# The Luxembourg Agreement Reform of the CAP: an Analysis Using the AG-MEMOD Composite Model

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## *Abstract*

In this paper we present the results for EU-15 of a simulation of the Luxembourg CAP reform based on the AG-MEMOD composite model. This dynamic partial equilibrium econometric multi products model comprises of national country level sub-models that are combined to be linked and solved in prices generating projections for each country, and the entire EU, for each year to a 10-year horizon.

Under the Luxembourg reform scenario simulated direct payments in the grains and oilseeds, cattle and beef, and sheep commodity market organisations are fully decoupled. Intervention price reductions for butter agreed as part of the reform are also considered. The impact of the Luxembourg Agreement reform scenario is measured against a Baseline of a continuation of Agenda 2000 agricultural policy. The impact of the Luxembourg Agreement reform scenario is measured against a Baseline of a continuation of Agenda 2000 EU agricultural policy.

**Key words:** Partial Equilibrium Modelling, EU CAP Reform, Decoupling, Agriculture.

## *1. Introduction*

The AGMEMOD Partnership model is an econometric, dynamic, multi-product partial equilibrium model that allows us to make projections and simulations in order to evaluate measures, programmes and policies at the European Union level as well as at the Member States level.

Fourteen teams, that are members of the AG-MEMOD Partnership, have built compatible models for their own countries (all partner institutions are listed in an Appendix to this paper). These models account for over 99% of the agricultural output of the EU15. The diverse nature of agricultural production systems and agri-food markets across the EU poses a challenge to economists seeking to develop a model that can be used to analyse policy at an EU and Member State level. The AG-MEMOD Partnership model maintains the analytical consistency of the composite model across national sub-models, while still allowing the national sub-models to reflect the intrinsic diversity of the agri-food sectors in different EU member states.

This paper provides an introduction to the AG-MEMOD modelling system. In particular, the paper will concentrate on the modelling approach used in the EU-15 component of the AG-MEMOD model, and the results of the Luxembourg Agreement simulation with the model are traced through to the year 2010. The paper is structured as follows: the next section is devoted to the methodological approach used in the AG-MEMOD model, baseline scenario assumptions (Agenda 2000) and results are presented in section three, scenario assumptions (Luxembourg Agreement) are defined and the main results are presented in section four. The paper concludes with some remarks on the projected impact of the reform agreement and on future research using the tool developed.

## *2. Methodology: The AG-MEMOD composite Model*

As noted above, the AG-MEMOD country models are econometric, dynamic, multi-product, partial equilibrium commodity models. The commodity coverage of the current version of the model extends to markets for grains (soft and durum wheat, barley and maize), oilseeds (rapeseed, soybeans and sunflower seed) and to the markets for their associated meals and oils, root crops (sugar beet, sugar and potatoes), livestock (cattle, pigs, poultry, and sheep) and milk and dairy products (cheese, butter, whole milk powder and skim milk powder). Most of the equations in the model are estimated using annual data from the period 1973-2000, or over shorter periods when data are not available. The annual data were obtained from Eurostat's New-Cronos database, Oil World, OECD databases, FAPRI forecasts and from Member States' agriculture ministries. Here we describe, in general terms, the functional specification of the econometrically estimated equations of the AG-MEMOD country level models.

In the three crops sub-models (grains, oilseeds and root crops) we assume that land allocation is made in a two-step process. In the first stage of the process producers are modelled as determining the total land area allocated to grains, oilseeds and root crop culture groups ($i$). Then, in a second stage, the shares of the land areas allocated to the grains, oilseeds, and root crop cultures are allocated to each culture $j$ belonging to the corresponding culture group ($i$).

The total area harvested equations for grains, oilseeds and root crops can be written as

$$ah_{i,t} = f\left(p^{j}_{i,t-1}, ah_{l,t-1}, V\right) \qquad j = 1,...,n; \quad i,l = 1,...,3; \quad i \neq l \qquad (1)$$

where $ah_{i,t}$ is the area harvested in year $t$ for culture group $i$, $p^{j}_{i,t-1}$ the real price in year $t-1$ of culture $j$ belonging to the culture group $i$, and $V$ is a vector of exogenous variables which could have an impact on the area of culture $i$ harvested (such variables include, inter alia, the set aside rate and the rate of arable aid compensation).

The equations used to determine the share of culture $k$ belonging to culture group $i$ ($sh^{k}_{i,t}$) can be written as

$$sh^{k}_{i,t} = f\left(p^{j}_{i,t-1}, sh^{k}_{i,t-1}\right) \qquad j,k = 1,...,n. \tag{2}$$

The yield equations of culture $k$ in culture group $i$ can be written as

$$r^{k}_{i,t} = f\left(p^{j}_{i,t-1}, r^{k}_{i,t-1}, V\right) \qquad j,k = 1,...,n \tag{3}$$

where $r^{k}_{i,t}$ is the yield per hectare of culture $k$ belonging to the culture group $i$, and $V$ a vector of variables, which could have an impact on the yield per hectare of the culture being modelled.

In the specification of the AG-MEMOD crops sub-models' supply side we do not consider income per hectare in the functional forms. This choice was made in order to distinguish the price and compensation variables separate effects on producers' supply decisions.

On the demand side, crush and feed demand and non-feed use per capita are modelled using the following general functional forms

$$Fu^{k}_{i,t} = f\left(p^{j}_{i,t}, Z\right) \qquad j,k = 1,...,n \tag{4}$$

where $Fu^{k}_{i,t}$ is the feed demand for culture $k$ belonging to the culture group $i$ and Z a vector of endogenous variables, which could have an impact on the demand considered (meat production for example).

$$NFu^{k}_{i,t} = f\left(p^{j}_{i,t}, NFu^{k}_{i,t-1}\right) \qquad j,k = 1,...,n \tag{5}$$

where $NFu^{k}_{i,t}$ is the non-feed demand for culture $k$ belonging to the culture group $i$. Crush demand for oilseed culture $k$ ($CR^{k}_{i,t}$) is modelled as

$$CR^{k}_{i,t} = f\left(p^{h}_{i,t-1}, p^{h}_{i,t-1}, p^{l}_{i,t-1}, CR^{h}_{i,t-1}\right) \qquad h,l = 1,...,n \tag{6}$$

where $p^{h}_{i,t-1}$ the real price of considered seed oil and $p^{l}_{i,t-1}$ the real price of the seed meal produced as a product of the crushing process.

