THE CHANGING POLICY ENVIRONMENT FOR AGRICULTURE IN THE EUROPEAN UNION

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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled

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ABSTRACT

The European Union (EU) has undergone two major expansions in just three years, enlarging from 15 members (EU-15) to 25 members in May 2004, and then adding Bulgaria and Romania in January 2007. Agriculture has played a central role in all the enlargement negotiations as a result of the significant levels of government support in the EU for the sector, the sector's importance in terms of the overall EU budget, and the large number of farmers in the new member states (NMS). A major reform of the Common Agricultural Policy (CAP) was carried out in parallel to the first enlargement, and included changes to the way that agriculture was supported in the EU. Reform of the CAP is ongoing, with a timetable for the elimination of dairy quotas included in the latest reforms. As the link between production and support is broken, the policy most influencing market developments has become that relating to biofuels, whose production and consumption in the EU has expanded rapidly in recent years.

In this dissertation, a partial equilibrium model is used to examine aspects of each of these developments. Three papers are presented. The first paper examines the interaction between the 2004 reform of the CAP and the enlargement of the EU. In the second paper

the impact of the removal of dairy quotas for the EU is investigated. The third paper considers the impact of biofuels policy in the EU on agricultural markets, and *vice versa*. The linkage between the papers goes beyond the common model that was used for the analyses; underlying all the papers are the EU's attempts to reconcile the enlarged EU with the WTO, reform of the CAP, and the changing objectives of agricultural policy in the EU.

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LIST OF ABBREVIATIONS

CAP: Common Agricultural Policy (of the EU).

CEC: Central European Countries - Czech Republic, Denmark, Estonia, Latvia, Lithuania, Poland, Slovenia, Slovakia.

CET: Common External Tariff.

CMO: Common Market Organization.

DDR: Doha Development Round (of the WTO)

EEC: European Economic Community.

EU: European Union.

EUROSTAT: Statistical service of the European Union.

EU-15: Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom.

FAO: Food and Agriculture Organisation

EU-25: EU-15 plus the NMS-10.

EU-27: EU-25 plus Bulgaria and Romania.

FADN: Farm Accountancy Data Network.

GATT: General Agreement on Tariffs and Trade.

GTAP: Global Trade Analysis Project.

MTR: Mid-Term Review (of the CAP).

NMS-2: The new member states that joined in 2007; Bulgaria and Romania.

NMS-10: The new member states that joined in 2004; Czech Republic, Hungary, Estonia, Cyprus, Latvia, Lithuania, Malta, Poland, Slovenia, Slovakia.

OECD: Organization for Economic Cooperation and Development.

RTFO: Road Transport Fuel Obligation.

SFP: Single Farm Payment.

SMP: Skimmed milk powder.

TGAP: Tax Generale sur les Activites Pollutantes.

URAA: Uruguay Round Agreement on Agriculture.

USDA: United States Department of Agriculture.

WMP: Whole milk powder.

WTO: World Trade Organization.

1. INTRODUCTION

The enlargements of the EU in 2004 and 2007 represent one of the most substantial achievements in the EU's 50-year history. The expansion has had an impact on all areas of the EU's operations, politically, socially as well as economically. It resulted in a huge increase in EU area and population. Given the importance of the Common Agricultural Policy (CAP) in the EU, accounting for close to half of the overall EU budget, agriculture's role was central to the enlargement process. In this dissertation three papers are presented that examine aspects of the turbulent years for the CAP since the start of the new millennium. The papers cover the enlargement, the substantial reform of the CAP that was undertaken, and the emergence of biofuels policy as a leading driver of agricultural markets in the EU.

Background

The conclusion of negotiations in Copenhagen in December 2002 and the subsequent successful referenda in the NMS, meant that the EU was expanded from 15 members (EU-15) to 25 members in May 2004. In 2007 Bulgaria and Romania acceded to the EU. Agriculture has been central to the enlargement process, as a result of the high levels of government support in the EU for the sector and its subsequent importance in terms of the overall EU budget, and the large agricultural sectors in the NMS.

The move from centrally planned to market based economies in the central European countries (CEC)[1] was accompanied by a collapse in the economies of the region and also in the economies of a major trading partner, Russia. The EU had an important role in promoting economic and political stability in the region, and responding through the negotiation of trade agreements that provided the CEC with preferential access to the EU market (and, importantly, vice versa).

Despite these trade agreements, a number of factors resulted in a large fall in the output of the agriculture sector in the region since the beginning of the transition process. Part of the cause was the dismantling of the price system that prevailed in the countries where prices were largely fixed, with inputs and the consumption of meat effectively highly subsidized. When these subsidies were removed and the economic situation deteriorated, producer incomes fell. The redistribution of land led to the fragmentation of production in some areas, exacerbating the production problems.

The EU indicated early in the transition process that enlargement to include these countries was a realizable aim, prompting many of the CEC to put in place policies that supported agriculture in a manner that was similar to the CAP. These policies often replaced measures that had been applied in an *ad hoc* manner in response to problems arising from the transition process. These changes, along with the recovery of the economies of the countries concerned, prompted an increase in the output of the

[1] There are many ways to refer to the countries of the region. Of the 12 new member states 10 were at one time centrally planned and these will be distinguished by the term CEC when the distinction regarding the transition process is required, otherwise the more general NMS term will be used.

agricultural sectors of these economies, although in the vast majority of cases production remains below that of the pre-reform era.

In 2000 the EU finally produced an official timetable for the enlargement of the EU. It did not include details for the application of the CAP in the CEC after enlargement. In Agenda 2000 the EU had increased, and made permanent, direct payments that had been introduced in the MacSharry reforms of 1992. The CEC argued that these payments should be extended to them after enlargement, whereas the then members of the EU worried about the cost of doing this, both in terms of the payments themselves and the effect on production. The direct payments issue was central to the subsequent accession negotiations with the EU finally agreeing that the CEC will eventually receive payments, albeit phased in over a number of years.

Direct payments have been used in the CAP for many years, especially in the beef sector where payments were introduced in the mid-1980s to compensate for the imposition of dairy quotas. Existing payments were increased, and new ones were introduced, as part of the 1992 MacSharry reforms as compensation for reductions in support prices. At the time the new payments were presented as being temporary, but Agenda 2000 saw a further drop in support prices and increase in payments.

The 1992 reforms were criticized at the time by many agricultural economists because they were still coupled to production, i.e. they still had some production inducing effect. In fact, differences in the manner in which the payments were implemented meant that the degree to which the payments were coupled to production varied amongst commodities.

Decoupling is a central issue in agricultural policy, and is examined in Paper 1. The OECD (2000) defines as “Effectively Fully Decoupled” those policies where production or trade do not differ from the level that would have occurred without the policy. An alternative, more restrictive, definition would be that the response to any exogenous shock would be unchanged by the presence of the policy. In reality, for the reasons given in Paper 1, there is likely to always be some production inducing impact from policies targeted at farmers. There is a tendency by some to label the more recent CAP payments as the “decoupled payment”, in contrast to those introduced in MacSharry, but as Paper 1 argues, newer payments may not be as decoupled as some imagine, while their predecessors (although undoubtedly more linked to production than the new payments) may have been more decoupled than assumed.

In the end the EU agreed to extend the CAP enjoyed by the EU-15 to the NMS-10, albeit with direct payments phased in over a decade. As in the EU-15 these payments were to be bound by limits and for the NMS-10 these were determined by the historical animal numbers and area planted. For the first three years the NMS-10 are allowed to implement a simple area based payment scheme but eventually they would have to conform to the CAP as applied to other EU countries.

At the time that the terms of enlargement were being finalized, the Commission introduced plans to dramatically reform the way that direct payments were made. In 2002 the Commission released the Mid-Term Review (MTR) which argued that most of the existing direct payments be combined into a single, decoupled payment, the single farm payment (SFP). The CAP that the NMS have implemented is therefore very different from that which prevailed when the negotiations regarding enlargement were instigated. It is also fair to say that such a significant reform being passed the year before enlargement was not a coincidence, given that from 2004 onwards changes to the CAP would have to be agreed with all the new members.

The SFP was the centerpiece of the MTR. It proposed that most of the wide variety of payments that were in existence then be converted to a single payment, which would be tied to land in the form of an entitlement. The Commission also proposed both the modulation of payments (the transfer of money within the CAP from agricultural market support to rural development measures) and the setting of a maximum level for individual payments. Member States were generally split in their response to the decoupling payments proposal, with the major concerns being that decoupling would result in a dramatic reduction in production in some areas, with marginal lands being abandoned, and knock-on impacts on related industries (particularly associated with the processing of meat) in rural areas. Farmers were also concerned that the payment, once established, would become a target both for those that objected to the level of support that farmers obtained, and those that wanted CAP money reallocated.

