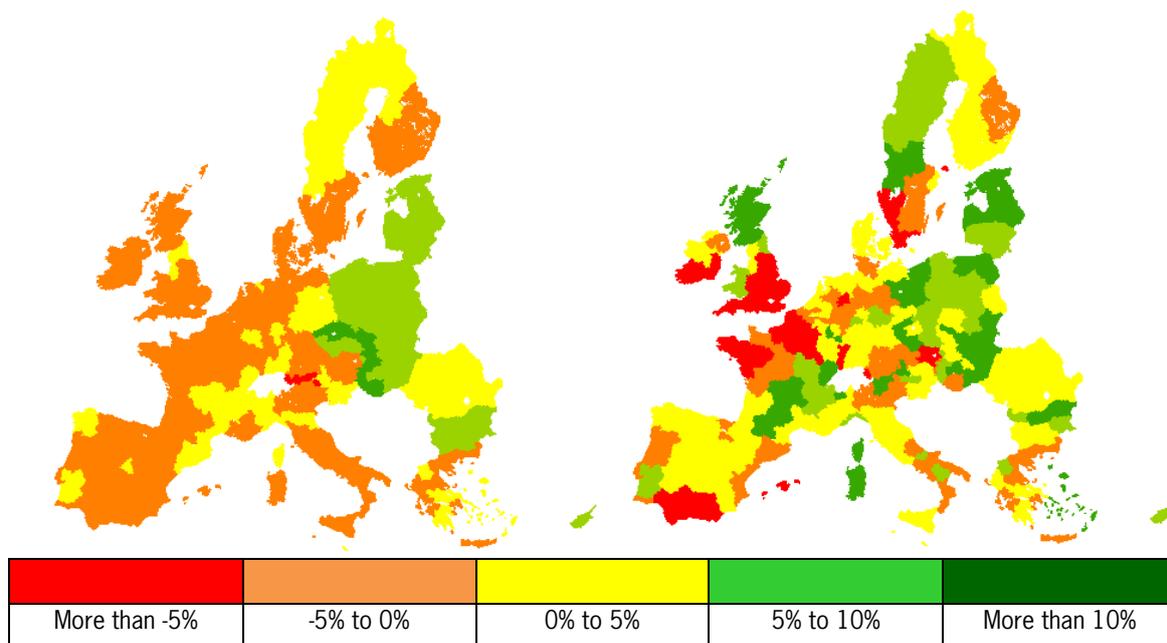
Figure 5.12: Changes in agricultural income per NUTS 2 region in scenario 1 (left figure) and scenario 2 (right figure) in 2020 (Percentage changes compared to 2020 baseline)