The stock level, exports and imports equations for the grains and oilseed models in general have the following functional forms

$$St_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, St_{i,t-1}^{k}\right) \tag{7}$$

$$Ex_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, Ex_{i,t-1}^{k}\right) \tag{8}$$

$$\mathrm{Im}_{i,t}^{k} = f\left(PR_{i,t}^{k}, DU_{i,t}^{k}, \mathrm{Im}_{i,t-1}^{k}\right) \tag{9}$$

where $\mathrm{Im}_{i,t}^{k}$, $Ex_{i,t}^{k}$ and $St_{i,t}^{k}$ are respectively the ending stocks, exports and imports for culture $k$ belonging to the culture group $i$ in year $t$, $PR_{i,t}^{k}$ and $DU_{i,t}^{k}$ are the production and the total domestic use of culture $k$ belonging to the culture group $i$.

The other commodity markets considered in the crops sub-models are the oils and meals markets. The supply sides of these markets are determined by oilseeds crushed and technical coefficients. For all these markets the specification of equations for exports, imports, stocks, oil per capita consumption, industrial demand for oil and meal domestic use are similar to equations (7), (8), and (9). The estimation of these functional forms, allows us to determine harvested areas, yields, feed and non-feed uses, ending stocks, exports and imports for the corresponding commodity markets.

While the structure of individual livestock and meat sub-models varies, their general structure is similar and is presented below. Ending numbers of breeding animals can be written as

$$cct_{i,t} = f\left(cct_{i,t-1} p_{i,t}, V\right) \qquad i = 1,...,n \tag{10}$$

where $cct_{i,t}$ is the ending number in year $t$ for the breeding animal type $i$, $p_{i,t-1}$ is the real price in year $t-1$ of the animal $i$ considered, and $V$ is a vector of exogenous variables which could have an impact on the ending inventory concerned (such variables are the direct payment linked to the animals concerned or specific national policy instruments).

Numbers of animals produced by the breeding herd inventory can be written as

$$spr_{i,t} = f\left(cct_{i,t-1}, ypa_{i,t}\right) \qquad i = 1,...,n \tag{11}$$

where $spr_{i,t}$ is the number of animals produced from breeding herd $cct_{i,t}$ in year $t$ and $ypa_{i,t}$ is the exogenous yield per breeding animal concerned.

Within each animal culture $i$ there may be $m$ categories of slaughter $j$. The number of animals in animal culture $i$ that are slaughtered in slaughter category $j$ can be written as

$$ktt_{i,t}^{j} = f\left(cct_{i,t}^{j}, p_{i,t}, z_{i,t}^{j}, V\right) \qquad i = 1,...,n \qquad j = 1,...,m \tag{12}$$

where $ktt_{i,t}^{j}$ is the number of animals slaughtered in category $j$ of animal culture $i$ in year $t$, $z_{i,t}^{j}$ is an endogenous variable that represents the share of different categories of animals

slaughtered in the total number of animals slaughtered for the animal culture concerned, and $V$ is a vector of exogenous variables. Average slaughter weight in animal culture $i$ can be written as

$$slw_{i,t} = f\left(slw_{i,t-1}, z^{j}_{i,t}, p_{i,t}, V\right) \qquad i = 1,...,n. \qquad j = 1,...,m. \tag{13}$$

Total meat production from animal culture $i$ is then derived as the product of average slaughter weight times total slaughter in that culture, which is defined as

$$ktt_{i,t} = \sum_{j} ktt^{j}_{i,t} \qquad i = 1,...,n. \qquad j = 1,...,m. \tag{14}$$

Ending stocks of animals (breeding and non-breeding), and meat production are derived using identities. Total domestic use of meats is derived as the product of per capita demand for the meat concerned times an exogenous population variable. Per capita consumption of meat can be written as

$$upc_{i,t} = f\left(upc_{i,t-1}, p_{i,t}, p_{k,t}, gdpc_{t}, V\right) \qquad k, i = 1,...,n; \; k \neq i. \tag{15}$$

where $upc_{i,t}$ is the per capita consumption of meat $i$ in year $t$, $gdpc_{t}$ is the exogenously determined per capita real income and $V$ is a vector of other exogenous variables that have an impact on per capita meat consumption.

The functional form used to estimate the ending stocks of meats has the same general form as that used in the estimation of the animal breeding inventories, equation (10). Similarly the specifications of the trade equations for animals and meats follow the same general functional form used in the grains and oilseeds models, equations (7)-(9).

Of the AG-MEMOD sub-models, the dairy model is arguably the most complicated. A particular feature of the dairy model is its emphasis on the allocation of milk fat and milk protein (rather than just simply milk) to the production of the various dairy commodities modelled. These products are butter, cheese, skimmed milk powder, whole milk powder and "other dairy products". For each dairy commodity modelled, supply and utilisation is projected, as are wholesale prices at the country level as well as at the aggregate EU level.

The AG MEMOD dairy sub-model is comprised of several components. The first component determines milk production, milk imports and exports. The second component allocates milk to feed use and fluid milk consumption. Total milk factory use (manufacturing milk) for further processing into dairy products is then determined as a balancing item.

Milk yield per cow can be written as

$$ypc_{t} = f\left(ypc_{t-1}, p_{t}, qua_{t}, V\right) \tag{16}$$

where $ypc_t$ is the yield per cow in year $t$, $p_t$ is the real price of milk, $qua_t$ is the exogenous milk quota pertaining in the country concerned, and $V$ is a vector of other exogenous variables that could have an impact on per cow yields of milk. Dairy cow ending numbers can be written as

$$dct_t = f(ypc_t, p_t, qua_t, V) \tag{17}$$

where $dct_t$ is the ending numbers of dairy cows and other variables are as defined above. Total milk production is then derived as the product of milk yield per cow and total ending cow numbers.

