A Tool to Analyse the Impact of Policy Changeson the Agri-Food Sector of Finland

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Abstract

An econometric model for Finnish agriculture is built as a part of the AGMEMOD project, a joint endeavour by several European research institutes. The AG-MEMOD modelling framework provides a unified approach to the specification, estimation, and simulation of the national-level commodity markets. The projection and policy simulations presented in this paper demonstrate that the Finnish country model is able to catch the essentials of the behavioural relationships underlying the specialised nature of each commodity market. Furthermore, the model is well adapted for inclusion into a framework of multi-country model of the whole EU.

Key words: econometric models, Finland, commodity markets, policy analysis.

1. Introduction

Through the last decades, the use of economic models in relation to agricultural policy issues has increased substantially, and a huge literature exists on these issues (see Heckelei et al., 2001). Economic models serve as a means for better understanding the structure and parameters of the behavioural relationships underlying agricultural commodity markets. At the same time, models can be employed to generate quantitative forecasts to evaluate the effects of alternative decisions or strategies under the direct control of policy makers. A number of different modelling approaches have been applied, including computable general equilibrium (CGE) models, partial (agriculture-focused) models based on mathematical programming, econometric estimations or calibrated behavioural parameters, and commodity-specific models focusing on only subset of agricultural commodities.

This paper presents a multi-commodity model for the Finnish agricultural sector developed within the AG-MEMOD modelling framework, a joint endeavour by several European research institutes. The objective of the AGMEMOD project is to build and validate an econometric model of the whole EU agricultural sector for projection and policy simulation purposes. The building blocks of the AGMEMOD model are the national policy models. Each national model has to reflect the specific problems and characteristics of that particular country. Compatibility and performance of the country models is promoted by the common guidelines for model building in the AG-MEMOD partnership (Donnellan et al., 2001), which covers model validation with in-sample and post-sample performance of the models and their response to shocks.

The specific aim of the Finnish modelling project is to build the country model on a common format so that it, and its commodity sub-models, would link-up to provide an integrated model for the whole EU. Econometric sub-models are constructed for main agricultural commodities produced in Finland. The responsiveness of the model to policy changes is demonstrated by comparing the results of different policy scenarios with that of the baseline scenario. The policy scenario examined in this paper is the CAP reform approved at the EU Agricultural Council in Luxembourg in September 2003 (Council of the European Union, 2003). The most significant element in the 2003 CAP reform is the decoupling of most of the EU payments to arable crops and livestock from the production, combining these into a Single Farm Payment scheme.

The paper is divided into 4 major sections. The structure of the Finnish AGMEMOD model is explained in section 2. This includes the links of the Finnish model to other countries in the EU combined model, a structural description of the commodity sub-models and a short introduction to the Economic Accounts of Agriculture. Section 3 features the baseline scenario in the form of commodity balance sheets for the major products and projections up to 2010. The CAP 2003 reform scenario is also presented and its effects are revealed by comparing the long term results of those of the baseline scenario. In addition, section 3 contains the impacts of the CAP reform on agricultural income. Finally, the analytical capability of the modelling system is broadly outlined, and conclusions are drawn in section 4.

2. The structure of the Finnish model

2.1 Overall structure

The Finnish AG-MEMOD model is an econometric, recursive dynamic, multi-product partial equilibrium commodity model. The specification of the model is inspired by the structure in Westhoff's (2001) EU GOLD (Grains, Oilseeds, Livestock and Dairy) model, which comprises separate models for the individual commodities. The commodities are linked together through cross-price effects in supply and demand equations and the price transmission equations that link domestic prices with international price. The commodity models describe acreage, animal stocks, yield levels, production, commodity stock building, food and feed demand, processing demand, imports and exports. Individual crop sector models are linked through the allocation of land, and crop and livestock sectors are linked through the use of feeds.

The range of commodities in the Finnish AG-MEMOD model spans soft wheat, barley, oats, rapeseed, vegetable oils and oil-based fodder meals, potatoes, sugar, beef, pork, poultry and dairy commodities (fluid milk, butter, cheese, skimmed milk powder and whole milk powder). The products contained in the model cover 58 percent of all agricultural land in Finland. There are some GOLD commodities which are not covered in the Finnish model due to climatic reasons or the insignificance of the particular products in the Finnish agriculture. Maize, albeit an essential crop elsewhere in Central Europe, cannot be produced in Finland due to the climatic conditions, nor is it imported in large amounts, therefore it is not included to the country model. Soft wheat is the only wheat variety in Finland. Imports of durum wheat, which have been small, are included in the imports of soft wheat. On the other hand, oats is included in the Finnish model, even though it is not a GOLD commodity (Jansik, Kettunen & Niemi, 2003).