Environmental indicators

Figures 5.13 to 5.15 show that measure B in general has a positive effect on the selected environmental indicators. The impact of measure C differs for the different indicators but is in general rather limited. Compared to other measures, measure D in general has the biggest effect on the selected environmental indicators (except ammonia output (Figure 5.13) and phosphate surplus at soil level (Figure 5.15)).
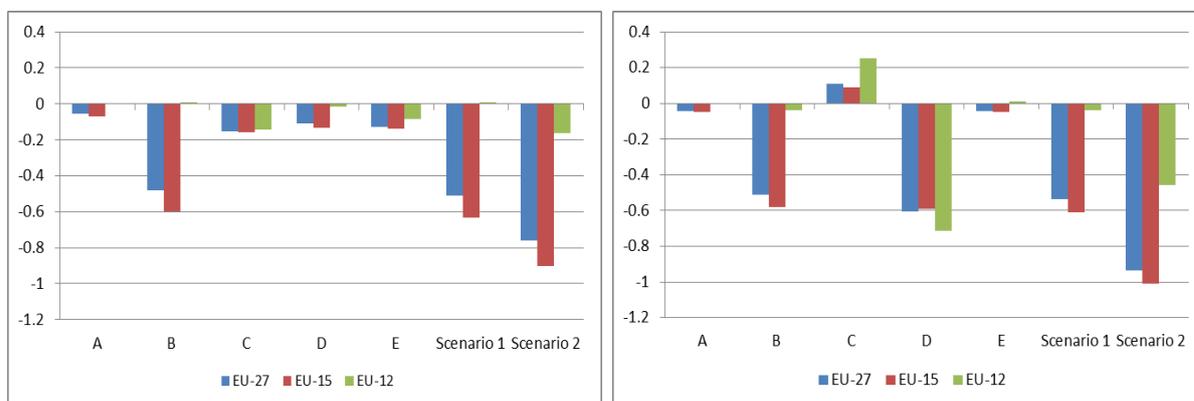
Figure 5.13: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on ammonium output (left figure) and CH_4 total emission (right figure) (% change compared to the baseline scenario).
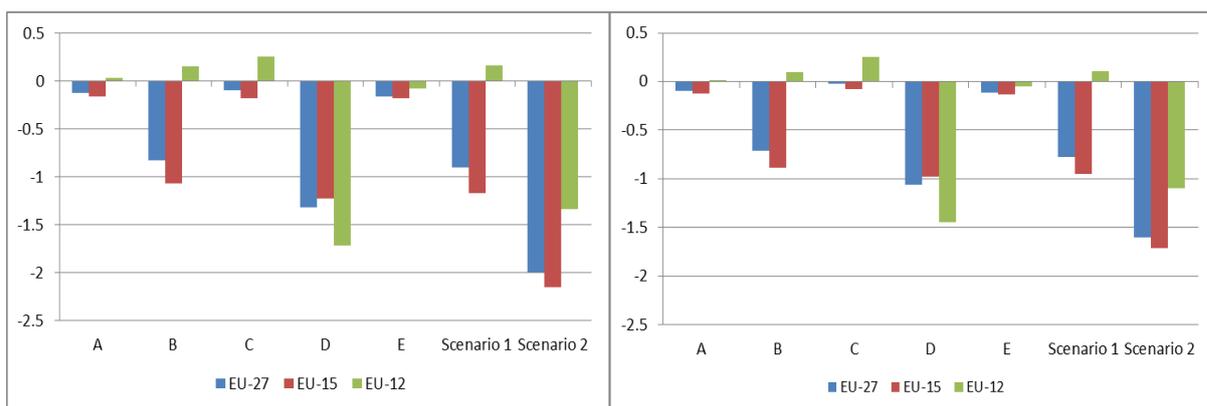
Figure 5.14: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on N_2O total emission (left figure) and Global Warming Potential (right figure) (% change compared to the baseline scenario).
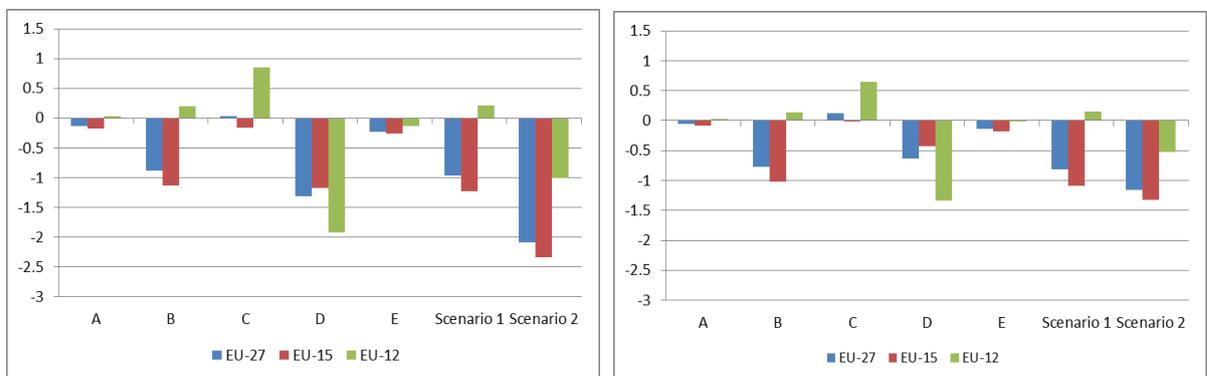
Figure 5.15: Effectiveness of individual measures and the total impact of scenario 1 and scenario 2 on Nitrate (N) surplus at soil level (left figure) and Phosphate (P_2O_5) surplus at soil level (right figure) (% change compared to the baseline scenario).

Table 5.7 summarizes the results presented above. It shows that emissions to the environment will be lower in scenario 1 and 2 as compared to the baseline. This is especially the case in the EU15 in scenario 2. Model results show that especially import from N by mineral fertilizer decreases sharply in scenario 2 in the EU15. This is explained by the ecological set aside obligation on arable land as well as the extra AE measures.

Table 5.7: Impact of the different scenarios on the total emission of selected environmental variables in different regions in the EU27 (Percentage changes compared to 2020 baseline)

	Scenario 1			Scenario 2		
	EU-27	EU-15	EU-12	EU-27	EU-15	EU-12
Ammonium output	-0.5	-0.6	0.0	-0.8	-0.9	-0.2
CH4 Total emissions	-0.5	-0.6	0.0	-0.9	-1.0	-0.5
N2O Total emissions	-0.9	-1.2	0.2	-2.0	-2.2	-1.3
Global warming potential	-0.8	-1.0	0.1	-1.6	-1.7	-1.1
Nitrate surplus at soil level	-1.0	-1.2	0.2	-2.1	-2.3	-1.0
Phosphate surplus at soil level	-0.8	-1.1	0.1	-1.2	-1.3	-0.5

The emission of CO_2[3] in the baseline scenario in 2020 is 450340 million kg CO_2. The emission of CO_2 per ha (agricultural area) differs between the EU-blocks representing the intensity of the agriculture. On average in EU27 in 2020 in the baseline scenario 7 the emission is 2400 kg per ha, in EU15 this is 2700 kg per ha, in EU10 this is 1800 kg per ha and in Bulgaria and Romania the average emission is 1000 kg per ha.