As noted earlier total milk production is allocated to three uses, feed use ($ufe_t$), fluid use ($ufl_t$), and factory use ($ufa_t$). Feed use of milk can be written as

$$ufe_t = f(ufe_{t-1}, p_t, V) \tag{18}$$

with fluid use derived as the product of population times per capita fluid milk consumption. The per capita fluid milk consumption equation specification has the same form as that specified for per capita meat consumption, see equation (15). Factory use of milk is derived to balance total milk supply and use.

As noted earlier, the AG-MEMOD model allocates the fat and protein components of raw milk. The amount of fat and protein in the raw milk produced that is used in the manufacturing sector is first calculated. This calculation involves a number of assumptions concerning the fat and protein content of the raw milk and the fat and protein content of the dairy commodities produced with manufacturing milk.

Once the available supplies of milk protein and fat are calculated, the next step is to allocate the protein and fat components. The milk protein allocated to dairy commodity $i$ can be written as

$$ppc_{i,t} = f(ppc_{i,t-1}, p_{i,t}, p_{k,t}, V) \qquad i,k = 1,...,n;\ i \neq k. \tag{19}$$

where $ppc_{i,t}$ is the allocation of protein to dairy commodity in question in year $t$, $p_{i,t}$ is the price of dairy commodity $i$, and $V$ are exogenous variables that affect the protein allocation to commodity $i$. Total protein available is allocated to $n$ dairy commodities. Milk protein allocation equations are estimated for $n-1$ products, with the milk protein allocation to the $n^{th}$ product derived as a balancing residual allocation.

Production of dairy commodities using milk protein is derived as the total milk protein allocation divided by an exogenous technical protein content conversion factor. Given these production levels the allocation of milk fat to these products is derived from fixed technical factors.

The allocation of milk fat to butter or other dairy products is written as

$$fpc_{i,t} = f(fpc_{i,t-1}, p_{i,t}, p_{k,t}, V) \qquad i,k = 1,...,n;\ i \neq k. \tag{20}$$

where $fpc_{i,t}$ is the fat allocation to the dairy commodity $i$, $p_{i,t}$ is the price of dairy commodity $i$, and $V$ are exogenous variables that affect the protein allocation to commodity $i$. Given the allocation of milk fat to other dairy products or butter the allocation of the remaining milk fat is derived from the milk fat supply and use identity.

To complete the building of the AG-MEMOD composite models for each of the commodities modelled it is necessary to add an equation describing the equilibrium for each commodity market at both the Member State and EU levels. This condition implies that production plus beginning stocks plus imports equal domestic use plus ending stocks plus exports. In a closed economy, this supply and use equilibrium condition is sufficient to determine endogenously the equilibrium country market prices, matching supplies and demands. Given that our model does not represent a closed economy, the Rest of the World can have important impacts on the economy modelled. To account for such impacts we have chosen to use price linkage equations to account for the relations between Member States, and between the European Union and the Rest of the World.

When the national level market is not consider as the key market in the Europe Union, the price linkage equations used in the model can be written as

$$p_{j,t} = f\left(Kp_{j,t}, p_{j,t-1}, ssr_{j,t}, Kssr_{j,t}, V\right) \tag{21}$$

where $p_{j,t}$ is the national price of culture $j$ in year $t$, $Kp_{j,t}$ is the key price of culture $j$ in year $t$, $ssr_{j,t}$ is the self sufficiency ratio (domestic use divided by production) for commodity $j$ in the country concerned, $Kssr_{j,t}$ is the self sufficiency rate for the same commodity in the key price market, and $V$ a vector of exogenous variables which could have an impact on the national price.

When the national price is the key price, the price linkage equations used in the model can be written as

$$Kp_{j,t} = f\left(Wp_{j,t}, EIp_{j,t}, Kp_{j,t-1}, Essr_{j,t}, V\right) \tag{22}$$

where $Wp_t^j$ is the corresponding world price, $EIp_t^j$ the corresponding European intervention price, $Essr_{j,t}$ is the EU self-sufficiency rate for commodity $j$, and V a vector of variables which could have an impact on the key price (exchange rates, tariff rate quota levels and subsidised export limits).

## *3. Business as usual Baseline Scenario*

### *3.1. Description of the baseline scenario*

In this section we describe the agricultural policies that characterise the Baseline and provide a short summary of the macroeconomic outlook that underlies the AG-MEMOD composite model's projections. The origin of the world market price projections used under the Baseline and the Luxembourg scenario are also outlined.

The Baseline policy incorporates the Agenda 2000 reforms of the CAP. The Baseline does not make assumptions concerning the outcome of the Doha Development Round of the WTO. The Uruguay Round Agreement on Agriculture (URAA) is assumed to prevail for the whole of the projection period. In the current EU-15 Baseline the accession of the EU-10 group on the 1st of May 2004 is not incorporated. In future policy scenarios analysed with the composite AG-MEMOD model such WTO and EU enlargement assumptions will be relaxed.

The macroeconomic outlook incorporated in this Baseline is based on external sources such as macroeconomic institutes in Member States and the FAPRI-Ireland Partnership. World market price projections are not endogenous to the AG-MEMOD model. However, the AG-MEMOD model is linked to the FAPRI-Missouri EU GOLD model (Hanrahan, 2001). This model incorporates world price projections from the FAPRI world agricultural modelling system and allows for the incorporation of the impact of global supply and demand developments on EU agricultural markets. The world market price projections used in both the Baseline and scenario analysis presented below are taken from the most recent FAPRI-Ireland Baseline publication (Binfield et al., 2003).

### *3.2. Baseline Results*

Under the Baseline EU grains prices are expected to decline over the projection period. With the exception of the durum wheat price, which is expected to fall by 28% to 104 €\ton in 2010, the declines in grain prices that are projected under the Baseline follow the price spikes observed in 2002. Soft wheat, barley and maize prices are projected to decrease by 7%, 9% and 9% respectively over the period to 2010.