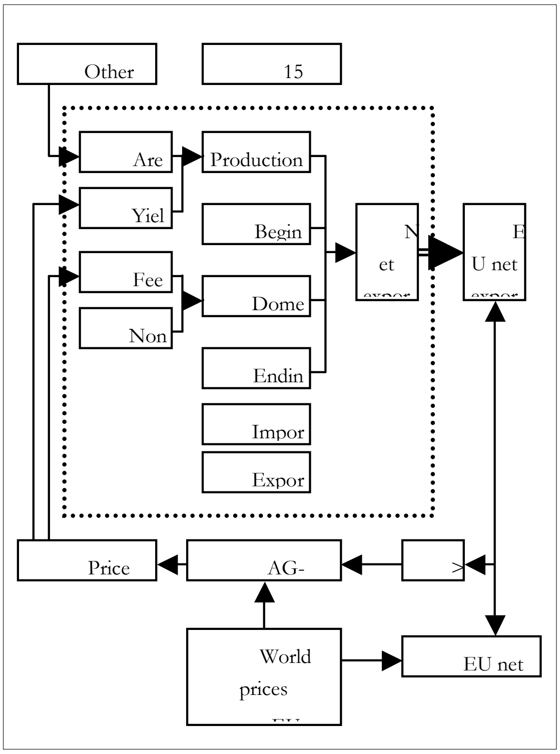

Figure 1. **AG-MEMOD Model Structure. Source: Chantreuil (2002)**

Commodity models are composed of a number of components which reflect various aspects of demand, supply and price determination. Modelling of commodity markets entails integrating all of the above components into the overall market of industry structure. Figure 1 presents the general outline of a grain model, but it applies to all other products, if the production module is replaced by an appropriate supply module. For poultry supply is a simple production function whereas production module for milk and milk products is rather complicated as presented later on. Most equations are linear. Only consumption functions of the Finnish model are nonlinear (half logarithmic).

Determination of the key prices is the core of the whole model system. Given the world prices of commodities and the policy measures of the EU like intervention prices and WTO requirements the net export supply and the net export demand determine the equilibrium key price for each year. National prices are thereafter derived via price linkage equations. Country models are basically recursive by nature.

An essential requirement for the commodity submodels is that they have to close for each year. The sum of production, domestic utilisation, beginning and ending stocks, imports and exports has to be equal to zero i.e. one of the six components has to be a residual. A common rule was applied for all country models: the closing variable is the greater one of imports or exports. Since Finland is mostly exporting country of agricultural products, the closing variable is exports. The imports are determined by a equation of various factors and exports are then determined as an identity.

The nature of the economic relationships in the model are based, in so far as is practicable, on time series econometric estimates of these relationships. The structural equations of the commodity models are generally estimated as single equations using ordinary least squares (OLS). In order to link successfully all countries, national models had to be consistent with the economic theory. Therefore, econometrically estimated models may not always applied as such, since all estimated parameter values hardly fullfill all theoretical requirements. Theory and expert judgment is used in the verification of the projections generated by the model. The behavioural responses of consumers and producers are kept consistent with microeconomic theory (Donnellan et al., 2002).

2.2. Explanatory variables

Most of the expalanatory variables (in particular prices) are endogenous, determined by the model. The growth rate of the GDP as well the GDP deflator and the growth rate of population are exogenous. Exchange rates are also exogenous. Costs are represented by cost indices. The cost index for the crops is assumed to follow the GDP deflator. In animal production feed costs obviously depend on the grain prices, but other input prices depend on the factors outside the agriculture. Therefore, for each animal product a cost index is defined which depends on the prices of various grains and protein crops (barley, oats and rape seed in Finland) and the GDP deflator. The consumer price index is assumed to be the same as the GDP deflator in demand equations.

2.3. Commodity models

The following description includes the structure and causal relations within the major commodity sub-models. Since the model is relatively large, only an overall presentation is possible in this paper. As to the mnemonics, each variable consists of a two letter variable name, three letter activity or price name and national code (see appendix 1). Details of the model are available from the authors.

Price linkage. National models are linked together by key prices which are determined by the whole model and given international prices. In the beginning of the AG-MEMOD model a study was carried out in order to figure out which is the most influencing price for each product. Obviously, the dependence of prices is a complex matter and a compromises have to be made in selecting key prices. The list of the key prices is as follows:

Product	Key price country	Product	Key price country
wheat	France	pork	Germany
barley	France	cheese	France
rape seed	Germany	butter	Germany
potatoes	Netherlands	milk powder	Netherlands
beef and veal	Germany		

Sugar beet price is derived from the intervention price for sugar. Milk price is determined as a function of cheese and butter (and milk powders in some countries).

As an example, the linkage for soft wheat price for Finland is as follows:

$$WSPFHFI = \beta 0 + \beta 1\ WSPFHFR + \beta 2\ WSSSRFI + \beta 3\ WSSSRFR$$

where βi:s are parameters and

WSPFHFI and WSPFHFR are prices of soft wheat in Finland and France, and
WSSSRFI and WSSSRFR are the self-suffiences of soft wheat in Finland and France.

Self-sufficinces depict the market situation in respective countries. Excess supply tends to press the price in the domestic market. There were difficulties in application of the basic model and the only explanatory variable in the Finnish model is the key price.

Supply of grains. The grain sub-model starts with the estimation of the grain price linkage equations. Thereafter the total grain area, that is the sum of the three crops' harvested area, is determined. Grain area plus set-aside area is assumed to be constant. The set-aside area is a residual after the grain area is determined.

The grain price equations are estimated using the French reference prices. As no key prices were given for oats the French barley price were used to model the Finnish oats price.

WSPFMFI = f(WSPFHFR)
BAPFMFI = f(BAPFHFR)
OAPFMFI = f(BAPFHFR)

Gross returns are used to indicate the incentive price of each grain crop. Three year weighted moving averages of reference prices are calculated, which are then multiplied with the respective trend yield.