In the end a political compromise was obtained. The capping of payments was rejected, and the plans for modulation was scaled back from up to 20 percent to just 5 percent. However, the concept of decoupling was retained, although it was diluted with the member states allowed to choose from a menu of options that allowed a proportion of payments to be made in the old way. Most countries chose to decouple all of their arable area aid payment and this allowed the Commission to claim that most payments were decoupled given the high share of the arable area aid payment in total expenditure. But many countries took the option of re-coupling their beef payments. Part of the compromise allowed Member States to calculate payments in one of two ways[2]; either on the basis of individual producer's historical claims or by averaging payments over regions. These choices have led to different policy environments in each of the member states[3], a development that has led to many claiming that the MTR "renationalized" the CAP.

The MTR reforms resulted in fundamental changes to the way that the CAP works. However, the political compromise that emerged meant that, as in the Agenda 2000 reforms, the Commission was left unsatisfied and therefore a further set of changes was proposed in the "Health Check". The changes that were proposed were far less sweeping than those of the MTR, and were mostly an attempt to try to stem the profusion of different implementation strategies that were employed by the different Member States in response to the latitude that they were given in the political compromise. Previous

[2] Or as a combination of both, in a kind of hybrid scheme.

[3] For example, the UK has chosen four different methods of applying the SFP, one each for England, Wales, Scotland and Northern Ireland.

reforms had left one sector largely untouched, with the MTR merely suggesting some alternatives for the thorny issue of eliminating dairy quotas. The Health Check process however managed to establish a timetable for the ending of dairy quotas, along with the ending of intervention for many grains, and the commitment to end export subsidies. These change means that although support for agriculture still exists in the EU, the orientation is now one that is almost totally focused on decoupled payments and increasingly markets trade at close to world prices.

Undoubtedly, the ability of the Commission to push through further reforms in the Health Check was aided by developments on world markets, where prices for almost all commodities spiked in 2007 and early 2008. There are many reasons for the spike, but many considered the new biofuels policies, particularly those in the US and the EU were responsible for part if not most of the increases. It is difficult to establish the contribution that these policies made to the increase in prices, but it is clear that the extra demand from biofuels in the EU was significant, especially in the case of vegetable oil. The 2008 agreement on a new Renewable Fuels Directive for the EU cements the desire of the EU to increase the contribution of biofuels to transport fuels. With CAP reform resulting with in agricultural policy that is increasingly decoupled from production, future agricultural markets in the EU will be driven by world market developments and energy and environmental policy.

The changes that have occurred in the EU over the period of the PhD have been substantial. The three papers are presented as written when the research was carried out, and in some cases are therefore out of date. In the concluding part of this thesis this is addressed, with the implications of the papers in the current environment brought up to date.

Paper 1: Incorporating EU Enlargement and CAP Reform in a Partial Equilibrium Modeling Framework.

The objective of the first paper is to examine the impact of the enlargement of the EU to 25 countries (the paper was completed before the most recent enlargement) and its interaction with CAP reform through the appropriate restructuring and simulation of a partial equilibrium model of the sector. The objective can be broken down into a number of tasks:

i) The construction of a dataset for the EU-25. Data comes from EUROSTAT, the European Commission, the USDA, and the FAO.

ii) The determination of the appropriate methodology. A review of related studies has been undertaken; the methodology to be utilized is presented and justified.

iii) A review of the changing policy environment and the agriculture sectors in the NMS. It is appropriate to focus on the supply-inducing effects of EU policy, past and present.

iv) The production of a baseline projection under prevailing policy, normal weather, and projections of exogenous variables.

v) The evaluation of the model through the simulation of shocks.

The aim is that the resulting model therefore provides projections that are robust with regard to economics, the policy environment, and the underlying biological constraints of the system.

Paper 2: The Impact of Ending Dairy Quotas in the EU.

Dairy quotas were introduced to the EU in 1984 in an attempt to stem the growing surplus in the dairy sector that was crippling the EU budget. In the years since then, most of the other sectors have undergone significant reforms that first replaced price support with direct payments and then dramatically reduced the link between these payments and production. Policy in the dairy sector has seen relatively few changes, but it now appears that quotas will be abolished for good in 2015. Estimating the impact of ending quotas is complicated by the fact that they have been in place for over 20 years, and are applied in different ways in each of the Member States. The enlargement of the EU also complicates analysis, since the dairy sectors in these countries are also undergoing restructuring after joining the EU market. In this paper an estimate of the impact of ending quotas is presented, along with an analysis of how this may be impacted by world market conditions or any agreement under the Doha Development Round (DDR).

Paper 3: Linking a Partial Equilibrium Model of Biofuels to EU Agricultural Markets and Beyond.

In this paper a partial equilibrium model of biofuels in the EU is presented. The model runs simultaneously with FAPRI's pre-existing partial equilibrium model of the EU-27 agriculture sector, the GOLD (grains, oilseeds, livestock and dairy) model. The model is simulated to examine the impact of requiring that biofuels account for 10 percent of total transport fuel energy – which is an approximation of the actual policy agreed in 2008. The results illustrate the importance of biofuels policy on agriculture markets within the EU, as well as producing an estimate of the impact on world markets of changing biofuels targets. The introduction of the mandatory target significantly increases the demand for both cereals and vegetable oil. World cereals trade is more elastic with respect to price than in the case of oilseeds and therefore vegetable oil prices increase more than their cereal counterparts.

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2. INCORPORATING EU ENLARGEMENT AND CAP REFORM IN A PARTIAL EQUILIBRIUM MODELING FRAMEWORK[4]

Abstract

There cannot have been many circumstances that have challenged the modeler of agricultural markets to the extent that the developments in the EU in recent years have. The enlargement of the EU involves a large number of countries, with important agricultural sectors, many emerging from a volatile transition from central planning, and raises many issues. This is occurring at a time of radical reform of the CAP, with the substantial decoupling of payments, an area that has attracted some research but provides little concrete guidance for sector level modelers. In this paper the challenges of each of these developments are outlined and their importance to the sector addressed. An approach to incorporating them into a partial equilibrium model is outlined and evaluated.

Keywords: Common Agricultural Policy, enlargement, policy reform, modeling.

In May 2004 the European Union (EU) expanded to 25 member states, a move that greatly increased its agricultural area and farming population. The enlargement

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4 This paper was published as "Challenges of incorporating EU enlargement and CAP reform in the GOLD model framework" (Julian Binfield, William Meyers and Patrick Westhoff) in the proceedings of the 89th EAAE Seminar "Modelling agricultural policies: state of the art and new challenges", 3-5 February 2005, Parma (Italy).

necessitated that the model for the EU agricultural sector maintained at FAPRI-Missouri be expanded as well. The development provides challenges for the modeler in terms of the scale of the expansion, the collation of a data set, the economic transition ongoing in entrants, and the fact that the CAP has just undergone another reform.

From an agricultural standpoint, the NMS are dominated by the central European countries (CEC): Poland, Hungary, Czech Republic, Slovak Republic, Slovenia, Estonia, Latvia and Lithuania. At the onset of the enlargement process it was feared by many in the EU-15 that extending the level of support in the Common Agricultural Policy (CAP) to these countries would result in them increasing their output substantially and thereby putting pressure on the EU budget. Subsequent reforms of the CAP have lessened this possibility. Nonetheless, there remains much uncertainty regarding the evolution of the agricultural sectors in these countries.

The CEC present a number of challenges to the successful modeling of the agricultural sector. Until the 1990s the countries all ran centrally planned economies, with the importance of the private sector varying across countries. As the countries moved to market based systems there were prolonged periods of adjustment for the agricultural sector. During this period there were also a variety of support policies enacted. Data for the countries is of variable quality and sometimes difficult to obtain. There is therefore a limit to the extent that history can assist in the calibration or validation of an economic model, and econometric estimation using time series data is not possible in most cases. In addition the introduction of the single farm payment (SFP) under the newly reformed

CAP presents a departure in agricultural support from that which has been operated in both the EU-15 and the CEC.

The GOLD (grains, oilseeds, livestock and dairy) model is a dynamic, partial equilibrium model of the EU agricultural sector that is maintained by FAPRI at the University of Missouri and has been used for the analysis of recent changes in EU policy (Binfield and Westhoff, 2003; Binfield et al, 2003). In the past the model disaggregated the EU-15 into France, Germany, Italy, Ireland, the UK and an "other EU" category. During 2003 and 2004 the model has been expanded to include the new member states (NMS). In this paper the changes that have been made are documented and modeling issues that have arisen are highlighted through the use of specific examples. The model is used to generate a constant policy baseline projection, and this is used to highlight the impact of the modeling assumptions. Finally the impact of enlargement and CAP reform through the Luxembourg 2003 agreement are evaluated through the simulation of the GOLD model.