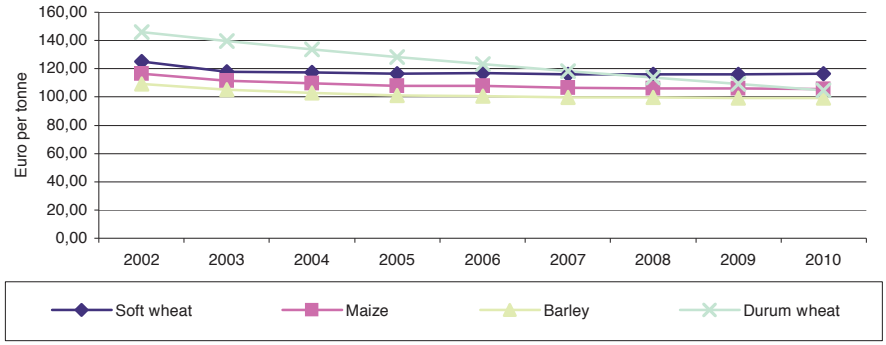


**Figure 1.** Grain Prices

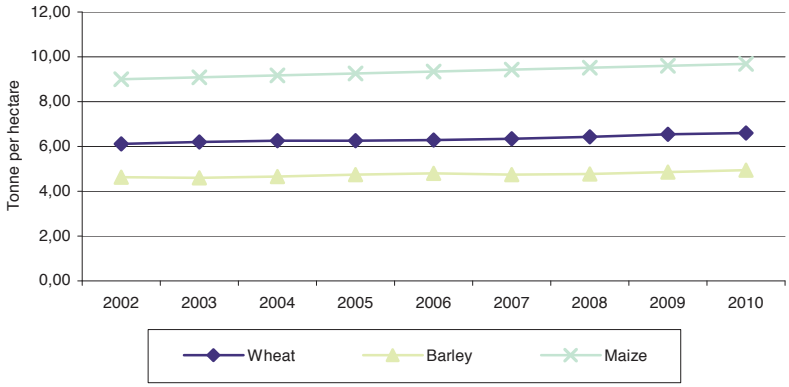


**Figure 2.** Grains yields per hectare

With EU grains prices projected to decline over the period 2002-2010 and arable aid payments fixed at levels agreed under Agenda 2000, total EU-15 grains area is projected to marginally decrease to approximately 31 million hectares by 2010. Within the cereals sector the EU barley area is projected to decrease by 4%, other crops area is projected to increase slightly over the projection period with wheat area increasing by less than 1% and maize increasing by 1.5%.

Under the Baseline yields per hectare of wheat, barley and maize are projected to increase by 8%, 6% and 7% respectively by 2010. The combination of developments in grains' areas harvested and yields leads to increases in EU production of grain. Production of wheat, barley and maize are projected to increase by 6% under the Baseline. The large majority of this increase is accounted for by projected growth in EU soft wheat production.

On the demand side, the domestic use, under the Baseline, is projected to increase by 3% over the projection period to over 181 million tonnes by 2010. The majority of this increase in

domestic use of grains is due to increased wheat domestic use, which accounts for more than 90% of the increase in total grains domestic use.

The projected changes in EU grain production and domestic use are not expected to lead to changes in the status of the EU as a net exporter of wheat and barley. Under the Baseline net exports of these commodities are projected to increase. EU net imports of maize are projected to decline under the Baseline.

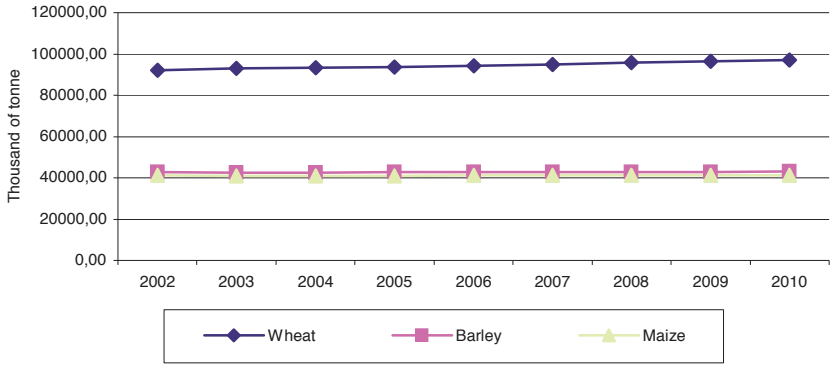


**Figure 3.** Grains total domestic uses

Under the Baseline total oilseeds area harvested is projected to increase by 3% over the projection period. Though total oilseeds area increases, at the level of individual oilseed cultures the results are more diverse. Sunflower seed area harvested is, under the Baseline, projected to decline by 11% over the projection period, by contrast both rapeseed and soybean areas harvested are projected to increase by 5% and 41% respectively.

With Baseline EU rapeseed, soybean and sunflower seed yields per hectare projected to increase by 19%, 16% and 8% respectively, total EU oilseeds production is projected to increase to over 20 million tonnes by 2010. This increase in production amounts to an increase of 23% over the projection period.

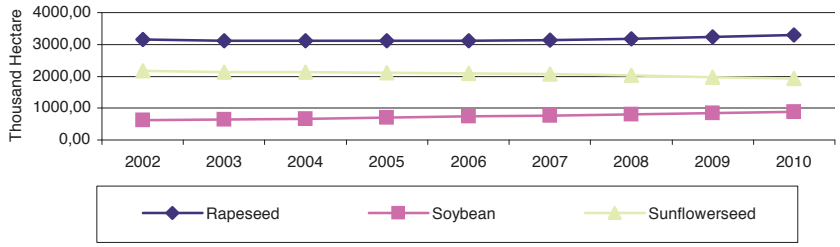


**Figure 4**. Oilseeds area harvested

Crush demand for oilseeds represents the main component of oilseeds domestic use. Under the Baseline crush demand for oilseeds is projected to increase by 12%. As a direct consequence of increased crushing of oilseeds, EU production of oilseed meals and oils is projected to increase by 11% and 15% respectively. The Baseline projections for the EU net-trade status in oilseeds are for the EU to remain a net exporter of rapeseed and a net importer of soybean and sunflower seed.