WSEGMFI = WSPF3FI*WSYHTFI

The area is determined as the total grain area, that is the sum of the three crops' harvested area. Costs are represented by the GDP price index. The ratio of the gross return and GDP deflator (G3EGRFI) is included as an explanatory variable in the area function. Other variables are the set-aside ratio and the rape seed area plus linear trend.

G3AHAFI = f(G3EGRFI, GRSARFI, RSAHAFI, TREND70)

The share of the barley area is a function of gross returns and set-aside ratio.

BAASHFI = f(BAEGMFI/G3EGMFI, GRSARE5)

The areas of barley and oats are calculated as the product of the share and three grain area, and the area of wheat as a residual.

BAAHAFI = G3AHAFI * BAASHFI

The yield per hectare is determined as a function of the trend yield, 5-year average producer price, area of the product and the total area.

WSYHAFI = f(WSYHTFI, WSPF5FI, WSAHAFI, ALAHAFI)

The total production is the product of harvested area and yield per hectare.

WSSPRFI = WSAHAFI*WSYHAFI

Consumption, stocks and foreign trade. Equations for consumption, beginning and ending stocks, and imports and exports are basically the same for all variables. Therefore, only the equations for wheat are presented in the following.

Consumption is calculated differently for wheat and for the other two grains. The primary part of wheat demand is the per capita human consumption, which depends on real wheat price and real GDP.

WSUFCFI = f(WSPFI, RGDPCFI).

The total human consumption is the product of the per capita consumption and the population.

WSUFTFI = WSUFCFI*POPFI

The total domestic use is equal to human consumption plus feed demand results:

WSUDCFI = WSUFTFI + WSUFEFI

In the case of barley and oats, the primary form of utilisation is feed use, which depends on real crop prices and feed demand indices. The latter ones are function of the production of livestock products, i.e. beef and veal, pork and milk.

WSFINFI = f(MKSPRFI, BVSPRFI, PKSPRFI)

Wheat feed use is a function of the feed use index and real prices of crops:

WSUFEFI = f(WSFINFI, WSPFRFI, BAPFRFI, OAPFRFI, RLPFRFI, PTPFRFI, STPFRFI, TREND70)

Non-feed use, or other industrial use, is estimated by using real prices and real GDP for both barley and oats.

WSUFOFI = f(WSPFRFI, RGDPCFI)

Ending stocks for all three grain products depend on beginning stocks, production, real prices and intervention prices. Intervention is assumed to be effective a little (five per cent) before the price falls to the intervention level. The data is still too short to reveal this relationship, even though the phenomenon is evident.

WSCCTFI = f(WSCCTFI (-1), WSSPRFI, WSPFRFI, max(0, (1 – [WSPFMFI/1.05* WSPINE5])), TREND70)

Imports are estimated by using a balance of production stocks and domestic use and real prices.

WSSMTFI = f((WSSPRFI + WSCCTFI (-1) – WSUDCFI), WSPFRFI, TREND70)

Exports are, then, calculated as a residual item.

WSUXTFI = WSSPRFI + WSSMTFI + WSCCTFI (-1) – WSUDCFI – WSCCTFI

Finally, net exports are

WSUXNFI = WSSPRFI + WSCCTFI (-1) – WSUDCFI – WSCCTFI

The structure of barley and oats models is equivalent with the structure of wheat above with exception that there is no intervention for oats.

Rapeseed. The area and yield of rapeseed is estimated by using the same structure as in the case of grains. Rapeseed area harvested depends on the expected real gross returns of three grains and rapeseed, and the set aside rate. The domestic production plus the imported rapeseed is crushed and processed into meal and oil. Constant crushing rate is used, 40 percent is processed into oil and the rest into meal.

Rape meal feed use is a function of feed demand index (determined by livestock production) and the real prices of all crop products. Rape oil demand is 40 percent of total rapeseed supply in the Finnish model. The imports of rapeseed, meal and oil are calculated by using the respective prices of products, while rape meal and oil exports are residual items. Rapeseed export is set to zero, as it is assumed that the entire rapeseed supply, i.e. production plus import is processed domestically.

Beef and veal. As for beef and veal production, the Finnish country model follows the structure of the GOLD model (Figure 2). The ending stocks of beef and dairy cows is determined first as a function of the beginning stock and the cattle price. It serves as a basis for the calf crop, of which the renewal of beef and dairy cows and the slaughter of small calves is determined. The rest is raised for full grown animals for slaughter. The total beef prodction consists of slaughter of small calves, suckler and dairy cows and full grown calves. The rest of the beef and veal model consists of beginning and endings stocks, imports and exports as in other product models.