Figure 5.16 shows the changes in N surplus at soil level per NUTS 2 region in the different scenario. The figure also shows that changes at regional level can be different from the national average. In scenario 1 increases in N surplus at soil level can found in regions in Eastern Europe, Austria and in France. The increases occur in regions with relatively low N surplus at soil level in the initial situation, of which a relative large share is N from animal manure.

| More than +1.5% | 0 to 1.5% | 0% to -1.5% | -1.5 to -3% | More than -3% |
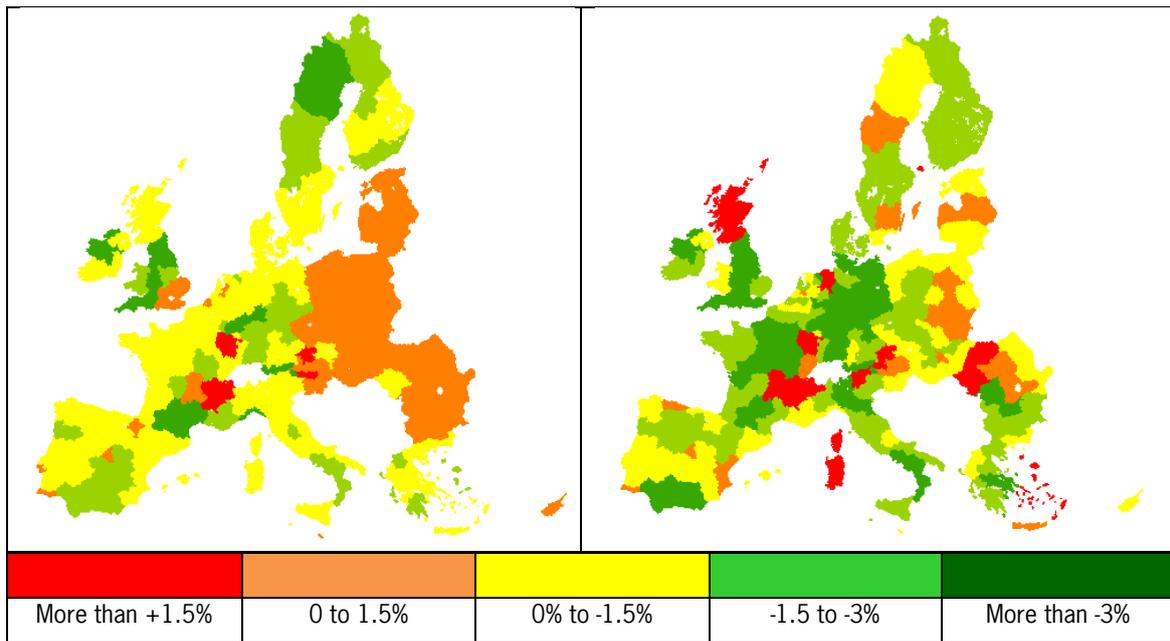
Figure 5.16: Changes in N surplus at soil level per NUTS 2 region in scenario 1 (left figure) and scenario 2 (right figure) in 2020 (percentage changes compared to baseline scenario in 2020)

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[3] The CO_2 (GWP) is referring to the conversion of CH_4 and N_2O to CO_2. So it doesn't include the use of energy.

6 Discussion and conclusions

In this study, three scenarios on the CAP beyond 2013 have been modelled by CAPRI: a baseline scenario, a moderate shifts scenario and a greening scenario. The consequences of the scenarios for the CAP budget have been estimated by the LEI budget model. The baseline scenario assumes a continuation of the present CAP beyond 2013, whereas the moderate shifts scenario includes a budget reduction of 10% of P1 in the EU15, of which 50% is distributed to P1 in the new member States and 50% to P2 in the EU15. The greening scenario also assumes this 10% reduction of P1 in the EU15. In addition, it distinguishes four types of direct payments in P1: a flat rate, a payment for permanent grassland, a payment for arable land and a payment to compensate for natural constraints.

More equity in the level of direct payments in old and new Member States
According to the LEI budget model, the flat rate payment per ha in 2020 in the baseline scenario amounts to 295 euro in the EU15 versus 187 euro in the new Member States. Due to the reduction of P1 in the EU15 in the moderate shifts scenario, the gap in the level of the flat rate per ha in the old and new Member States reduces: in this scenario the flat rate per ha is 265 euro on the EU15 and 226 euro in the EU12. In the greening scenario, a farmer receives a flat rate payment. This can be increased by a payment for grassland or arable land or a compensation payment for natural constraints. Farmers in the EU15 and farmers in most of the new Member States, who only receive a flat rate payment or a flat rate payment plus a payment for grassland or arable land, are worse off than in the baseline scenario, whereas farmers in LFA, receiving all four types of payments per ha, are better off than in the baseline scenario.

Moderate decline crop production
CAPRI results show that agricultural production in the EU in 2020 in the moderate shifts scenario is more or less similar to that in the baseline scenario. The production of cereals, oilseeds and fodder in the EU15 deviates a little from this picture: the production of these crops in 2020 is 1-2% lower than in the baseline scenario. Changes in agricultural production in the greening scenario exceed those in the moderate shifts scenario; however, animal production in 2020 is at highest 1% lower than in the baseline scenario. Crop production is more affected by the greening scenario; this is due to the assumption of 5% set aside on arable land which receives an arable payment in P1. In the greening scenario, production of crops in 2020 is 1-6% below that in the baseline scenario. As a result of the slight production decrease, producer prices of agricultural products increase a little: in the moderate shifts scenario they are 0-1% higher and in the greening scenario 0-5% higher than in the baseline scenario.