The GOLD Model

FAPRI uses dynamic partial equilibrium models to analyze agricultural markets and policy scenarios. The aim of these models is to provide timely and realistic analyses by using models that incorporate the important economic, biological and policy relationships for the sector. The model of the EU that is used as the basis of this paper is the GOLD (grains, oilseed, livestock and dairy) model (see Hanrahan, 2001 for more details).

The crop component of the GOLD model covers wheat, barley, maize, rye, rice, oilseeds and oilseed products. The crops component interacts with the livestock sector through feed demand relationships. The number of sheep, pigs and cattle are tracked, and the production of pork, poultry, lamb and beef are modeled. Milk production is allocated through a fat and protein balance into butter, cheese, skimmed milk powder (SMP), whole milk powder (WMP) and an 'other' category.

In addition to the EU-15 disaggregation outlined above the model has been expanded to include the ten NMS in the form of Poland, Hungary and "other NMS" components. The model used data from EUROSTAT, the European Commission, USDA and FAO. An important aspect of the model is that it relies on the most recent data available sets – and the move to EUROSTAT, where balance sheets are often not available for recent years, has meant that the demand side of the model is only carried out at an EU-15 and NMS-10 level.

The model is a system of single equations simulated in Excel. The equations have not been estimated econometrically; parameter selection has been guided by theory and expert feedback. In the case of the NMS econometric estimation is unwise if not impossible given the transition process and the nature of the data that is available. Whether or not the EU-15 model would be improved if estimated is a valid question – in the case of the GOLD model it is believed that the additional time and resources needed to generate reliable econometric estimates would not be justified in terms of the improvement of projections that this may or may not bring given the scale of the model and the transformation (partially policy related) that the EU-15 agricultural sector itself has undergone.

Incorporating CAP Reform

In order to incorporate the latest CAP reforms, the commodity coverage of the model was expanded to include rye and rice. The changes in the rye sector feed into the other cereals and oilseed crops, especially in Germany and Poland where the only significant production of rye within the EU is undertaken. Rice production occurs mostly in France, Italy and Spain.

Changes within the reform that were made to existing policy instruments were largely already incorporated within the GOLD model structure. The implementation of the SFP presented a number of practical challenges. The model needed to be able to analyze a relatively large number of policy scenarios in relation to the different proposals, and the possible combinations of different member state choices. It was necessary to be able to compare the situation under Agenda 2000 and the new reforms. The fact that there remained the possibility to re-couple the payments after the reforms meant that the Agenda 2000 framework still had to be retained, anyway, in the generation of the post-reform baseline.

The Single Farm Payment – decoupled?

The decoupling issue is clearly the key to the successful modeling of the CAP reform. In fact there are two issues that need to be examined – how decoupled the SFP is, but also how decoupled the pre-reform policy instruments are/were. The latter is often neglected in any discussion of the impact of the SFP.

Most of the research that followed the expansion of usage of direct payments under the MacSharry reforms focused on the cereals sector (e.g. Cahill, 1997; Moro and Sckokai, 1999). These studies generally confirmed the belief that the payment was partially decoupled. Producers were free to shift amongst different crops, and the equalization of payment rates with oilseeds as part of the Agenda 2000 reforms further decoupled the payment from arable producers' decision making. In addition to being able to choose between crops, producers could also choose not to produce at all and instead set aside area in excess of the compulsory rate. This is reflected in the model, where the arable area aid payment enters into the cereal and oilseed total area determination, but not in the equations that determine the allocation of that area between the crops. Where it does appear in the total area equations the impact of a change in payment rates is half that of an equivalent price change.

Less attention has been paid to the livestock sector, presumably because it is taken that the payments are very highly coupled, since in order to receive a payment producers needed to have the corresponding animal, or animals in the case of a cow and a calf. In the years after the MacSharry reforms the payments have become less coupled.

MacSharry introduced limits on payments in the beef and sheep sector, which constituted some decoupling. Agenda 2000 gave producers the ability to claim the suckler cow premia on heifers, and headage payments made in less favoured areas were converted to an area basis in a precursor to the introduction to the SFP. In GOLD, payments influence the level of the breeding herd (in practice the special beef premia influences cow numbers through its capitalization in calf prices) and have a smaller impact than their monetary equivalent in market returns, but they have a greater proportional impact than payments in the arable sector.

In GOLD for the dairy sector, the payments that were to be phased in as part of Agenda 2000 were never incorporated in the model on the basis that milk production would continue to be determined by the quota. The issue of whether there are any production impacts of payments is delayed until quotas are no longer binding.

The introduction of the SFP undoubtedly further decouples payments made under the CAP. The ability to maintain some of the payments in their Agenda 2000 form means that the reforms were less radical in this respect than was initially proposed under the Mid-Term Review. It has been argued that the SFP is not fully decoupled. If we are willing to assume decreasing absolute risk aversion then increasing producers' wealth will result in them undertaking more risk. The payment will make it easier for producers to obtain credit. In the USA an important factor linking payments to production has been that the ability to re-base area in the past means farmers may think that future payments could be affected by current production. In the EU, however, it seems unlikely that farmers will expect wholesale re-coupling of payments in the future.

Perhaps the biggest reason why one might suggest that the SFP is not fully decoupled from production is that the payment is associated with cross compliance criteria. The exact form of these requirements varies from country to country. In particular, claiming a payment requires qualifying land to be held, and that land must be in “good agricultural condition.” In addition to this there appears to be some instances of modulated payments being paid in ways that are closely linked to production.

The above discussion highlights the problems for the modeler in terms of the complexity of the CAP reform finally agreed. Countries can choose to re-couple some of their payments. Also, entitlement to the SFP can be calculated in a number of different ways. It seems likely that the SFP is coupled in some way, so these differences need to be accounted for in some way. To complicate issues further there is little research available at the moment that helps guide the decision of how to incorporate the payment in a model of this type.

In contrast to the complex manner of the problem, the SFP is incorporated into the GOLD model in a simplistic way. Where the model in the past has incorporated an Agenda 2000 payment this is instead replaced by a “payment” calculated in the following manner:

Types of Payment:

A = Agenda 2000 payment   Y = SFP

B = Re-coupled Agenda 2000 payment

C = New coupled payment

x = “decoupling coefficient”

m = (1 - modulation rate)

s = stocking density

The new payment for the model is:

New “historic system” payment = (A*x+B)*m + C

New “regional system” crops payment =(Y*x+B)*m + C

New “regional system” livestock payment = (Y*x*s+B)*m + C

Where countries, such as England, are moving between historic and regional schemes the calculation is adjusted accordingly. Since the details of countries’ plans so far are limited, there are no “C” payments, coupled schemes funded from modulated payments, currently in the model.

Ideally, there would be a value for “x” that had already been determined by research (or more likely a series of values for different commodities and regions), but this is not the case. In the US, FAPRI has faced a similar challenge after the introduction of payments that are similar to the SFP under the 1996 Farm Bill (initially referred to as AMTA or Agricultural Market Transition Act payments now know as direct payments). In the

GOLD model a factor of 0.3 was decided upon based on the American experience (Adams et al, 2001) and modeler judgement. In effect this means that 1 euro of the SFP has 30 per cent of the influence on production than when it is paid as part of the Agenda 2000 payments. Note that this does not mean that an increase of 1 euro in the SFP has 30 per cent of the impact of a euro increase in price, far from it in the case of the arable sector.

The approach outlined above has the advantages of being simple, transparent, and compatible with the existing model structure. However, the choice of “x” is somewhat arbitrary and does not take into account the different sources of coupling between the payment and production. It also assumes that a euro paid in countries where the historic calculation has been used is equivalent to one where entitlement is the same across regions. Another serious issue is that the payment is assumed to have the same impact on production in the NMS, as the EU-15, despite the fact that in most cases producers in the former would not have benefited from payments on this scale, and that wealth levels of the farming community would be significantly lower.[5]

Quantifying CAP reform

Analysis begins from the generation of a baseline. The baseline incorporates agreed policy, and since the baseline that is used here is from the latter part of 2004 it

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[5] The fact that payments were not previously paid in NMS might decrease the production related impact of the payments, but this would be offset in some way by lower income levels which would mean that the payments would have a bigger impact than in the EU-15.

incorporates EU enlargement to the 25 countries. The baseline is compared to a simulation comprising of Agenda 2000 and the pre-reform agreement on accession (the no CAP reform or NCR scenario). From this the results of CAP reform are inferred. Due to the nature of the scenario the results that are generated are different from those that were produced by previous FAPRI studies of the MTR (Binfield, 2003).