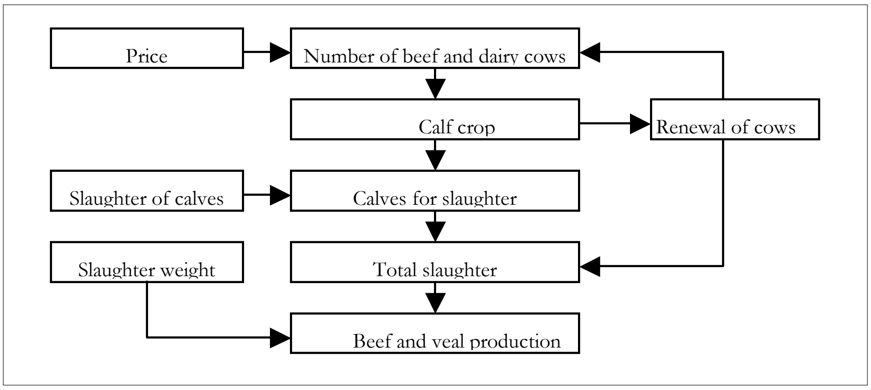

Figure 2. Supply of beef and veal

Pork, poultry and lamb meat. The ratio of the price and the input cost index is used for the estimation of ending sow numbers. Pig crop is a function of piglets per sow and a weighted ending sow numbers of the two previous years. Pig slaughter weight is estimated by the ratio of sow slaughter and total pig slaughter and the ratio of pork price and pig input cost index. Pork production is equal to the product of pig slaughter weight and total number of slaughtered pigs.

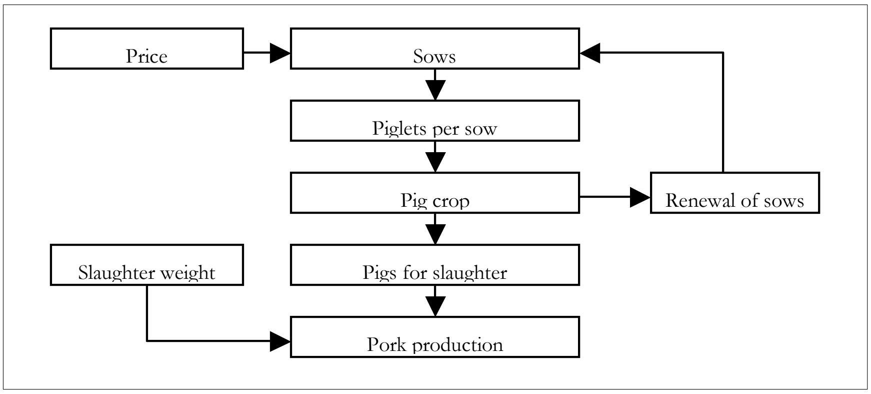

Figure 3. Supply of pork

The ratio of the price and the broiler input cost index is directly used for the estimation of broiler meat production, which additionally depends on lagged production. Sheep and lamb production is represented at a constant level using the 2001 true figures, because of its minor role in Finland.

Milk and dairy products. The dairy sub-model begins with the estimations of prices of butter and cheese (key price of butter from Germany and key price of emmental cheese from France) and subsequently the price of milk, and then the dairy input cost index. Milk production per cow, i.e. productivity, is a function of milk quota and the ratio of milk price and dairy cost index. Dairy cow stocks are based on the ratio of milk quota and milk production per cow, the ratio of milk price and dairy cost index and the ratio of lagged milk price and dairy cost index.

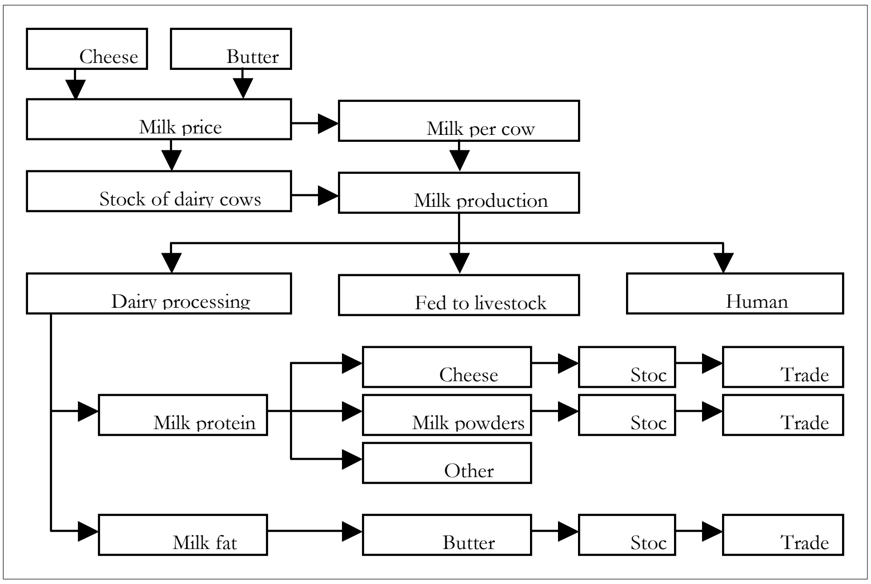

Figure 4. Structure of the dairy sector

Milk production is the product of dairy cows and milk production per cow. As for milk use, per-capita fluid milk consumption is estimated by using real milk prices and real GDP and then total fluid milk human use is obtained by multiplying the per-capita estimate by the population figure. Fluid milk feed use is estimated based on dairy cows stocks and fluid milk factory use is derived as a residual.

Fluid milk factory use is the milk available for processing. The protein is allocated to cheese, WMP and fresh products, based on price ratios. The rest of the available protein is finally allocated to skim milk powder. Milk fat is needed for fluid milk, cheese, whole milk powder and other fresh product. Rest of the milk fat is used for butter. Ending and beginning stocks as well as foreign trade modules are constructed as for other products.