Agricultural income in new Member States increases
In the moderate shifts scenario, agricultural income in the EU15 in 2020 is nearly 1% below that in the baseline scenario, while agricultural income in the new Member States increases by over 8%. These shifts are mainly due to the reduction of the P1 payments in the EU15 and the increase in these payments in the EU12. In the greening scenario, agricultural income in the EU15 in 2020 is similar to that in the baseline scenario, whereas income in the EU12 rises by more than 8%. In this scenario, the reduction of P1 payments in the EU15 is compensated by price increases of agricultural products. Within Member States, a pattern can be perceived in which agricultural income increases in regions with a relatively high share of permanent grassland or LFA in total agricultural area, whereas it declines/increases less in regions with a relatively high share of arable land and a low share of LFA in total agricultural area.

Nowicki *et al.*, (2006) assumes a rather direct relationship between income possibilities and number of farms. Given the limited effects of the moderate shifts and the greening scenario on agricultural income (including horticulture activities) at member state level, the impact on the number of farms will also be limited. This means that the decrease in the number of farms as predicted under the baseline scenario (see Table 4.5), will continue. However, at regional and sector level the impacts on agricultural income possibilities can be different from the national average. As a result the development of the number of farms per region or sector can also be different from the national average. This is for example the case in LFA regions in the greening scenario. The decrease in number of farms and the increase in the size of the farms might slow down, as a result of the increased income possibilities in LFA regions in the greening scenario as compared to the baseline.

Increase in direct payments per ha results in higher land prices
It has to be noted that direct payments tend to be capitalized in land prices; so in regions in which the amount of direct payments per ha increases in the moderate shifts and the greening scenarios relatively to the baseline scenario, land prices will increase as well and vice versa. On the whole, this implies that land prices in the new Member States will increase in the alternative scenarios, whereas those in the old Member States will decrease, except in LFA regions. Due to the redistribution of the P1 budget to targeted payments, some farmers will gain and some farmers will lose. The impact of e.g. extra P1 payment in the new Member States on farm enlargement, investments and modernization is unclear from an empirical point of view (see Helming *et al.*, 2010b for a literature overview). In this study it is shown that some extra land is kept into production.

Different impacts if additional P2 budget is spent on other rural development measures
In both the moderate shifts and the greening scenario it is assumed that the additional budget for P2 in the EU15 is spent on agri-environmental measures. These tend to mitigate agricultural production. However, in case we would have assumed that the additional budget for P2 was spent on other P2 measures as well, scenario results may change. Nowicki *et al.* (2009) and Helming *et al.* (2010a), for example, analysed the impact of shifting P1 direct payments towards human and physical capital investment measures in P2. They found that these types of investments can have a potentially large impact on supply of agricultural products and competitiveness on world markets. If directed at productivity, at regional and sector level such investments could partly offset the decline of supply of agricultural production of agri-environmental measures. This is especially the case in regions with relatively low productivity of labour and a low level of capital investments in the initial situation, but it depends on the exact implementation of the agri-environmental measures and the implementation of the human and physical capital investments.

The extra supply induced by investments in human and physical capital will have a negative impact on agricultural prices. Such a development, combined with a decrease in direct payments in P1, may deteriorate agricultural income. This especially account for farmers that do not participate in the above mentioned investment programs. Other farmers that do participate might increase the size of their farms and the number of farms at regional and sector level will decrease. However, if these investments are directed at encouraging sustainable production (e.g. investment in air srubbers in stables), the level of production remains unchanged.

Uncertainties
The impacts of the moderate shifts scenario and the greening scenario on the variables discussed above (production, prices, exports, imports, income) are rather uncertain. These uncertainties are caused by limitations of the model as well as data limitations. Ecological set-aside under measure D will especially affect the less productive borders of a parcel. This is not included in CAPRI. Measure D is also implemented as a mandatory measure affecting all farmers with arable crops. If the measure would be voluntary, highly efficient farmers might not participate and the production and price effects

would be less. Another short-coming of CAPRI is that changes in farm structure and re-allocation of land to more efficient farmers, that might affect the regional average yield per crop per hectare, is not fully captured. Moreover, behavioural parameters used in the market model and used to model land supply are also taken from the literature and other models and might not fully match the specifications used in CAPRI. Given the uncertainties with respect of the land supply function, especially the supply effect of the shift of the P1 payment from the EU15 to the EU-12 (measure A) is uncertain. Another source of uncertainty due to lack of data is the impact of the AE measures in P2 on yield losses. At this stage there is little data available about the exact AE measures that are applied on the farm and what crops are targeted. In this study it is assumed that the yield loss of one hectare of grassland with AE measures equals 37.5 %, while the yield loss of a hectare of arable land with AE measures equals 68.9%. For reasons of simplicity these percentages are applied to all regions in the EU27. In reality yield losses could be bigger or smaller and as a result production and import and export effects could be different as well.

Notwithstanding the uncertainties it is believed that the directions and the magnitude of the impacts presented in this study are correct. However, the impacts on cereals and oilseeds should be considered as maximum effects in the medium to longer term. Whereas the supply and price effects of especially other arable field crops could be bigger.