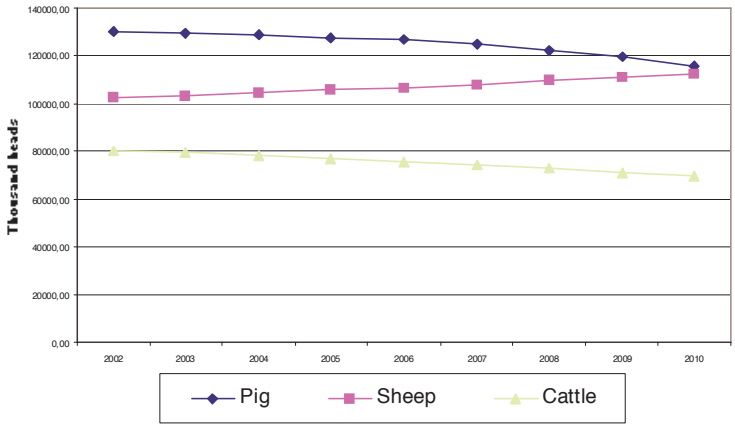


**Figure 5.** Livestock inventories

Under the Baseline EU livestock supply is projected to be characterized by a drop in cattle and pigs inventories (13% and 11%), while sheep ending stocks are projected to increase by 10% over the period to 2010.

Under a continuation of Agenda 2000 agricultural policy the EU cattle price is expected to decline by 8% to 256 Euro per 100 kg by 2010. The EU pig meat price is projected to increase by 4% over the period considered, the poultry meat price is projected to decrease by 27%, while the EU sheep meat price is expected to decrease by 4% by 2010.

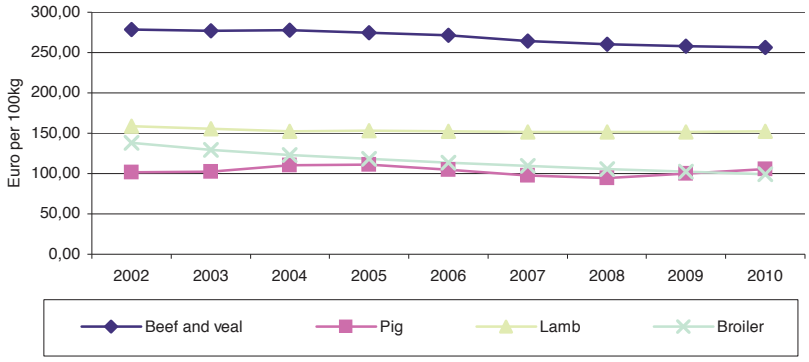


**Figure 6.** Meat prices

With the projected price developments, as presented in Figure 6, and the continuing link between production and direct payments in the EU livestock sector, EU pig meat production is projected to increase by 6% over the period to 2010, while EU domestic consumption is projected to increase by 8%. EU Lamb meat production is projected to remain relatively constant over the projection period while lamb meat consumption, under the Baseline, is expected to increase by 7%. Due largely to heavier slaughter weights, EU beef and veal production is projected to increase by 1% under the Baseline, while total domestic consumption should increase by 2%. Finally, Baseline EU poultry production is expected to increase by 6% over the projection period, and EU poultry domestic use increases by 14%.

Under the Baseline of continued Agenda 2000 policy the EU dairy sector is projected to be characterised by reductions in the milk price reflecting the decreases in the intervention prices of dairy commodities that were agreed as part of Agenda 2000. Butter and skim milk powder prices are projected to decrease by 18% and 11% respectively, while cheese price is projected to increase by 2% over the period considered. Table 1 presents details of the EU price for the key dairy commodities for the period 2002 to 2010.

**Table 1.** Dairy products, prices in euro per tonne

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|
| Butter | 317 | 318 | 318 | 303 | 289 | 274 | 274 | 274 | 274 |
| Cheese | 460 | 461 | 464 | 465 | 467 | 466 | 468 | 470 | 471 |
| SMP | 204 | 200 | 199 | 194 | 189 | 184 | 182 | 181 | 181 |

Source: AG-MEMOD Composite Model 2004.

Ending numbers of dairy cows in the EU are projected to decline by 6% to approximately 20 million head by 2010. This reduction in dairy cow numbers, given developments projected for per cow yields of milk, translates into a marginal 0.1% decrease in milk production. Cheese production is projected under the Baseline to increase by 4% while butter production is expected to decline by 2%. These developments on the supply side are projected to occur in tandem with a 10% rise in cheese domestic use and a 1% increase for butter domestic use over the period considered. Finally, skim milk powder production is projected to decrease by 17% while EU domestic use of SMP is expected to decline by 24%.

## *4. CAP reform Scenario- the effects of the Luxembourg Agreement*

### *4.1. Description of CAP reforms in the Luxembourg Agreement*

The policy reforms examined are those contained in the Presidency compromise document (Council of the European Union, 2003). The macroeconomic environment under the Luxembourg Agreement scenario is the same as that pertaining under the Baseline.

Under the Luxembourg Agreement and the negotiations that have followed, a very wide set of possible implementation scenarios can be envisaged. What is examined here, however, is the most extreme implementation scenario allowed under the Luxembourg Agreement, i.e. all direct payments under the Agenda 2000 Common Agricultural Policy (CAP) are fully decoupled at the earliest possible date. At the time of writing the exact implementation plans of all Member States are not known. Some Member State choices, vis-à-vis the implementation of the Luxembourg Agreement, have been notified to the European Commission. In some instances these plans deviate significantly from the maximum decoupling scenario analysed here. The analysis presented below serves primarily to illustrate the analytical capacity of the AG-MEMOD model.