2.4. Estimation of parameter values

The fact that Finland joined the European Union in 1995 makes econometric estimations extremely difficult in all cases. The price linkage can be estimated only on the basis of EU membership period, because no direct relationship prevailed between the EU key prices and the Finnish prices before 1995. Upon accession, agricultural and food prices immediately witnessed a rapid decline, and prices have followed EU prices from then on. Similarly, trade and stock relations could be estimated only based on the EU membership years, since agricultural trade was strictly regulated by the state in the pre-accession period. As trade was liberalised in 1995, trade trends of the late 1990s should be handled with utmost care and caution, and their simple linear extrapolation to the next decade ought to be avoided. Various time periods were used for the estimations of the parameters of the demand and supply equations due to the changes in the prices and support systems when Finland joined the EU.

OLS method was applied for the estimation for single equations, even though simultaneus estimation methods would have been better in several cases. In addition, some estimates of parameters were adjusted to make the supply consistent with the actual data.

Various sensitivity tests were applied to check the applicability of the model. The elasticities are relatively small and shocks did not generate any projections which would not be acceptable. The model is not too sensitive even for big changes in values of variables.

3. Model simulation: The effects of the Luxembourg Agreement

3.1. 'Business as usual' baseline scenario

The baseline scenario, which was applied to assess the suitability of the model for policy purposes, corresponds to the continuation of the Agenda 2000 agricultural policy (agreed in Berlin 1999) over the medium term. The baseline simulation is a view of the world where policies remain unchanged. However, it is important to remember that the baseline scenario includes the reductions in intervention support prices and future increases in quota that were already politically agreed in Berlin 1999. The impact of EU enlargement has not been incorporated into the baseline.

Table 1. Main prices for the baseline scenario, (€/100 kg).

	2003	2004	2005	2006	2007	2008	2009	2010
Wheat price	140.7	140.7	140.2	140.3	139.9	139.9	140.0	140.1
Barley price	121.5	121.3	121.1	121.0	120.9	120.9	120.9	120.8
Oats price	111.9	110.9	110.1	110.0	109.6	109.5	109.4	109.3
Beef price	220.4	220.6	219.2	218.1	214.9	213.5	212.5	211.8
Pork price	120.9	123.2	123.5	121.4	119.3	118.3	120.1	121.8
Poultry price	109.0	108.7	108.6	108.4	108.2	108.1	108.0	107.9
Milk price	30.1	30.2	29.6	29.1	28.4	28.4	28.5	28.6

The purpose of the baseline is not as a forecast of the future but to establish a yardstick against which policy simulations can be judged. The projections for the baseline are dependent on the assumptions of various macroeconomic indicators. The most important of these indicators are population, macroeconomic growth rates and inflation rates and key currency exchange rates such as the euro/US dollar (Binfield et al., 2003). For the Finnish macroeconomic variables, the baseline corresponds to the one generated by FAPRI (2003). First observation of the baseline is that changes in prices are relatively small (Table 1). Grain prices are also rather stable. Only beef and milk prices are falling slightly. Finnish prices follow closely the key prices.

Stable prices generate also slightly falling area and production trends (Table 2). These results are in line with other studies and general expectations. Pork production is at a higher level at the moment than in the baseline scenario. It is a result of the national investment support which is not taken into account in the model. It is a temporary policy action, but it may cause a permanent rise in the production. It will be seen soon and the model may need to be calibrated to a new production level. Increasing costs press farm income downwards.

Table 2. Areas (000 ha) and production (000 tons) of main products and farm income (mill. euros) for baseline scenario

	2003	2004	2005	2006	2007	2008	2009	2010
Wheat area	127.8	130.4	130.5	131.7	130.7	131.1	130.9	130.8
Barley area	514.8	517.6	515.9	515.1	513.6	512.8	511.3	509.8
Oats area	376.6	375.7	372.9	370.9	369.7	368.4	367.2	366.0
Beef production	96.9	88.5	86.3	89.4	85.5	86.2	80.1	79.4
Pork production	169.7	169.5	169.1	168.5	167.6	166.6	165.5	164.5
Broiler production	73.6	76.6	79.5	82.5	85.4	88.3	91.2	94.0
Milk production	2256.1	2282.9	2229.4	2189.1	2129.9	2148.8	2167.8	2186.0
Farm income	1315.9	1276.9	1242.2	1203.5	1188.1	1148.3	1112.6	1061.3

3.2. CAP reform scenario

The CAP reform scenario follows the Luxembourg Agreement approved at the Council of Agricultural Ministers in September 2003 (Council of the European Union, 2003). The most significant element in the reform is the de-coupling of most of the EU payments to arable crops and livestock from the production, combining these into a Single Farm Payment (SFP) scheme. Yet, the EU has given the Members States a number of options for implementing the reform. Part of the support may still be linked to production. There is a great deal of flexibility especially for the part of beef, but also for the part of cereals and milk. Thus, assumptions are made here regarding the de-coupling option. An option, in which 70 percent of the current CAP payments to arable crops and livestock are decoupled, is considered in the reform scenario.

In the AG-MEMOD model, so-called "modulation-decoupling" sheet calculates new supply inducing payment, which affects supply decisions. Since it is assumed that 30 percent of the current CAP payments will remain coupled, a coefficient 0.3 is chosen to adjust for change in supply inducing payment since reference period. It should be noted that some CAP payments are already treated as partially decoupled in pre-2003 reform baseline (Westhoff and Binfield, 2003).