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Annex 1 CAP budget tables in the different scenarios

Table A1 CAP budget in the baseline scenario, 2014-2020 (mln euro)

	CAP budget, 2007-2013 (mln euro)			CAP budget in baseline scenario, 2014-2020 (mln euro)			Total budget (baseline scenario) as % of total budget 2007-2013
	Total	P1 1)	P2	Total	P1	P2	
Belgium	4749	4262	487	4791	4304	487	101
Denmark	7779	7201	578	7921	7343	578	102
Germany	49383	40307	9076	50046	40970	9076	101
Greece	18386	14480	3906	19422	15516	3906	106
Spain	39616	32680	6936	42912	35976	6936	108
France	65348	58423	6925	66574	59649	6925	102
Ireland	11859	9383	2476	11862	9386	2476	100
Italy	35917	26973	8944	39534	30590	8944	110
Luxembourg	349	259	90	350	260	90	100
Netherlands	6539	5946	593	6877	6284	593	105
Austria	9231	5205	4026	9287	5261	4026	101
Portugal	7581	4007	3574	7816	4242	3574	103
Finland	6095	3958	2137	6131	3994	2137	101
Sweden	7284	5331	1953	7349	5396	1953	101
United Kingdom	32456	27827	4629	32544	27915	4629	100
EU15	302573	246242	56331	313417	257086	56331	104
Cyprus	384	217	167	537	374	167	140
Czech Republic	7358	4500	2858	9181	6365	2858	125
Estonia	1218	494	724	1423	708	724	117
Hungary	10353	6493	3860	13039	9233	3860	126
Lithuania	3611	1868	1743	4404	2661	1743	122
Latvia	1779	725	1054	2066	1025	1054	116
Malta	98	20	78	113	36	78	116
Poland	28269	15039	13230	34542	21312	13230	122
Slovenia	1628	712	916	1910	1010	916	117
Slovak Republic	3892	1923	1969	4686	2717	1969	120
Bulgaria	5098	2489	2609	8083	5474	2609	159
Romania	13626	5502	8124	19988	11965	8124	147
EU-12	77314	39982	37332	99972	62880	37332	129
EU27	379887	286224	93663	413389	319966	93663	109

1) The total budget for DP is less than the total budget for the first pillar as it excludes expenditure for export subsidies and market interventions.

Table A2 Share P1 and P2 budget of each Member State in the total EU27 budget and the national budget, 2007-2013 (%)

	Total budget: P1 (DP) and P2, 2007-2013 (mln euro)	Total budget as share of EU27 budget (%)	Budget P1, 2007-2013 (mln euro) 1)	P1 budget as share of EU27 budget (%)	Budget P2, 2007-2013 (mln euro)	P2 budget as share of EU27 budget (%)	P1 budget as share of national budget (%)	P2 budget as share of national budget (%)
Belgium	4749	1.3	4262	1.5	487	0.5	90	10
Denmark	7779	2.0	7201	2.5	578	0.6	93	7
Germany	49383	13.0	40307	14.1	9076	9.7	82	18
Greece	18386	4.8	14480	5.1	3906	4.2	79	21
Spain	39616	10.4	32680	11.4	6936	7.4	82	18
France	65348	17.2	58423	20.4	6925	7.4	89	11
Ireland	11859	3.1	9383	3.3	2476	2.6	79	21
Italy	35917	9.5	26973	9.4	8944	9.5	75	25
Luxembourg	349	0.1	259	0.1	90	0.1	74	26
Netherlands	6539	1.7	5946	2.1	593	0.6	91	9
Austria	9231	2.4	5205	1.8	4026	4.3	56	44
Portugal	7581	2.0	4007	1.4	3574	3.8	53	47
Finland	6095	1.6	3958	1.4	2137	2.3	65	35
Sweden	7284	1.9	5331	1.9	1953	2.1	73	27
United Kingdom	32456	8.5	27827	9.7	4629	4.9	86	14
EU15	302573	79.6	246242	86.0	56331	60.1	81	19
Cyprus	384	0.1	217	0.1	167	0.2	57	43
Czech Republic	7358	1.9	4500	1.6	2858	3.1	61	39
Estonia	1218	0.3	494	0.2	724	0.8	41	59
Hungary	10353	2.7	6493	2.3	3860	4.1	63	37
Lithuania	3611	1.0	1868	0.7	1743	1.9	52	48
Latvia	1779	0.5	725	0.3	1054	1.1	41	59
Malta	98	0.0	20	0.0	78	0.1	20	80
Poland	28269	7.4	15039	5.3	13230	14.1	53	47
Slovenia	1628	0.4	712	0.2	916	1.0	44	56
Slovak Republic	3892	1.0	1923	0.7	1969	2.1	49	51
Bulgaria	5098	1.3	2489	0.9	2609	2.8	49	51
Romania	13626	3.6	5502	1.9	8124	8.7	40	60
EU-12	77314	20.4	39982	14.0	37332	39.9	52	48
EU27	379887	100	286224	100	93663	100	75	25

1) The total budget for DP is less than the total budget for the first pillar as it excludes expenditure for export subsidies and market interventions.
Source: see Table A1.

Table A3 CAP budget in scenario 1 (moderate shifts), 2014-2020 (mln euro)

1) The total budget for DP is less than the total budget for the first pillar as it excludes expenditure for export subsidies and market interventions.