The Luxembourg Agreement changes the CAP as it applies to livestock, cereals and oilseeds and dairy sector. Under the Luxembourg Agreement scenario analysed here all direct payments are decoupled from production from January 2005. In the beef sector the suckler cow, special beef, and slaughter premiums are all decoupled from production. In the sheep sector the ewe premium is fully decoupled. In the cereals and oilseeds regime arable aid payments are decoupled from production. In the dairy sector a reduction in the butter intervention price of 10% will take place, this is in addition to the intervention price reductions agreed under Agenda 2000. These intervention price reductions are also brought forward to the 2004/05 production year. The dairy compensation premiums agreed under Agenda 2000 are also further augmented to compensate for the reduction in the intervention price for butter. These compensation payments from 2005 are fully decoupled from production. The milk quota regime, under the Luxembourg Agreement, is to continue until 2014/15.

In this policy reform simulation with the AG-MEMOD composite model the impacts of the introduction of the single farm payment are captured by reducing the supply inducing effect of payments to 30 per cent of their level under the Baseline. Thus, in the analysis presented below, the "decoupled" payments retain some of their production inducing effect. This assumption firstly reflects the fact that payments are still tied to land, i.e. farmers must remain farmers, and secondly reflects the likelihood that the receipt of the single farm payment will, by reducing the income variability of farmers, influence their production behaviour, with regard to risk for example. Hennessy (1998) presents the theoretical basis for this latter argument concerning the impact of decoupled income payments on producer decisions in a world characterised by the presence of risk. Adams et al. (2001) present empirical evidence on the degree to which decoupled payments in the US affected producer decisions. No attempt has been made to incorporate the cross-compliance or modulation elements of the Luxembourg Agreement.

### *4.2. Results from simulating the Luxembourg reform scenario*

In this section we present the results obtained when the Luxembourg Agreement scenario, described above, is simulated using the AG-MEMOD Composite Model. With the decoupling of direct payments from production leading to lower returns to both cereal and oilseed production, it is expected that relative to the Baseline EU cereal and oilseed areas harvested and total cereal and oilseed production will decline.

As is shown in Figure 7, relative to the Baseline, total EU-15 cereals area harvested is projected to decline by approximately 2%, while total oilseed area declines by approximately 6%.

Within the total cereals area harvested, soft wheat area declines by approximately 2%, relative to the Baseline, with maize area harvested declining by 4% and barley area harvested declining by approximately 1%.

The impact on production of the decline in cereal and oilseeds harvested area is partially offset by higher average per hectare productivity. In general average crop yields increase as a result of the decoupling of arable aid payments- yields for barley, maize and durum wheat remain constant over the simulation period.

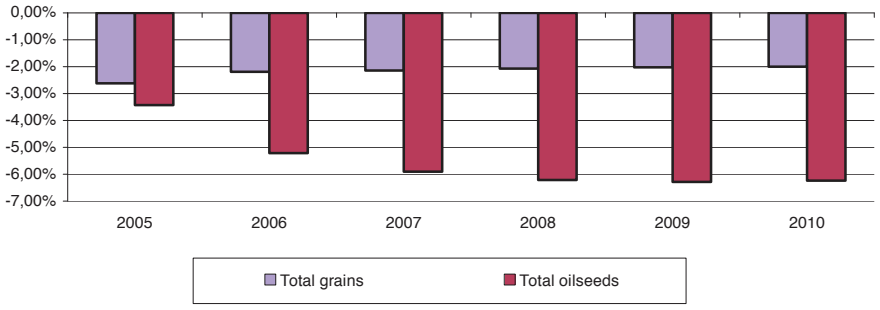


**Figure 7.** Harvested area, changes from the Baseline Scenario (%)

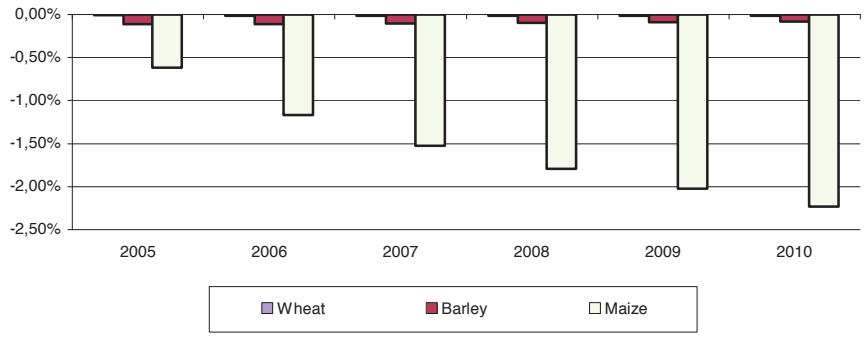


**Figure 8.** Harvested area, changes from the Baseline Scenario (%)

While the decoupling of arable aid payments from production affects the indigenous EU production of cereals and oilseeds, the impact of the policy reform on domestic use of crops and oilseeds is projected to be minor due to the relatively small impact of the reform analysed on cereals and oilseed prices. Under the scenario analysed EU maize prices are projected to increase by approximately 1.6%, while wheat and barley prices are projected to be largely unchanged, relative to the Baseline.

Despite the reduction in EU production of cereals and oilseeds that occurs as result of decoupling, the net trade status of the EU in respect to all of the cereals and oilseed commodities modelled is not projected to change. EU net exports of wheat, barley and rapeseed remain positive, and the EU remains a net importer of maize, soybean and sunflower seed over the period to 2010.

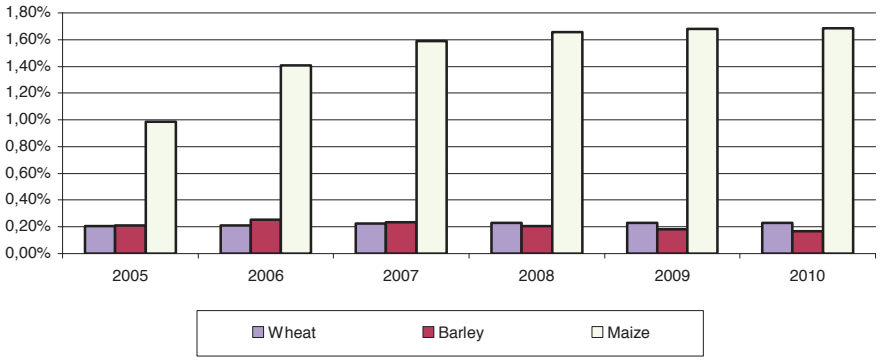


**Figure 9.** Cereals prices, changes from the Baseline Scenario (%)

When compared with projections under the Baseline scenario, for those cultures for which the EU under the Baseline is a net exporter (soft wheat and barley) the level of net exports decline under the Luxembourg Reform scenario, for those cultures for which the EU is a net importer under the Baseline (maize, sunflower seeds) net imports increase.