Crops. Under the NCR scenario crop area increases (Table 2-1). This is partly due to the reintroduction of the marginally more coupled arable area payment, the increase in the durum payment, and the fact that re-introducing the monthly increments increases the effective intervention price. Wheat sees the biggest increase in area as a result of the relatively larger increase in durum area. The increase in cereals production has a negative impact on prices of 2-3 per cent in the short run, and slightly less in the longer run.

Table 2-1: Impact of NCR for crop variables.

	2006-2010 Average				2010-2014 Average			
	Baseline	Scenario	Abs. dif.	% dif.	Baseline	Scenario	Abs. dif.	% dif.
Area				million hectares				
Wheat	22.92	23.19	0.28	1.21%	22.94	23.2	0.25	1.10%
Barley	13.16	13.21	0.05	0.41%	13.1	13.18	0.08	0.59%
Maize	6.26	6.30	0.04	0.57%	6.24	6.28	0.04	0.70%
Rapeseed	4.07	4.13	0.07	1.68%	4.08	4.13	0.05	1.23%
Net Trade				million tonnes				
Wheat	12.3	13.03	0.73	5.97%	12.97	13.38	0.41	3.15%
Barley	8.22	8.39	0.18	2.15%	8.41	8.52	0.11	1.34%
Maize	0.56	0.68	0.12	21.32%	0.63	0.71	0.08	13.11%
Rapeseed	0.09	0.30	0.20	217.29%	0.23	0.34	0.12	50.97%
EU Prices				euro/tonne				
Wheat	118.93	115.82	-3.11	-2.61%	117.51	115.16	-2.35	-2.00%
Barley	109.2	106.48	-2.54	-2.33%	107.95	106.02	-1.93	-1.79%
Maize	123.74	120.63	-3.11	-2.52%	122.21	119.93	-2.28	-1.87%
Rapeseed	186.1	183.04	-3.05	-1.64%	184.23	182.06	-2.17	-1.18%

Livestock and meat. The fact that the various premia payable under Agenda 2000 are more closely coupled to production means that the results of the NCR scenario are more dramatic in the livestock sector than for the crops (Table 2-2). Re-introduction of the various premia increases the number of beef cows by over a million head, or around 10 percent, despite the fact that prices are substantially lower under NCR. The increase comes mainly from the re-coupling of payment in the EU, but also from the fact that the payments are coupled in the NMS-10, although the small number of beef cows and the subsequent low ceilings for premia rights mean the contribution from the NMS to the overall increase is limited.

Sheep numbers also increase under NCR as a result of the re-coupling of the premia. The larger impact on price in the sheep sector in relation to the beef sector is a result of the lesser degree of openness for sheep meat, where imports are controlled by the tariff rate quota (TRQ) and there are few exports.

Table 2-2: Impact of NCR for livestock and meat variables.

	2006-2010 Average				2010-2014 Average			
	Baseline	Scenario	Abs. dif.	% dif.	Baseline	Scenario	Abs. dif.	% dif.
Numbers				million head				
Beef cows	11.01	12.11	1.11	10.09%	10.94	12.12	1.18	10.75%
Cattle	81.71	83.57	1.86	2.27%	80.65	83.21	2.56	3.17%
Pigs	152.84	152.78	-0.06	-0.04%	153.13	152.84	-0.29	-0.19%
Sheep	85.06	89.28	4.22	4.96%	84.83	89.15	4.31	5.09%
Production				thousand tonnes				
Beef	7,825	7,926	101.07	1.29%	7,730	7,897	167.04	2.16%
Pork	21,557	21,561	3.62	0.02%	21,652	21,595	-56.82	-0.26%
Sheep meat	991	1,046	54.76	5.53%	989	1,045	55.93	5.65%
Poultry	10,969	11,008	38.50	0.35%	11,090	11,060	-29.37	-0.26%
Consumption				kg/head				
Beef	16.03	16.08	0.05	0.30%	15.91	16.04	0.13	0.85%
Pork	40.00	39.99	-0.01	-0.03%	40.17	40.04	-0.13	-0.32%
Sheep meat	2.50	2.58	0.08	3.07%	2.49	2.57	0.08	3.20%
Poultry	21.03	21.09	0.06	0.26%	21.25	21.18	-0.07	-0.31%
EU Prices				euro/100kg				
Beef	271.86	260.13	-11.73	-4.32%	275.4	259.51	-15.89	-5.77%
Pork	127.40	125.12	-2.28	-1.79%	126.45	124.65	-1.80	-1.42%
Sheep meat	301.23	271.86	-29.37	-9.75%	301.46	271.21	-30.26	-10.04%
Poultry	128.72	126.28	-2.44	-1.90%	127.26	125.48	-1.78	-1.40%

The substantial reductions in price for beef and sheep meat have knock-on impacts in the pork and poultry sectors. These sectors experience price reductions of around 1.5 to 2 percent, and small decreases in both production and consumption.

Dairy. The impact of the re-imposition of Agenda 2000 in the dairy sector is smaller than in the other sectors as a result of the continuance of the dairy quota, which determines the volume of milk produced. There is a difference in the timing of the reduction in intervention prices for butter and SMP. Under Agenda 2000 the butter intervention price was scheduled to be higher than has been decided by CAP reform. The butter market price tracks the increase in the intervention price under NCR, and this shifts production out of cheese and into butter. The shift of production into butter also increases the volume of SMP produced and this has the effect of reducing the SMP price.

Table 2-3: Impact of NCR for dairy variables.

	2006-2010 Average				2010-2014 Average			
	Baseline	Scenario	Abs. dif.	% dif.	Baseline	Scenario	Abs. dif.	% dif.
Production				thousand tonnes				
Cheese	8,531	8,515	101.07	-0.19%	8,596	8,551	-44.50	-0.52%
Butter	2,053	2,089	3.62	0.78%	2,043	2,064	20.14	0.99%
SMP	1,117	1,143	54.76	2.39%	1,094	1,130	36.19	3.31%
WMP	767	787	38.50	2.57%	755	782	26.79	3.55%
Consumption								
Cheese	8069	8055	0.05	-0.17%	8138	8094	-43.85	-0.54%
Butter	2067	2015	-0.01	-2.52%	2049	2007	-42.81	-2.09%
SMP	1046	1053	0.08	0.68%	1036	1049	13.31	1.29%
WMP	320	304	0.06	-4.76%	310	300	-10.38	-3.35%
EU Prices				euro/100kg				
Milk	26.24	26.72	0.49	1.87%	26.18	26.65	0.47	1.80%
Cheese	482.11	488.02	5.91	1.23%	482.15	487.36	5.21	1.08%
Butter	278.88	294.24	15.36	5.51%	274.99	291.66	16.67	6.06%
SMP	188.97	187.69	-1.27	-0.67%	189.34	187.31	-2.03	-1.07%
WMP	221.06	227.21	6.15	2.78%	219.24	226.04	6.80	3.10%

Enlargement and the GOLD model

When new countries are incorporated into a trading block or customs union the focus of economic analysis is often on questions of changing trade patterns. In the case of the enlargement of the EU to 25 member states and the agricultural sector the issue is more complex. Since the early 1990s, the transition to a market economy in many of the CEC has had a profound impact on the agricultural sectors of those countries. In the early years a reduction in consumption subsidies and an increase in input prices led to a cost squeeze that dramatically reduced both production and productivity. In recent years the agricultural sectors have stabilized, but can still be characterized as being less productive than their EU-15 counterparts. In Poland land ownership and operation is still fragmented in a significant part of the country. Upstream and downstream industries are also just emerging from the changes of transition.

If the models are going to be used primarily for the analysis of changes in the CAP then is it necessary to address these issues – which are primarily issues regarding the baseline. It is important to remember that the baseline is a projection that will be used for comparison purposes, and not a forecast of the evolution of the sector. Nonetheless it is important that it capture developments in the sector. The best example is for cereals. If we were to assume a rapid and full convergence of yields between the NMS and the EU-15, this would likely push prices in the EU-25 to close to intervention levels. This will impact on the results of any scenario that put pressure on crop prices; in this case the impact would be a build up of stocks, whereas if less yield convergence were built in the impact would be felt in price levels and their relativities.

SAPS, the SFP and CAP reform

As the NMS were concluding their accession agreement, Agenda 2000 was still the prevailing CAP policy. In the mid-1990s numerous studies were produced that postulated large increases in agricultural production in the NMS on enlargement – based on the CAP in operation at that time. By the time the accession agreement was being concluded, significant changes had been made to the CAP. The restrictions on the number of premia that could be paid, and the use of the late 1990s as the base year for these calculations, meant that the production stimulating effect of enlargement was reduced. In addition to this agricultural policy in the NMS had evolved to resemble its CAP counterpart in many countries.