	P1 budget, 2014-2020 (mln euro)			P2 budget, 2014-2020 (mln euro)			Total CAP budget, 2014-2020 (mln euro)		Direct payment P1 per ha		
	baseline	scenario 1	scenario 1 as % baseline	baseline	scenario 1	scenario 1 as % baseline	scenario 1	scenario 1 as % base-line	baseline	scenario 1	scenario 1 as % baseline
Portugal	4242	3818	90	3574	3786	106	7604	97	174	157	90
Spain	35976	32378	90	6936	8735	126	41113	96	206	186	90
Austria	5261	4735	90	4026	4289	107	9024	97	236	212	90
United Kingdom	27915	25124	90	4629	6025	130	31148	96	247	223	90
Sweden	5396	4856	90	1953	2223	114	7079	96	247	223	90
Finland	3994	3595	90	2137	2337	109	5931	97	249	224	90
Luxembourg	260	234	90	90	103	114	337	96	284	255	90
France	59649	53684	90	6925	9908	143	63592	96	310	279	90
Ireland	9386	8447	90	2476	2945	119	11392	96	324	292	90
Italy	30590	27531	90	8944	10474	117	38005	96	343	309	90
Germany	40970	36873	90	9076	11125	123	47998	96	346	311	90
Denmark	7343	6609	90	578	945	164	7554	95	394	355	90
Belgium	4304	3874	90	487	703	144	4576	96	447	403	90
Netherlands	6284	5656	90	593	907	153	6563	95	469	422	90
Greece	15516	13964	90	3906	4682	120	18646	96	544	489	90
EU15	257086	231377	90	56331	69185	123	300563	96	295	265	90
Latvia	1025	1235	120	1054	1054	100	2289	111	83	99	120
Estonia	708	853	120	724	724	100	1576	111	112	134	120
Romania	11965	14411	120	8124	8124	100	22535	113	124	150	120
Lithuania	2661	3205	120	1743	1743	100	4948	112	144	173	120
Poland	21312	25669	120	13230	13230	100	38899	113	197	237	120
Slovak Republic	2717	3272	120	1969	1969	100	5242	112	200	241	120
Bulgaria	5474	6593	120	2609	2609	100	9202	114	256	309	120
Czech Republic	6365	7666	120	2858	2858	100	10524	115	258	311	120
Slovenia	1010	1216	120	916	916	100	2132	112	295	356	120
Hungary	9233	11120	120	3860	3860	100	14981	115	312	376	120
Cyprus	374	450	120	167	167	100	617	115	366	441	120
Malta	36	43	120	78	78	100	121	107	498	600	120
EU-12	62880	75734	120	37332	37332	100	113066	113	187	226	120
EU27	319966	307112	96	93663	106517	114	413629	100	265	254	96

Source: see Table A1.

Table A4 CAP budget in scenario 2 (greening), 2014-2020 (mln euro)

	P1 budget baseline	P1 budget scenario 2	Of which:			As % of P1 budget scenario 2		
			P1 budget for flat rate	P1 budget for grass/ arable payment	P1 budget for LFA payment	P1 budget for flat rate	P1 budget for grass/ arable payment	P1 budget for LFA payment
Netherlands	6284	5656	4454	928	273	79	16	5
Denmark	7343	6609	5165	1415	28	78	21	0
Belgium	4304	3874	2859	726	289	74	19	7
Greece	15516	13964	9198	1730	3037	66	12	22
Italy	30590	27531	15083	5684	6764	55	21	25
Germany	40970	36873	18339	9750	8784	50	26	24
France	59649	53684	26559	14337	12788	49	27	24
Sweden	5396	4856	2223	1177	1457	46	24	30
Finland	3994	3595	1527	989	1078	42	28	30
Ireland	9386	8447	3504	2409	2534	41	29	30
United Kingdom	27915	25124	10049	7537	7537	40	30	30
Spain	35976	32378	12951	9714	9714	40	30	30
Luxembourg	260	234	94	70	70	40	30	30
Austria	5261	4735	1894	1420	1420	40	30	30
Portugal	4242	3818	1527	1145	1145	40	30	30
EU15	257086	231377	115426	59032	56919	50	26	25
Cyprus	374	450	331	34	85	74	7	19
Malta	36	43	32	1	11	73	2	25
Bulgaria	5474	6593	4158	1975	460	63	30	7
Hungary	9233	11120	6259	2620	2242	56	24	20
Slovenia	1010	1216	566	285	365	47	23	30
Estonia	708	853	341	256	256	40	30	30
Lithuania	2661	3205	1282	961	961	40	30	30
Czech Republic	6365	7666	3066	2300	2300	40	30	30
Latvia	1025	1235	494	370	370	40	30	30
Poland	21312	25669	10267	7701	7701	40	30	30
Slovak Republic	2717	3272	1309	982	982	40	30	30
Romania	11965	14411	5764	4323	4323	40	30	30
EU-12	62880	75734	33871	21808	20056	45	29	26
EU27	319966	307112	149297	80839	76976	49	26	25

Source: see Table A1.