Under the Luxembourg Agreement Scenario analysed all direct payments associated with the beef (suckler cow, special beef and slaughter premiums) and the sheep and goat (ewe premium) commodity market organisations are decoupled from production. The decoupling of these direct payments from production is expected to lead to reductions in the number of breeding animals (suckler cows and ewes) held that ultimately determine the indigenous EU production of beef and lamb. The impact of the reform on the poultry and pig meat sectors is expected to be relatively minor with any changes that are projected to occur arising from cross price effects of the reforms of the beef and lamb commodity market organisations.

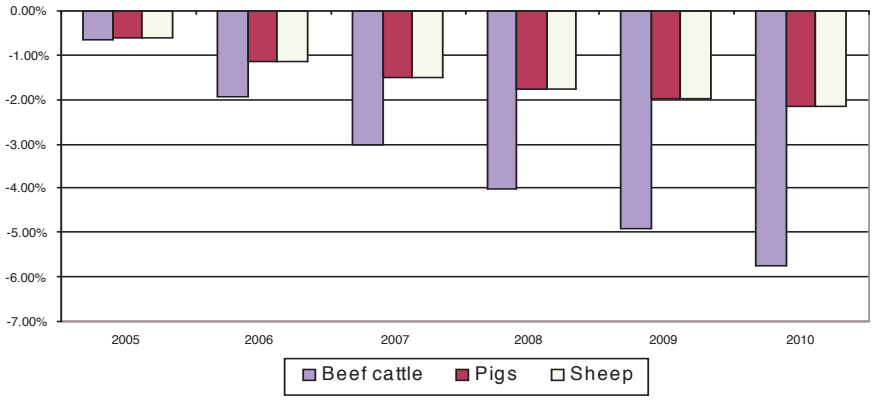


**Figure 10.** Ending inventories, changes from the Baseline Scenario (%)

The projected changes in ending inventories of animals are shown in Figure 10, these changes relative to the Baseline are also reflected in changes in the production of meat associated with these animals. Production of both beef and lamb is projected to decline relative to the Baseline, with beef production declining by almost 5%, while lamb production declines by approximately 4%. Both poultry and pig meat production are projected to be relatively unchanged relative to the Baseline level.

Reductions in the indigenous production of beef and lamb are projected to lead to increases in EU meat prices. The projected changes in EU meat prices are marginal for lamb, pig meat and broiler meat, while beef and veal prices are projected to increase by over 6% relative to the Baseline level.

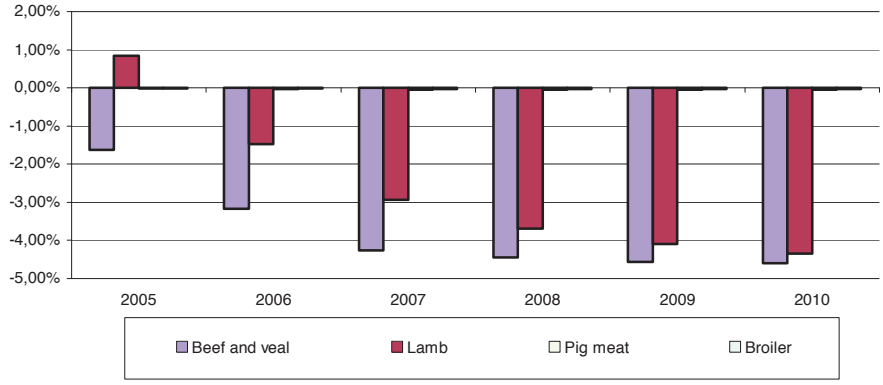


**Figure 11.** Meat production, changes from the Baseline Scenario (%)

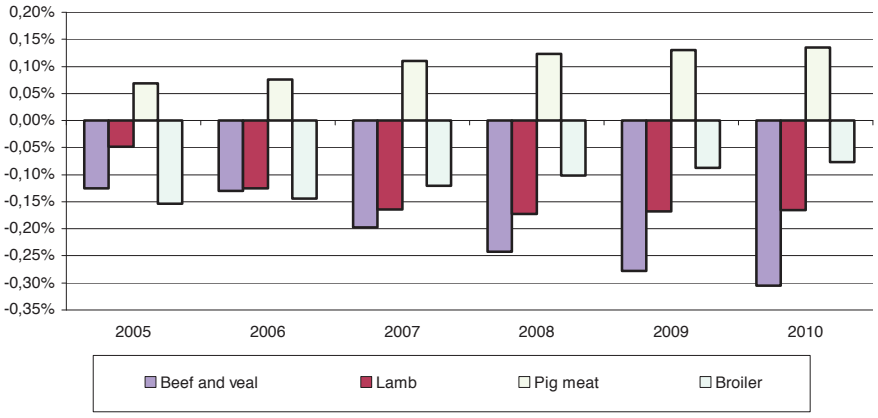


**Figure 12.** Meat consumption, changes from the Baseline Scenario (%)

The changes in prices of meat that are projected under the Luxembourg Agreement Scenario lead to changes in EU meat consumption. Under the Luxembourg Agreement Scenario, the relative changes in the prices of the different meats lead, when compared with the Baseline levels, to reductions in EU consumption of beef and veal, lamb and broiler meat, while EU pig meat consumption is projected to increase.

With EU production of beef and lamb declining relative to the Baseline, EU imports of both beef and lamb increase in response to increased internal prices. With EU exports of beef declining and imports increasing, EU net exports of beef decline dramatically relative to the

Baseline levels. In 2010, under the Baseline, the EU was a net importer of approximately 50 thousand tonnes of beef, by 2010 under the Luxembourg Agreement scenario, EU net imports increase to almost 380 thousand tonnes. EU net imports of lamb also increase to approximately 45 thousand tonnes, an increase of 13% relative to the Baseline level.