The level of intervention prices and payments for the commodities changed in the reform scenario are set, as indicated in Table 3. The intervention price for butter is reduced 25 percent (-7 percent in 2004, 2005, 2006, and -4 percent in 2007), which is 10 percent more than agreed in Agenda 2000. For skimmed milk powder (SMP) prices will be cut by 15 percent as agreed in Agenda 2000 (but in 5 percent steps over three years from 2004 to 2006). The price cuts are brought forward one year compared to the Agenda 2000 plan. Compensation payments to milk producers are fixed as follows: €11.81 /tonne in 2004, €23.65 /tonne in 2005 and €35.50 /tonne from 2006 onwards.

Table 3. Policy variables changed in the Luxembourg Agreement Scenario

Variable Name	2003	2004	2005	2006	2007	2008	2009	2010
Butter intervention price	328.2	328.2	305.2	282.4	259.5	246.4	246.4	246.4
SMP intervention price	205.5	205.5	195.2	185.0	174.7	174.7	174.7	174.7

The changes of the Luxembourg Agreement have an influence on the Finnish model both directly, through the changed policy variables, and indirectly, through the changed key reference prices. In the case of grains, the major driving force is the expected gross return, which includes the return of production plus subsidies. The basic assumption is that producers react to changes in expected gross return. As the expected gross return falls by 12 percent in the CAP reform scenario, this causes the 3-4 percent decrease of harvested area for all grain commodities.

Table 4. Changes in the prices of main product (in percent compared to the baseline scenario)

	2003	2004	2005	2006	2007	2008	2009	2010
Soft wheat	+00.00	-00.00	+00.08	+00.08	+00.08	+00.08	+00.08	+00.08
Barley	+00.00	+00.00	+00.02	+00.03	+00.03	+00.02	+00.02	+00.02
Oats	+00.00	+00.00	+00.09	+00.12	+00.11	+00.10	+00.09	+00.09
Beef	+00.00	+00.00	+03.08	+03.10	+03.15	+03.17	+03.18	+03.19
Pork	+00.00	-00.00	+00.06	+00.06	+00.06	+00.07	+00.07	+00.07
Milk	-00.00	+00.00	-00.86	-01.72	-02.65	-04.42	-04.41	-04.40

Grain prices change very little in the CAP reform scenario. They tend to rise slightly, but the intensity of the changes remains at 0.08 percent for soft wheat, 0.02 percent for barley and around 0.1 percent for oats. This is a logical outcome of the projection. The decrease in grain production i.e. grain supply results in the slight increase of prices in a pursuit to equilibrium.

The harvested area and production is projected to decline slightly as a result of the decoupling. The reduction is smaller towards the end of the simulation period when markets have adjusted to the initial change. The area removed from grain cultivation is going to be shifted to set aside. The change would probably be greatest on sub-marginal soils and on farms with higher than average production costs, since harvesting and drying costs are high in Finland.

The impact of the 2003 CAP reform on the dairy sector is relatively modest because the baseline already incorporates Agenda 2000 decisions. Following the additional 10 percent cut in butter intervention price, Finnish butter price will be nearly 8 percent lower than in the baseline scenario by the end of the simulation period. This directly influences the changes in milk prices, which are 4 percent lower in 2010 compared to the baseline. Cheese prices do not change, while SMP prices are slightly (0.7 percent) higher than in the baseline.

Milk production is derived from the dairy cow stock and the production per cow, which both are lower in the CAP reform scenario, resulting 6 percent lower milk production figures compared to the baseline. Since fluid consumption does not change in the CAP reform scenario, the lower milk production directly affect the amount of milk available for processing. Milk for manufacturing use is found to decline by 8.6 percent by the end of the simulation period.

Table 5. Changes in the areas of grains, production of main animal products, and in farm income (in percent compared to the baseline scenario)

	2003	2004	2005	2006	2007	2008	2009	2010
Wheat area	+00.00	-00.00	-03.31	-02.84	-02.83	-02.79	-02.73	-02.68
Barley area	+00.00	+00.00	-03.49	-02.90	-02.85	-02.80	-02.75	-02.71
Oats area	-00.00	+00.00	-03.50	-02.86	-02.80	-02.75	-02.71	-02.66
Beef production	-00.00	+00.00	-02.62	+02.79	-01.85	-03.78	-01.78	-05.32
Pork production	-00.00	-00.00	+00.00	+00.00	+00.00	+00.01	+00.01	+00.01
Milk production	-00.00	-00.00	-01.19	-02.36	-03.58	-05.89	-05.82	-05.75
Farm income	+00.00	+02.22	+04.11	+04.19	+03.26	+03.66	+03.72	+04.26

The decrease in male bovine premium results in lower beef cow stock, but this effect has relatively little implication on meat production, since beef cow stock constitute only 10 percent of total cattle stocks. The cattle and beef sub-model is very strongly linked with the dairy sub-model. Since about 90 percent of slaughtered cattle come from dairy cows in Finland, the dairy stock decrease of 5 percent directly translates into a decline of calf production, and therefore lowers the cattle slaughter projections.

Beef prices are 3 percent higher in the Luxembourg Agreement Scenario than in the baseline. This price increase is caused by the changes in German key prices, which are over 6 percent higher than in the baseline. The higher prices are the results of lower beef availability in the EU market. However, following the decline in total cowherd – combined with the implementation of the decoupling scheme in the livestock sector – the cattle slaughter is projected to fall by 6 percent. As a consequence, beef and veal production will exhibit a 5 percent decline by 2010 in comparison with baseline levels.