The (further) decoupling of payments from production that was undertaken as part of the most recent reforms has further reduced the likely impact of the adoption of the CAP in these countries. However we have argued above that the SAPS/SFP should not be considered as fully decoupled and it is therefore likely to influence production. In the GOLD model payments are incorporated in the NMS in the same manner as for EU countries adopting a regional scheme, ie as a reduced value of the equivalent Agenda 2000 payment. Although the model impact of the introduction of payments is limited, incorporating the CAP is likely to influence the sector in other ways. Changes in the levels of market support affect market prices in ways the model is designed to capture, but the integration of the NMS into the CAP may have other impacts not captured by the model.

The impact of converging market prices is relatively straightforward in the model. There are other issues of CAP implementation that are more problematic. One of the uncertainties is regarding the implementation of set aside. Under SAPS there is no obligation to set aside land. Even after countries implement the SFP, they may be able to avoid set aside implementation for several years. Also, farms below a certain area will not have to implement set aside. Given the structure of farms in the NMS, and the fact that set aside will be spread over a larger area than would have been the case had Agenda 2000 been implemented, the impact of set aside will be less than in the EU-15. However, one might expect that enlargement might prompt a restructuring of farms into larger units that could influence the outcome.

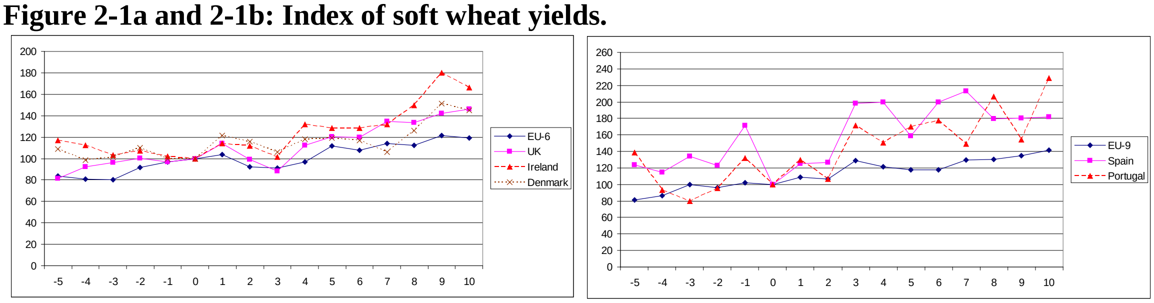
The Unknowables

In addition to the impact of the adoption of CAP reform, the act of enlargement itself is likely to impact on the evolution of the agricultural sector in other ways, through increased flows of investment, increases in competition etc. A comprehensive evaluation of these impacts is beyond the scope of this paper but two key issues are discussed here for illustrative purposed. The importance of assumptions regarding yield growth for crops has already been outlined above. Yields in the GOLD model are influenced by economic factors with an increase in the price of a product increasing yields, and an expansion of planted area having the opposite effect. The most important component of the yield equations is the exogenous assumption that is made about the rate of technological change.

As a result of the transition process, yields in most cases for the NMS fell dramatically. There are a number of approaches that could be taken in determining future yields. One could assume that relative yield between the NMS and EU-15 could return to their pre-transition levels, but high yields in the NMS in that period were boosted by subsidies on inputs. A convergence to EU-15 yields could be assumed, but to which levels, EU average or some country chosen as representative. This would involve making heroic assumptions regarding agronomic conditions in the countries. A further choice could be to assume no convergence.

The 2004 enlargement is not the first enlargement of the EU. Figures 1a and 1b show the evolution of soft wheat yields in countries involved in the first two expansions of the EEC/EC/EU. The figures show that in the period after accession in all cases yields grew faster in the countries that joined in relation to existing members. Prior to accession, it appears from this rudimentary measure that growth in yields was at or below the EU level. It is not possible to form strong conclusions from this as there are many other factors that influence the situation, with a different CAP in place, and differences between the members and those acceding. Nonetheless, if the CEC yields were to converge on those of the EU-15, it would not be unprecedented.

Figure 2-1a and 2-1b: Index of soft wheat yields.



Note: Year of accession =100.

In the model there is partial yield convergence – with the convergence varying by crop and by country, partially on the basis of existing differences between EU and NMS yields. In the first three years of accession some catch up is assumed, and thereafter yields in the CEC are assumed to grow faster than in the EU. For example, over the projection period EU-15 wheat yields grow by 10 per cent, but NMS-10 yields are projected to grow by 25 per cent, but remain 25 per cent below EU yields by the end of the period.

In the early months after accession some Central European livestock markets saw large changes in prices. In Poland, cattle prices pre-accession were half the level in neighboring EU-15 countries, and there was a rapid period of equalization. Account of these price differentials was built into the model, but it is harder to anticipate changes in the structure of industries themselves. CEC food companies have had to undertake widespread change in order to attain the kinds of standards of the EU-15, and where this continues to be the case CEC processors may struggle to compete with those in the EU-15. On the other hand, it may be that the populations of the CEC may be more open to establishment or expansion of, say, pig or poultry processing facilities than those of some EU-15 countries. The EU has witnessed the migration of the pig industry south within the EU-15, perhaps EU enlargement would prompt a move east.

The examples that have been outlined above have been chosen to illustrate areas where economic models have difficulty, but which nonetheless have to be incorporated in a modeling framework. The FAPRI approach is to address these through interaction with experts in the form of policy makers or people from industry. Where analyst judgements are made it is important to make these transparent.

Quantifying the impact of enlargement

The baseline for this scenario, as outlined above, includes both enlargement and CAP reform. Is it possible to use this to assess the impact of enlargement? It is difficult as we would have to think carefully as to what constitutes a non-enlargement scenario. The issue of the CEC becoming members of the EU has been on the table since the early 1990s, and although a timetable for accession did not appear until much later, there has been the expectation of enlargement for many years, with agricultural policies moving towards a CAP-like structure in many countries. In addition to this, the Europe Agreements began a process of market integration, although the liberalization of trade was slower than for other products given CAP sensitivities.

Therefore a scenario quantifying the impact of enlargement is not possible given the model as it exists. What is possible, however, is to remove from the model both the CAP, and the various adjustments that have been made such as those to yields mentioned above, and to observe the implications for the various markets. The model still solves for prices by clearing the EU-25 market, and therefore the model overstates the impact of changes in the NMS-10 on the EU-15 to the extent that market disturbances in the NMS might be reflected in a divergence in prices in that region rather than be fully transmitted to the EU-15 in the manner the model assumes. The scenario is therefore not very informative on the issue of enlargement but is useful in assessing the impact of the changes that we have made to the model.

Crops. Under the non-enlargement (NE) scenario crop area is higher, Table 2-4. This is primarily as a result of the fact that prior to enlargement the CEC were not subject to set aside. Production increases are much smaller than the increase in area because yield growth is not as high as in the baseline. Yields drop as the positive adjustment is removed, and lower prices and an expansion in area also reduce yields. The increase in production reduces EU prices and therefore EU-15 area falls slightly for cereals.

Table 2-4: Impact on NE scenario on crop variables, difference between baseline and scenario, 2014.

	NMS-10	EU-15	EU-25
Area			
Wheat	4.56%	-0.03%	1.02%
Barley	5.31%	-0.13%	1.08%
Maize	0.02%	-0.40%	-0.27%
Rapeseed	2.75%	0.52%	1.09%
Production			
Wheat	1.15%	-0.10%	0.12%
Barley	1.96%	-0.15%	0.21%
Maize	-1.91%	-0.44%	-0.79%
Rapeseed	0.09%	0.49%	0.40%
EU Prices			
Wheat		-2.83%	
Barley		-1.92%	
Maize		-2.40%	

Livestock and meat. The cattle sector results are dominated by the evolution of the herd in Poland. Under the baseline, dairy production is reduced dramatically to levels close to the quota. With this adjustment removed in the NE scenarios, the number of dairy cows is higher and this supports beef production, which therefore increases. The increases come despite the fact that beef cow numbers are significantly lower as a result of the increase in dairy cow numbers and lower prices. The removal of the SFP also has an impact, although this is much lower than would be the case if the comparison were to its Agenda 2000, more coupled, counterpart. Pork production in the NMS-10 is reduced because a positive adjustment to sow numbers in those countries is removed. The positive adjustment was included to proxy for some industry reorganization that would likely occur on enlargement, as a result of increased competition or investment from EU-15 countries.