Table A5 Direct payments in scenario 2 (greening), 2014-2020

	Euro per ha					As % direct payment P1 baseline			
	direct payment P1 baseline	flat rate, sc2	Pay-ment for grass / arable land sc2	paym ent LFA sc2	Pay-ment for LFA and grass/ arable land sc2	flat rate, sc2	pay-ment for grass/ arable land sc2	pay-ment LFA sc2	pay-ment for LFA and grass/ arable land sc2
Netherlands	469	332	432	482	582	71	92	103	124
Denmark	394	277	377	427	527	70	96	108	134
Belgium	447	297	397	447	547	66	89	100	122
Greece	544	322	422	472	572	59	78	87	105
Italy	343	169	269	319	419	49	78	93	122
Germany	346	155	255	305	405	45	74	88	117
France	310	138	238	288	388	45	77	93	125
Sweden	247	102	202	242	342	41	82	98	138
Finland	249	95	195	162	262	38	78	65	105
Ireland	324	121	221	247	347	37	68	76	107
Spain	206	74	149	146	221	36	72	71	107
Austria	236	85	157	180	253	36	67	76	107
United Kingdom	247	89	164	234	309	36	66	95	125
Luxembourg	284	102	198	179	274	36	70	63	97
Portugal	174	63	133	117	186	36	76	67	107
EU15	295	132	222	250	340	45	75	85	115
Cyprus	366	324	424	474	574	89	116	130	157
Malta	498	438	538	588	688	88	108	118	138
Bulgaria	256	195	295	345	445	76	115	134	173
Hungary	312	211	311	361	461	68	100	116	148
Slovenia	295	166	266	312	412	56	90	106	140
Estonia	112	54	109	155	210	48	98	139	188
Romania	124	60	111	206	257	48	89	166	207
Czech Republic	258	125	225	275	375	48	87	106	145
Lithuania	144	69	134	201	266	48	94	140	185
Latvia	83	40	81	80	121	48	98	97	146
Poland	197	95	175	237	317	48	89	121	161
Slovak Republic	200	97	182	194	279	48	91	97	139
EU-12	187	101	176	237	312	54	94	127	167
EU27	265	124	209	246	331	47	79	93	125

Source: see Table A3.

Table A6 Maximum P1 payments for permanent pasture/arable land and for LFA in scenario 2 (greening)

	Payment for permanent pasture and arable land		LFA payment	
	exceeding the 30% budget limit with payment of 100 euro per ha	payment per ha grass/arable land per ha (euro)	exceeding the 30% budget limit with payment of 150 euro per ha	payment per ha LFA (euro)
Portugal	yes	70	yes	54
Finland		100	yes	67
Spain	yes	75	yes	71
Luxembourg	yes	96	yes	77
Austria	yes	73	yes	95
Ireland		100	yes	127
Sweden		100	yes	140
United Kingdom	yes	75	yes	145
Belgium		100		150
Denmark		100		150
Germany		100		150
Greece		100		150
France		100		150
Italy		100		150
Netherlands		100		150
EU15		90	yes	117
Latvia	yes	41	yes	40
Slovak Republic	yes	85	yes	97
Estonia	yes	55	yes	101
Lithuania	yes	65	yes	131
Poland	yes	80	yes	142
Romania	yes	51	yes	146
Slovenia		100	yes	146
Cyprus		100		150
Czech Republic		100		150
Hungary		100		150
Malta		100		150
Bulgaria		100		150
EU-12	yes	75	yes	136
EU27	yes	85	yes	122

Source: see Table A1.

Annex 2 Description of agri-environmental measures modelling and LFA payments in P2

In this Annex we give a more detailed description of the modelling of agri-environmental (AE) measures and LFA payments in CAPRI in this study.

Distribution of the AE budget over farm types and land-use types

A first step in the modelling of the AE measures in CAPRI is to distribute the budget for agri-environmental payments to farm types and land-use types. The total budget for AE measures is first distributed over eight farm types according to their share in total AE payments in 2005 based on FADN data. This gives us a budget for AE measures for eight different farm types at the level of the member state. Next, the farm types are assigned to a land-use type (Table B1). We only distinguish between grassland and arable land. The AE budget per land-use type per member state is found by summing the AE budget over the corresponding farm types.

Table B1 Mapping from aggregated farm types in FADN (TF8) to different types of agri-environmental (AE) measures to activity groups in CAPRI

TF8 type	Farm type	Land use type
1	Field crops	Annual arable crops
2	Horticulture	Annual arable crops
3	Wine	Annual arable crops
4	Permanent crops	Annual arable crops
5	Milk	Grassland
6	Grazing animals	Grassland
7	Pigs and poultry	Grassland
8	Mixed	Grassland

Disaggregation of the AE budget per land use type to the regional level

In this study we have disaggregated the AE budget per land-use type per member state to the regional NUTS2 level by taking the following elements into account:

- The share of grassland in LFA in total acreage of grassland and the share of arable crops in LFA in total acreage of arable crops in a NUTS2 region. This is to reflect the idea that a farm is more likely to participate in an agri-environmental scheme if it is located in a LFA area (Nowicki *et al.*, 2009). The larger the above mentioned shares, the larger the AE budget per land use type per NUTS2 region;
- The total acreage of grassland and arable land per NUTS2 region. The larger the region, the larger the AE budget per land use type per NUTS2 region;
- The ratio between the regional average gross margin per hectare of grassland and arable crops and the national average gross margin per hectare of grassland and arable crops. Everything being equal, the lower this ratio, the larger the AE budget per land use type per NUTS2 region.