3.3. Effects on farm income

Since the model covers only a part of the agriculture, several calibrations had to be done in order to make the economic accounts calculated from the model comparable to the EAA accounts of the EUROSTAT. The gross return was calculated from the model and then calibrated to the level of the EUROSTAT EAA value in 2000. Subsidies were calculated and calibrated in a similar way. The volume of costs was assumed to depend on the volume of production. The price index of the costs was estimated as a weighted average of the price indices of feed grains and GDP deflator. Costs were then calculated as the product of the volume and price indices and calibrated to the EAA level in 2000.

Changes in farm income are caused only by the products included in the model. No changes in other sectors of agriculture are assumed. As a result of the CAP reform, farm income increases slightly (table 4). The reduction in the quantity of agricultural output is compensated by the resulting decrease in costs and by the higher level of direct support in the Luxembourg scenario since the decoupled support stays constant in spite of the decrease in the production. This result depends very much on the assumption of the volume of costs which should be kept in mind when the conclusions are made.

4. Summary and conclusions

The objective of this paper was to assess empirically the impacts of the 2003 reform of the Common Agricultural Policy (CAP) on the agri-food sector in Finland. The long term results of the CAP reform scenario from 2003 to 2010 were compared with the long term results of the baseline scenario, which corresponds to the continuation of the Agenda 2000 agricultural policy. To meet the objective, an econometric model for Finnish agriculture - built as a part of the AGMEMOD project - was utilised.

The AG-MEMOD modelling framework, a joint endeavour by several European research institutes, provides a unified approach to the specification, estimation, and simulation of the national-level commodity markets. By means of the model, the effects of different policy scenarios on agricultural production and incomes could be simulated.

The most significant element in the CAP reform is the de-coupling of most of the EU payments to arable crops and livestock from the production, combining these into a Single Farm Payment scheme. Decoupling support from production will affect economic efficiency, structural development and supply of agricultural products in the entire agricultural sector. Unlike the present support that is coupled to the area of individual crops and livestock numbers, a support that is decoupled from production will no longer be included in the marginal products of the production choices and it will not affect the mutual competitiveness of the different production alternatives.

However, land has to be kept in good farming condition in order to receive the farm payment. New conditions relating to the environment, maintaining the productive capacity of the land, food safety, animal welfare and occupational safety are incorporated in the direct payments. In practice, this would mean that land has to be cultivated or kept as set-aside land. Land abandonment or forest planting, for example, would not be possible. Furthermore, producers' behaviour is influenced by other considerations, such as social inertia, the maintenance of some crops for agronomic purposes, the need to depreciate long-term investment, the participation in the agri-environmental programmes, the eligibility to Less Favoured area payments – which requires the continuation of production - etc, which could all be expected to mitigate the overall impact of decoupling of the farm sector.

Compared to a baseline scenario (i.e. Agenda 2000), the main impacts of the 2003 CAP reform in Finland can be summarised as follows:

- A reduction in the production level in several commodity sectors where production decisions are influenced by the level of support and by the coupled policy instruments in place. As a result, net exports of many agricultural products from Finland will decline. This concerns in particular wheat, barley, beef, butter and skim milk powder (SMP).

- A small increase in farm income as compared to the baseline. The reduction in the level of agricultural production is expected to be broadly compensated by the resulting price rises and the increase in the level of aids.

Changes in crop sector are found to be moderate. Decoupling improves the relative profitability of such crops and land uses whose CAP support has been lower than the support for cereals (silage grass and fallow) or which have previously received no CAP support at all (other grass area and other crops). In Finland, the central issue is how much of the cereals area will become set-aside. The model indicates that, if 70 percent of the CAP support for arable crops will be decoupled from production, there will be an increase in the voluntary set-aside of approximately 15 percent, and a reduction in the area grown in cereals by around 3-4 percent.

As regards to milk, the results indicate that the additional 10 percent cut in intervention price of butter beyond the Agenda 2000 agreement will reduce the domestic price of butter by around 8 percent by the end of the simulation period. As a result, the production and exports of butter will be reduced by 9 percent and 12 percent, respectively. The reduction in butter production and increased demand for non fat solids in other dairy products will then reduce production of skim milk powder (SMP) by 19 percent and increase the SMP price slightly. These changes are estimated to reduce milk producer price by 4 percent and total milk production by 6 percent relative to the baseline.

The impact in the beef and veal production is expected to be dominated by the developments on the dairy sector. Changes in beef and veal production and cattle slaughter are a direct consequence of changes in total cattle stocks, which are made up of beef cow stocks and dairy cow stocks. As a result of CAP reform changes, beef and veal output will decline progressively to stand at around 6 percent below the baseline levels by 2010. Lower beef availability in the EU will trigger a rise in EU producer prices of some 6.5 percent and result a 3 percent higher producer price in Finland at the end of the simulation period compared to the baseline.

After the simulation carried out to test the impacts of CAP reform on Finnish agro-food sector, the following questions naturally arise: To what extent do the results reflect reality and to what extent can they be ascribed to the characteristics of the analytical tool used? How useful is the chosen modelling approach as an analytical tool? What are the methodological or analytical lessons to be learned from the research?