The impact on the EU-15 and on the total EU-25 is muted by the relative size of the NMS-10, particularly with respect to the number of beef cows. In both the EU-25 and EU-15 none of the variables changes by more than 1 per cent. The NE scenario results in lower beef, sheep meat and poultry prices, with the decrease in pork production in the NMS-10 resulting in a small positive impact on EU-15 pork prices.

Table 2-5: Impact on NE scenario on livestock and meat variables, difference between baseline and scenario, 2014.

	NMS-10	EU-15	EU-25
Numbers			
Beef cows	-12.77%	0.11%	-0.74%
Cattle	2.46%	0.04%	0.31%
Pigs	-5.01%	0.68%	-0.52%
Sheep	2.35%	0.11%	0.06%
Production			
Beef	1.96%	0.05%	0.22%
Pork	-5.11%	0.84%	-0.16%
Sheep meat	-3.36%	0.08%	-0.05%
Poultry	0.18%	0.24%	0.23%
Consumption			
Beef	0.06%	0.09%	0.09%
Pork	-0.13%	-0.17%	-0.16%
Sheep meat	-0.11%	-0.05%	-0.05%
Poultry	0.17%	0.21%	0.20%
EU Prices			
Beef		-0.53%	
Pork		0.24%	
Sheep meat		-0.10%	
Poultry		-0.74%	

Dairy. The importance of assumptions made regarding the dairy sector in Poland has been highlighted by the discussion of the livestock and meat sector. Poland is responsible for about half of the NMS-10s production of milk. The adjustment that was made to subsistence production has a large impact on the NMS-10 markets. The knock-on effects on EU-15 markets are small, however, given the existence of quota, and the relative size of the two regions. EU-15 prices fall, but none by more than 1 per cent.

Table 2-6: Impact on NE scenario on dairy variables, difference between baseline and scenario, 2014.

	NMS-10	EU-15	EU-25
Production			
Cheese	2.90%	0.07%	0.30%
Butter	7.54%	-0.12%	0.78%
SMP	7.66%	-0.77%	1.43%
WMP	6.22%	-0.14%	0.46%
Consumption			
Cheese	0.13%	0.31%	0.29%
Butter	-0.16%	0.51%	0.42%
SMP	-0.37%	0.22%	0.10%
WMP	0.30%	0.84%	0.78%
EU Prices			
Milk		-0.69%	
Cheese		-0.59%	
Butter		-0.98%	
SMP		-0.70%	
WMP		-0.62%	

As has been noted below, the NE scenario is a rather artificial scenario that does not capture all the impacts of EU enlargement. It is difficult to determine an alternative situation where all the aspects of enlargement are incorporated given that even without accession there would have been some integration of the two markets through the trade agreements, or through foreign land ownership or some other transfer of EU-15 production techniques. All that the scenario really shows is that on the variables that we model, the adjustments that we are making to attempt to capture the transition process may have significant impacts on the countries concerned. The reform of the CAP really means that the impact of implementing the CAP in the NMS is likely to be limited.

The reader should not take this as an argument that either enlargement or the introduction of the CAP will have no major impacts. Clearly, the transfer of payments will see incomes of those who receive them rise dramatically, and this will impact on the evolution of the overall rural economy of the NMS-10.

Conclusions

The objective of this paper has been to focus on the practical aspects of the incorporation of CAP reform and enlargement in a partial equilibrium model of the agriculture sector. In some respects, these examples illustrate the strength and weaknesses of the type of approach that is used here. The advantages of a model such as GOLD is that it is relatively flexible, and can therefore be amended in an attempt to incorporate the idiosyncrasies of the SFP, for example. The disadvantage is that the modeler is often reliant on the input of research from outside of the model for key parameters, such as the decoupling coefficient. Where this is not available the model is not able to generate its own estimates of those parameters and therefore the calibration of the model is reliant on the available information, the judgment of the modeler and the input of the review groups.

The results that the models produce of the impact of CAP reform are largely consistent with those that have been reported by other similar models. The impacts are largest in the livestock sector where the Agenda 2000 payments were most coupled, whilst there is a limited effect in the cereals sector.

Reform has limited the impact of the introduction of the CAP in the NMS. It is likely that the introduction of SAPS and the SFP will have an impact on the evolution of the sector, but the larger implications may be for the rural economy as a whole as a result of the impact on incomes. Enlargement itself is likely to have a greater impact through access to EU markets, but in a number of other ways that are altogether more difficult to model, such as the acceleration of yields or the implications of different tolerances for certain agricultural practices.

As the modeling system is so reliant on the rather ad hoc approaches that are outlined in this model, criticism is often made as to the validity of the modeling exercise. The authors believe that models such as GOLD are capable of making valuable additions to the policy debate, where the ability of the models to capture the intricacies of the markets yields useful information for policy makers, whilst the assumptions that underlie the projections are made transparent.

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3. THE IMPACT OF ENDING DAIRY QUOTAS IN THE EU[6]

Abstract

Dairy quotas were introduced to the EU in 1984 in an attempt to stem the growing surplus in the dairy sector that was crippling the EU budget. In the years since then, most of the other sectors have undergone significant reforms that first replaced price support with direct payments and then dramatically reduced the link between these payments and production. Policy in the dairy sector has seen relatively few changes, but it now appears that quotas will be abolished for good in 2015. Estimating the impact of ending quotas is complicated by the fact that they have been in place for over 20 years, and are applied in different ways in each of the Member States. The enlargement of the EU also complicates analysis, since the dairy sectors in these countries are also undergoing restructuring after joining the EU market. In this paper an estimate of the impact of ending quotas is presented, along with an analysis of how this may be impacted by world market conditions or any agreement under the Doha Development Round (DDR).

Introduction

The EU has used a quota system to restrict dairy output since the mid 1980s, in response to a huge build up in public stocks that were a consequence of the previously open-ended

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[6] The work that underlies this paper was carried out as part of "Phasing Out Milk Quotas in the EU", a project co-ordinated by Drew Associates in 2008 for the UK Department for Environment, Food and Rural Affairs.

price support policy. Prior to quotas, the dairy CMO comprised primarily of high tariffs on imported products, coupled with support prices for butter and skimmed milk powder (SMP) that trigger intervention (public) purchases. The level of these support prices, coupled with increased production in the UK and Ireland after their accession to the EEC in 1973, lead to a persistent surplus that at one point was absorbing over 30 percent of the CAP budget. These problems were by no means restricted to dairy, with surpluses also appearing for other commodities, and the European Commission was forced to consider a range of supply control measures.

For the dairy sector the preferred method of supply control was the use of quotas that were allocated to the different countries according to their 1981 level of milk deliveries, with "superlevy" fines of over 100 percent to punish overproduction. These were then subjected to a series of reductions until the EU market found balance. With the exception of Italy[7], the quota system succeeded in bringing production under control. However, a continued surplus was disposed of through the occasional purchase of intervention stocks, but mainly through export subsidies that bridged the gap between world prices and the higher EU prices for butter, WMP, SMP and cheese.

The continued need for export refunds and budgetary cost of intervention stocks put pressure on the dairy CMO, but unlike most of the other commodities, it managed to stay mostly intact until the "Health Check" process in 2008. In the 1992 MacSharry reforms support prices were reduced by a modest 5 percent. In the 1999 Agenda 2000 reforms,

[7] In Italy the superlevy was not passed on to the producer and therefore production in that country usually exceeded production.

the dairy sector again avoided large scale changes, but support prices were reduced and direct payments introduced as compensation. Milk quotas were increased slightly, as compensation for the drop in support prices. In some respect this constituted a beginning of the phasing out of quotas. In the MTR reforms, that saw a massive change to the way that agriculture was supported in the EU, the only difference for dairy was the fact that the small direct payments were rolled into the single farm payment. Dairy reforms were included in the text as options for consideration in the future. Thus, dairy quotas persisted in the face of reforms to other sectors until the Health Check process, where the ending of the quota system was formally proposed for the first time.

In this paper the impact of the elimination of quota is examined using the GOLD model system. Given that over the period of the changes to the CMO there is a chance of a WTO agreement, the impact of reducing import tariffs and removing export subsidies is also included. A series of different simulations regarding possible alternatives regarding the end of dairy quotas is considered and compared to the 2007 EU baseline projection. The baseline is a constant policy simulation of the model under a series of exogenous assumptions principally of world prices and macroeconomic variables. The impact of abolishing the dairy quota is very dependent on the assumptions in the baseline, and therefore the model was simulated under some alternative assumptions regarding these exogenous variables.