Different AE packages

The gross margin loss is an indicator for the AE premium per hectare of grassland and arable land. The gross margin loss is calculated by a) assuming a certain distribution of AE packages per hectare of grassland and per ha arable crop b) by assuming a certain yield loss and variable costs savings per land use type (grassland or arable crop) and AE package and c) using the average gross margin per hectare of grassland and arable crop in 2020 in the baseline scenario.

Given the total budget for AE measures for grassland and arable land per NUTS2 region and the AE premium per ha grassland and arable land per NUTS2 region, we can calculate the hectares of grassland and arable land with AE measures.

We compared the results of the procedure described above with data referring to the target value of total hectares with AE measures at member state level (Table B2). Table B2 shows that the total hectare under AE in 2020 in the baseline scenario can be quite different from this target value. There are quite some reasons that could explain this difference. First of all the definition of AE measures can be different. For example landscape conservation is not included into our definition of AE measures. We have used the target value as an upper value, in case our procedure results into total hectares under AE exceeding the target value. Baseline results are presented in Table B2.

Agricultural activities in CAPRI are not distinguished by having AE measures or not. To solve this problem we have translated the hectares of grassland and arable land with AE measures in set-aside equivalents:

Set Aside Equivalent$_{i,r}$=SUM$_j$, ($\alpha_{i,j}$*YieldLoss$_{i,j}$)*Hectares under AE$_{i,r}$

Where i (1,2) represents land use types, namely grassland and arable crops, r represents NUTS2 regions and j represents the different AE packages. Variable $\alpha_{i,j}$ is the share of AE package j on land use type i, YieldLoss$_{i,j}$ is yield loss per land use type i and AE package j. Next, these set-aside equivalents per NUTS2 region are summed over land use types i and included as a separate activity, requiring extra land from the NUTS2 land balance in CAPRI.

Table B2: Hectare under AE support (target value[1]), hectare under AE support in 2020 in the baseline and budget for AE measures in P2 in 2020 in the baseline scenario.

	Hectare under support (target value)	Hectare under AE in baseline		
		Total	Grassland	Arable land	Annual budget[2] for AE measures in P2
		(1000 ha)	(1000 ha)	(1000 ha)	(mln Euro)
Belgium	235	144	111	32	49
Denmark	410	410	36	374	31
Germany	5257	2440	1781	659	537
Austria	5400	1149	862	287	503
Netherlands	102	102	95	7	76
France	5100	3989	3653	337	441
Portugal	425	425	342	83	59
Spain	10863	6001	4457	1543	276
Greece	700	700	557	143	121
Italy	2973	1988	1652	336	547
Ireland	2250	1430	1394	36	337
Finland	2160	1153	257	896	296
Sweden	1950	642	225	417	284
United Kingdom	10435	4664	4311	352	551

1) Target value in 2013. In the baseline scenario, we suppose a similar target value in 2020; 2) EAFRD budget plus national cofinancing.
Source: Rural Development Programmes 2007-2013 (updated versions after Health Check Agreement and European Recovery Plan) of the EU Member States/regions; adaptation LEI.

To determine the hectares of grassland and arable land with AE measures under P1, the relationships found in the baseline are used as the distribution key. This means that as the total budget for AE measures in P2 increases by 10%, the hectares under support and the set aside equivalent will also increase by 10%.

Modelling LFA payments in P1 and in P 2

The share of LFA in a NUTS2 region is crucial for the distribution of the LFA budget among NUTS2 regions: In CAPRI the average LFA payment (€ per ha per crop per NUTS2 region) is relatively high in NUTS2 regions with relatively high shares of LFA in total utilised agricultural area.

All arable crops and grassland activities are eligible for the LFA payment. However, the average LFA payment per hectare per crop per NUTS2 region can be different for arable crops and grassland activities. This is true because the share of grassland in LFA in total acreage of grassland in a NUTS2 region can be different from the share of arable land in LFA in total acreage of arable land in a NUTS2 region. For example, a NUTS2 region can have a relative large share of mountainous LFA in total utilized agricultural area. It can be expected that the share of grassland in this mountainous LFA area, exceeds the share of grassland in the corresponding NUTS2 region as a whole. Hence, the average LFA payment per hectare grassland in this NUTS2 region should be larger than the average LFA payment per hectare of arable crops in this NUTS2 region. In order to capture a possible bias of this nature, land use data from Dyna-CLUE was used to compute the shares S_{ij} of LFA in broadly different land use classes $j \in$ {non-irrigated arable land, irrigated arable land, pasture, permanent crops} in each region i. Those shares were multiplied by a nominal premium rate A to compute an average premium amount P_{ij} for crops belonging to each class j in each region i. These computed amounts were taken to reflect the biased distribution of crops inside and outside LFA areas. Since Dyna-CLUE does not distinguish 'Mountainous' and 'Other' LFA, the nominal amount A to which the shares S were applied was assumed to be the same everywhere: €150.

$$P_{ij} = ACS_{ij}$$

where
P: Premium per hectare, i: Region, j: Group of crops (land class)
A: Maximum amount per hectare, €150
S: Share of LFA in all land of class j
C: Premium cut factor

The premium per hectare per crop is multiplied with the total hectares per crop in a NUTS2 region. In the above equation, the variable C represents the cut-off factor in case the value ceiling of the premium is overshot. A value ceiling for the premium was computed by adding LFA budget from P1 and P2.

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