It should be first acknowledged that the quantitative assessment of the impact of decoupling of direct payments is in general a difficult task. Thus caution is deemed necessary when analysing and interpreting the results from this quantitative analysis. Yet, the findings of the study are consistent with the other studies on the impacts of CAP reform on Finnish agriculture. Lehtonen (2004a,b), using a mathematical programming and technology diffusion approach, reported slightly larger reduction in overall dairy production, and a slightly smaller reduction in overall cereals production due to CAP reform and partially de-coupled CAP-payments, compared to simulations carried out in this study. The differences can be traced to the different modelling paradigms of the two studies. It is significant that the results of the two different models based on different paradigms are of the same direction. However, the magnitude of the production changes deserves more careful analysis. Robustness of the production changes on the model parameters could be tested.

The AG-MEMOD modelling framework provides a unified approach to the specification, estimation, and simulation of the national-level commodity markets. The Finnish country model presented in this paper is therefore well adapted for inclusion into a framework of multi-country model of the whole EU. The policy simulations demonstrate consistently the diverse responsiveness of the Finnish commodity markets to external stimuli. Although the markets differ significantly, it is possible to build models in each case and to observe dynamic behaviour properties for these models, which are substantially in accord with prior notions. Commodity experts in each of the markets considered will still be able to contribute information, which may significantly modify each of the sub-models. But it is highly promising that the Finnish country model is able to catch the essentials of the behavioural relationships underlying the specialised nature of each commodity market.

Though the broad patterns of reactions to agricultural policy change are fairly predictable, the specific details are not so. The changes in prices of different commodities, and often even the direction of these changes, are not easily predictable by single means. In particular, when several geographic markets simultaneously change the policy, the impact of policy reform depends not only on domestic price elasticities, but also on the transmission of domestic production and consumption adjustments to the other countries' markets for that commodity, and the feedback effects between market prices and production and consumption decisions in the group of countries pursuing policy reform. The results presented in the paper demonstrate the importance of accounting for the following in the analysis of the impact of agricultural policy change:

1. The substitution possibilities in production and consumption of commodities.
2. The interactions of simultaneous changes in policies of different countries.
3. The behavioural responses of economic agents as producers and consumers.

Thus although there remains substantial scope for further research on the model (improving the estimation and specification of the sub-models), the model offers considerable potential for application even without additional development. It provides the basis for relatively straightforward projection, and an initial framework for agricultural policy analysis. It is possible to introduce into the models modifications of supply and demand that approximate some potential policy measures and to get measurements of market responses under alternative policies. Finally, the Finnish model is well adapted for introduction into a framework of multi-country model of the whole EU. Such a comprehensive interactive framework of model is suitable for the study of the commodity, its responses to EU market changes, the international transmission of concurrent price changes, the impact of multilateral trade liberalisation, etc.

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Appendix 1

List of variables in the grain model

WSPFRFI =	Finnish soft wheat price
BAPFRFI =	Finnish barley price
OAPFRFI =	Finnish oats price
RLPFRFI =	Finnish barley price
PTPFRFI =	Finnish potato price
STPFRFI =	Finnish sugar beet price
WSPFHFR =	French soft wheat price
BAPFHFR =	French barley price
WSEGMFI =	Soft wheat net-expected gross return in Finland
WSPF3FI =	Finnish soft wheat price, three year average
WSYHTFI =	Soft wheat trend yield in Finland
G3AHAFI =	Three grains area in Finland (including soft wheat, barley and oats)
G3EGRFI =	Three grains adjusted real net-expected gross return in Finland
GRSARFI =	Set-aside rate in Finland
RSAHAFI =	Rapeseed harvested area in Finland
TREND70 =	Trend variable
BAASHFI =	Barley share of harvested area in Finland
BAEGMFI =	Barley net-expected gross return in Finland
G3EGMFI =	Three grains net-expected gross return in Finland
GRSARE5 =	Set-aside rate in EU-15
BAAHAFI =	Barley harvested area in Finland
G3AHAFI =	Three grains harvested area in Finland
WSYHAFI =	Soft wheat yield per hectare in Finland
WSYHTFI =	Soft wheat trend yield in Finland
WSPF5FI =	Five year average of Finnish soft wheat prices
WSAHAFI =	Soft wheat harvested area in Finland
ALAHAFI =	Total area (three grains area plus rapeseed area)
WSSPRFI =	Soft wheat production in Finland
WSUFCFI =	Soft wheat human consumption per capita
WSPFI =	Real Finnish soft wheat price
RGDPCFI =	Real Finnish GDP/capita
WSUFTFI =	Total soft wheat human consumption in Finland
POPFI =	Population of Finland
WSUDCFI =	Total soft wheat domestic use in Finland
WSUFEFI =	Feed demand for soft wheat
WSFINFI =	Feed demand index for soft wheat
MKSPRFI =	Milk production in Finland
BVSPRFI =	Beef and veal production in Finland

PKSPRFI =	Pork production in Finland
WSUFOFI =	Non-feed use of soeft wheat
WSCCTFI =	Soft wheat stocks in Finland
WSPINE5 =	Soft wheat intervention price for EU-15
WSSMTFI =	Soft wheat imports into Finland
WSUXTFI =	Soft wheat exports from Finland
WSUXNFI =	Net Finnish exports of soft wheat