Under the Luxembourg Agreement Scenario butter intervention prices are reduced by 10%. The reductions in dairy commodity intervention prices agreed under Agenda 2000 are also brought forward to the 2004/05 production year, while the dairy compensation agreed under Agenda 2000 and the Luxembourg Agreement is decoupled from 2005 onwards. Importantly, as under the Baseline, the EU milk quota system remains in place. The continuation of the milk quota system means that EU milk production remains largely unchanged when compared with the Baseline. The reduction in the intervention price for butter leads to changes in supply and uses, and prices of dairy commodities.

Relative to the Baseline of no change in EU agricultural policy, the EU market price of butter declines by over 10% due to the reduction in the intervention price of butter, this leads to a 3% decline in butter production. With milk production largely unchanged relative to the Baseline, the reduction in the production of butter leads to a reallocation of milk fat, which is largely reflected in increased production of other dairy products. EU cheese production remains largely unchanged when compared with the Baseline. Overall the impact on dairy commodity supply of the reform scenario analysed is relatively minor.

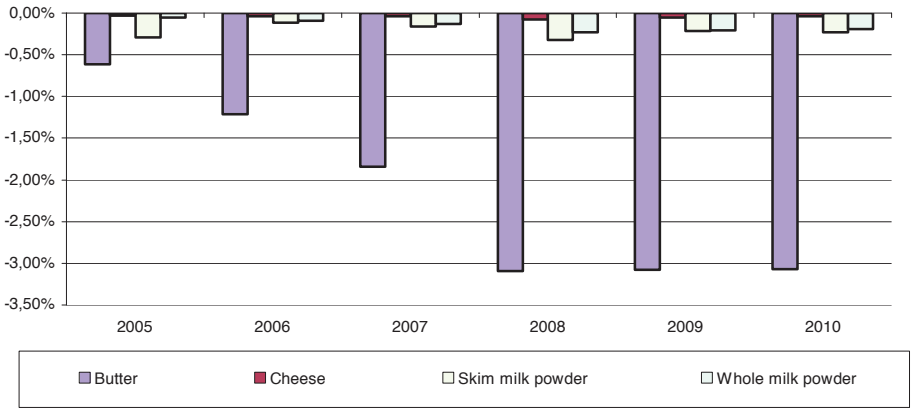


**Figure 13.** Production of dairy commodities, changes from the baseline scenario (%)

On the demand side the large reduction in butter prices leads to a small increase in EU domestic use of butter when compared with the Baseline level. EU domestic use of other dairy commodities remains largely unchanged. As is clear from Figure 13, the largest changes under the scenario occur in the EU butter market. These are reflected in changes in the EU net trade position in butter.

Under the Baseline the EU is a net exporter of butter, with net exports in 2010 projected to run at just under 5 thousand tonnes; under the Luxembourg Agreement Scenario with declining EU production of butter and marginally increased domestic use, the EU becomes a net importer of butter. By 2010, under the scenario, EU net imports of butter are projected to run at almost 54 thousand tonnes. Net exports of other dairy commodities also decline relative to the Baseline, though the changes relative to the Baseline that are projected under the scenario are not as dramatic as those that are projected to arise in the butter market. Under the Luxembourg Agreement scenario the EU is projected to remain a net exporter of cheese, skimmed and whole milk powder.

## *5. Conclusion*

The Luxembourg Agreement reform of the CAP represents a major change in EU agricultural policy. Using results from simulations of the AG-MEMOD composite model, an econometric, dynamic, multi-product, partial equilibrium commodity model, this paper has presented detailed medium-term prospects for EU agricultural markets under a scenario where the most extreme implementation plan allowed for under the Luxembourg Agreement occurs.

Under the reform scenario simulated direct payments in the grains and oilseeds, cattle and beef, and sheep commodity market organisations are fully decoupled. Intervention price reductions for butter agreed as part of the Luxembourg Agreement reform are also considered. The impact of the Luxembourg Agreement reform scenario is measured against a Baseline of a continuation of Agenda 2000 EU agricultural policy. In both the Baseline and reform scenarios exogenous world prices are those generated using the May 2003 FAPRI-Ireland modelling system projections.

Our results indicate that, relative to a Baseline of no policy change, the CAP reform scenario analysed causes area harvested and production of the main EU cereals crops to decline by an average of less than 2%. Barley area harvested declines by the greatest extent, with area harvested projected to decline by over 4%. The impact of the decoupling of direct payments from animal production is greater than in the arable sector. With the decoupling of direct payments from animal production, our results indicate for example that EU suckler cow ending inventories would decline by over 5% by 2010 relative to their Baseline level, while EU ewe inventories are projected to decline by approximately 4%. Lamb and beef production declines in line with the declines in inventories of breeding animals. Under the scenario the EU becomes a significant net importer of beef, this represents a significant change from the Baseline position where the EU is only a marginal net importer of beef.

The medium-term prospects for EU agricultural markets as represented by the Baseline and the Luxembourg Agreement Scenario results are based on a number of assumptions – in particular in the current AG-MEMOD composite model's Baseline the accession of the EU–10 group on the 1st of May is not incorporated. In this respect the results presented in this paper are subject to some uncertainties that could have major implications for EU markets.

Models of agricultural markets in the new member states have been constructed (Erjavec and Donnellan, 2004) with funding from the EU Commission. Future research will seek to incorporate models of agricultural markets for all members of the newly expanded EU in the composite AG-MEMOD model.

As noted earlier an important assumption underlying the analysis with the composite AG-MEMOD model that is presented in this paper was an assumption that the European Union's external trade regime will remain unchanged over the projection period. The ongoing Doha Round of the WTO, if successful, could lead to significant change in the EU external trade regime, internal EU agricultural policy, and in the balance of international agricultural commodity markets. Future work with the AG-MEMOD composite model will seek to develop the capacity of the composite model to evaluate the consequences of changes in the external trade regime of the EU.

## *Acknowledgements*

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## *Appendix*

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