The GOLD model

The GOLD model is a partial equilibrium model, comprised of a series of single equations that are not estimated but rather calibrated on historical data and assumptions regarding important parameters. The model includes wheat, barley, maize, rye, rice, soybeans, sunflower, rapeseed, oilseed products, beef, pork, poultry, milk, cheese, SMP, WMP and butter. In the model care is taken to incorporate the key economic, biological and policy drivers for each of the commodities. For example, milk prices are derived from dairy commodity prices and therefore can differ between regions. Cattle that are produced from the dairy sector are slaughtered and feed into the beef sector. When dairy quotas are in place they constrain milk production, and intervention purchases take place when prices fall below support levels.

The version of the model that is used in this analysis is of the EU-25. Regional disaggregation is different for supply and demand. Milk and dairy production is projected for France, Germany, Italy, Ireland, the UK[8], the rest of the EU-15, Poland, Hungary, and rest of the NMS-10. Consumption of products is modeled at the level of EU-15 and NMS-10, as a result of the lack of available data. The data for the model comes primarily from EUROSTAT and the European Commission, with the FAO providing some of the dairy data. The model is simulated in Excel. The model solves for French dairy product prices to clear the EU-25 market, with the French product prices transmitted back to the different regions wherein their weighted values determine milk prices.

[8] In this analysis the UK module was that which has been produced by Queens University Belfast, but was run simultaneously with the rest of the modeling system.

Changes in the dairy sector have impacts on other sectors, such as cereals, through changes in feed requirements. The biggest impact on other sectors, however, is on the beef sector where, for example, beef production and prices will be impacted by changing dairy cow numbers.

Exports and imports of dairy products are estimated separately. Exports are subject to the restrictions of the URAA (Uruguay Round Agreements Act). Export subsidies for dairy products are set at the minimum levels that keep market prices above support levels, which reflects the Commission's behavior in recent years. The high level of product aggregation makes it difficult to incorporate all the detailed issues surrounding trade. For example, the heterogeneity of cheese cannot be represented, given the lack of data available. However, each of the dairy products are modeled in a slightly different way in order to capture the different characteristics of the markets. When a policy scenario is undertaken, a reduced form world model is used which mimics FAPRI's global modeling system's reaction to changes in trade from the EU through representative world prices.

Prior to the Health Check proposals it has been largely acceptable to make the assumption that quota largely determined the output of milk.[9] In previous versions of the model, milk production was able to vary slightly as milk and feed prices moved, but only

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[9] Particularly in this version of the model where the UK, the only country where deliveries have been consistently below quota, is modeled separately.

in the short run.[10] In order to fully examine the phasing out or elimination of quota it was necessary to change the way that milk supply was determined in the model. The modeling problem is complicated by the fact that in this analysis the baseline must have quota in place and therefore determining production.

Where the quota is considered to be binding milk production is determined by two equations; milk production per cow and number of dairy cows. Milk production per cow is a function of a trend, the milk fat adjusted dairy quota, and milk price over input costs. The trend captures improvements in yield from technological advancements. Including the dairy quota (with an elasticity of 0.5) ensures that changes in production when quota levels are changed are evenly distributed between increases in cows and increases in yield. An increase in milk price relative to input prices results in an increase in yield.

Dairy cow numbers are a function of quota over milk per cow and milk price over input cost (current period and lagged). The former has a coefficient of one, which means that milk production is largely determined by the quota level. Milk cows and therefore production are also influenced to a small extent by prices. Under the quota system producers would respond to higher prices by increasing production to ensure that they could achieve their quota limits.

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[10] FAPRI used a similar model of the EU with different modifications than those incorporated here to analyse dairy quota elimination in 1999 (Teagasc, 1999).

In order to maintain the structure of the model (for baseline generation purposes) and to introduce the flexibility to examine a variety of quota elimination schemes an additional equation was incorporated. Planned milk production is give by the equation:

$$MKPPL_i = a + b MKSPRR_i\,(-1) + c MKPIR_i + d MKSFP_i + e MKBFP_i$$

Where $MKPPL_i$ is planned milk production, $MKSPR_i(-1)$ is lagged milk production, $MKPIR_i$ is the quota rent adjusted milk price over input cost, $MKSFP_i$ is milk payment over input cost, and $MKBFP_i$ is the adjusted milk price over the beef price with *i* denoting the region. The coefficients *b*,*c*,*d* and *e* are calibrated using the following matrix of assumed elasticities:

Variable	S.R. elasticity	L.R. elasticity
$MKPIR_i$	0.2	1.2
$MKSFP_i$	0.01	0.06
$MKBFP_i$	0.05	0.3

The values of these elasticities are determined from a review of studies whereby a short run elasticity of 0.25 and a long run elasticity of 1.5 for production relative to milk price is common. To the author's knowledge, no one has estimated the impact of the milk payment on production and so that it assumed to be very small. The final variable is intended to capture the fact that once the quota is removed then the dairy sector will be in direct competition with the beef sector for pasture (previously the profitability of the dairy sector has been large relative to the beef sector and therefore it has been reasonable to assume that there has been little competition).

The baseline is calibrated using assumed quota rents so that the planned milk production equals the adjusted milk quota. In scenarios quota rent is eliminated, which is modeled as an increase in milk price. Planned milk production is the maximum of the adjusted milk quota and the solution of the planned milk production equation. The model is therefore able to model a variety of situations; where milk price falls or cost increases cause milk production to fall below quota, the phasing out of quota, or the elimination of quota (in the model this is effectively the same as increasing the quota to a very large level).

The determination of quota rents is therefore a crucial determinant of the impact of scenario changes. Qualitative estimates of rent can be inferred from observable variables where the rights to quotas are trading freely. Unfortunately, this is not the case for many member states of the EU (with the exception of the UK, where their value is zero anyway). Estimating quota rents is beyond the scope of this study and instead they are taken from the literature, and adjusted appropriately given the time between their estimation and the period of analysis.

For the scenarios, rents are based on those calculated by Lips and Rieder (2005). In their study, quota rents for Austria and Germany were obtained from national experts in milk markets. An estimate of the total quota rents for the EU-15 is obtained from Klienhans *et al.* (2001). The other region’s rent are calculated by rescaling the rents for the remainder of the EU-15 estimated by INRA (Consortium INRA-University of Waginingen, 2002) in order to fit the total rent calculated by Kleinhaus *et al*. INRA used the EU's Farm Accountancy Data Network (FADN) statistics to determine the marginal cost at the quota level and from that the quota rent for each of the EU-15 member states.

Table 3-1: Rents used in the model, 1997 (% of milk price).

	Lips	INRA
France	0.22	0.35
Germany	0.20	0.35
Ireland	0.31	0.45
Italy	0.30	0.30
Other EU	0.19	0.37

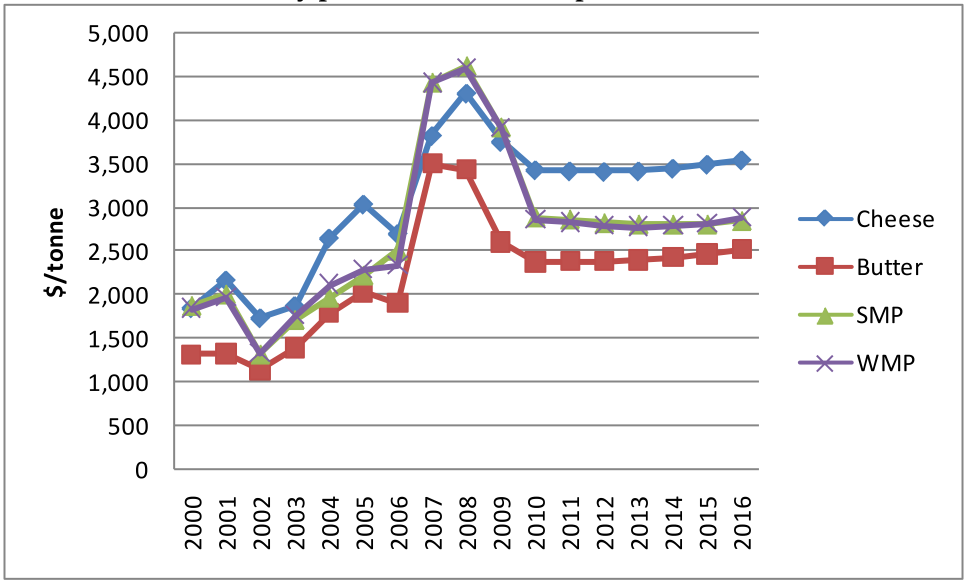
The EU-15 quota rents that are calculated as a proportion of the milk price and as stated are based on those calculated by Lips and Rieder (*op cit.*). The figures that this source used were for 1997, so in order for these to be relevant for the purposes of this exercise they have to be projected forward. This is achieved using milk prices that are projected as a matter of course by the GOLD model and by taking account of a cost index. The cost indices for the countries are based on FADN information. Feed costs are projected using GOLD projections of grain and meal prices; energy and fertilizer prices are projected using the Global Insight's oil price; and other costs are proxied by the GDP deflator and a constant. For Poland and Hungary, rents are determined by the difference between pre-accession and current year prices and costs, with other NMS-10 rents set at an average of these values.

The Baseline

The following baseline was generated in October 2007 based on data and information that was available at that time. It will be shown that the impact of the elimination of quotas and the WTO related scenarios is dependent on the projections of exogenous variables. The macroeconomic variables used in the baseline were obtained from Global Insight. The key macroeconomic variable for this analysis is the Euro/US dollar exchange rate. In the baseline, the US dollar depreciates rapidly to €/$ 0.69 in 2008 and stays around that level for the remainder of the projection period. The baseline assumes that policies in place at the time of its generation remain in place, along with any changes that have been agreed at that time.

The late-2007 EU baseline projects historically high prices for most commodities in the EU, despite the very strong Euro. Commodity prices are projected to be high due to a combination of factors including high oil prices and the impact of biofuels policies, drought in Australasia, and strong growth in Asian countries. In 2007 dairy prices were further buoyed by drought in Russia, the EU cutting its export refunds to zero, and strong cereal prices blunting dairy supply response. Prices were projected to fall in the near term but they remain high in historical terms throughout the ten-year projection period (see Figure 3-1).

Figure 3-1: Baseline world dairy prices, FOB N. Europe



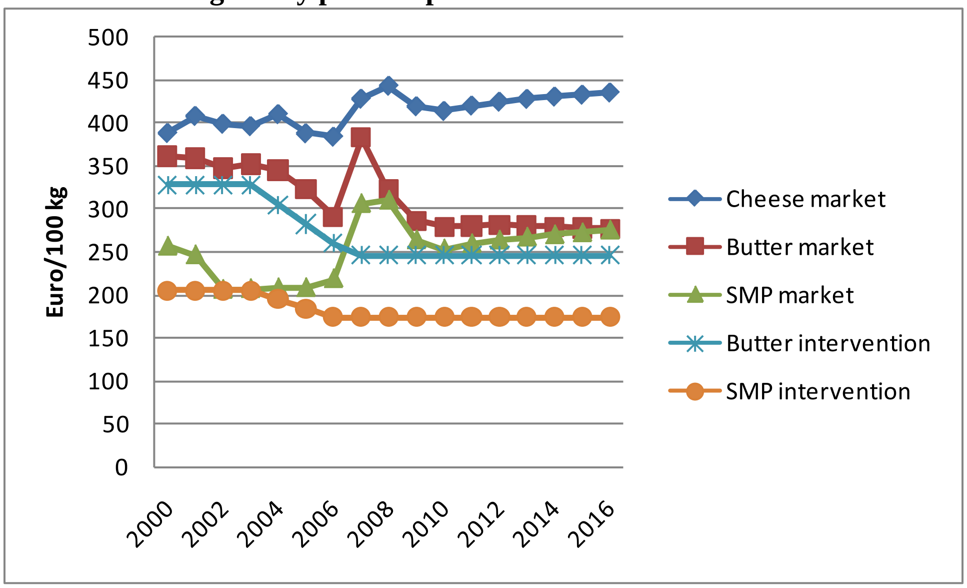
The EU-25 dairy sector baseline projections are provided in Appendix 3.1. In the projections all the countries are assumed to fill quotas with the exception of the UK and Hungary, where quota rents fall to zero. For Poland, total milk production falls since subsistence production is assumed to fall, and non-delivery quota is a significant proportion of overall output.[11] As a result there is a slight decrease in the volume of milk produced in the EU.

The relatively high levels of world commodity prices are transmitted to the EU markets with SMP and WMP exporting without subsidies. Once prices fall back, however, it is necessary to use export subsidies to export butter. Subsidy levels are increased until dairy

[11] In contrast to the EU-15, where almost 100 percent of milk for human consumption is processed through dairies, in the NMS-10 there is sometimes a high proportion that is consumed or distributed without a dairy.

product prices remain above their support levels and therefore stocks do not build.[12] Projected EU dairy product prices are presented in Figure 3-2. Strong demand for cheese boosts prices and also production over the projection period.

Figure 3-2: EU-25 average dairy product prices.

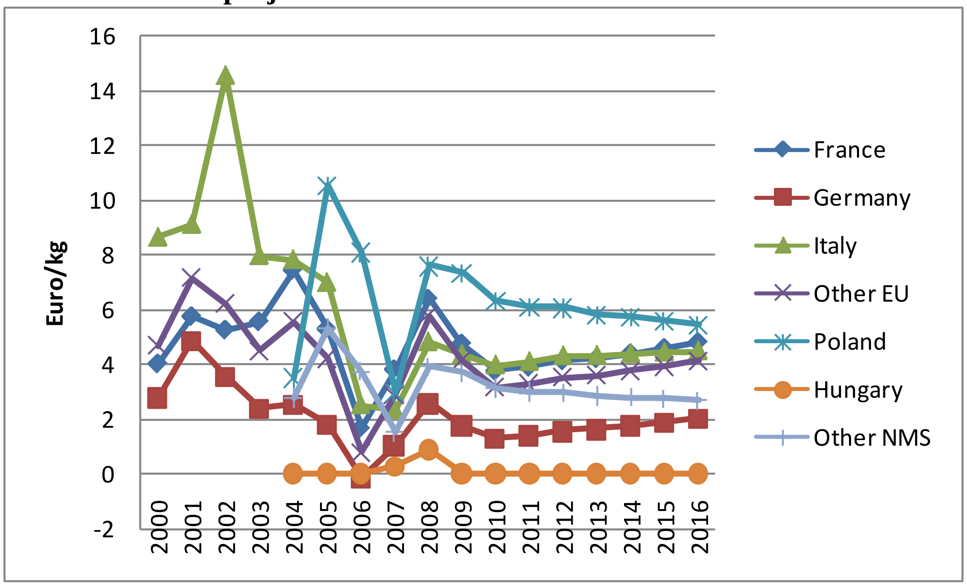


Quota rents are calculated as a proportion of the milk price for an average of 1997-1999. Thereafter actual and projected milk prices and input costs are used to project rents. The resulting quota rents are shown in Figure 3-3. The calculation of rents for the NMS-10 is problematic given the lack of data and the transitional nature of their agricultural sectors. Calculations yield large baseline quota rents for Poland throughout the projection period, suggesting that production potential is high in Poland. The production potential may be restricted by the rise in costs that producers have undoubtedly experienced as a result of meeting EU quality standards. Against this must be set the fact that accession into the EU

[12] Note that the butter price used is the EU average price, which includes the price in some countries where prices can be higher, even when the larger countries are selling butter into intervention.

has resulted in significantly higher dairy prices in Poland. Moreover, there is still room for more development of the sector as herd sizes are still very small. Also, the speed at which transition countries managed to meet their collections quota has surprised many and is an indicator of significant opportunity for expansion.

Figure 3-3: Baseline rent projections



Scenario Results

The details of the policy scenarios were decided by the Project Board for the FAPRI-UK project based in the UK. They were intended to represent a realistic interpretation of the information at that time regarding the likely future path of policy. They do not reflect the views of them, or the author, regarding the desirable path of policy.

Scenario 1: *Phasing out of export subsidies between 2009 and 2013, with 50% reduction in volume and value limits by 2010.* In conjunction with the phased elimination of export subsides, it is assumed that intervention prices are lowered, where necessary, to allow the markets to clear, thus avoiding the build up of intervention stocks.

Scenario 2: *Elimination of EU milk quotas in 2010, in conjunction with the phasing out of export subsidies between 2009 and 2013.* This scenario maintains the same assumptions as Scenario 1, with the exception that the EU milk quotas are abolished in 2010. 2010 was used to enable the full dynamics of the model to play out.

Scenario 3: *Elimination of EU milk quotas in 2010, in conjunction with reductions in EU import tariffs and phasing out of export subsidies between 2009 and 2013.* In this scenario EU tariffs agreed under the Uruguay Round Agreements Act are reduced by 65% for all products, apart from cheese, where the reduction is 60%. Tariff reductions are phased in between 2008 and 2013.

Scenario 4: *EU quotas are assumed to be expanded by 2.5% of the 2009 value each year between 2010 and 2015 (total 15%) and then eliminated with reductions in EU import tariffs and phasing out of export subsidies between 2009 and 2013.* This "phasing out" scenario is the same as Scenario 3 except that milk quotas are gradually increased rather than abolished.

Given the sensitivity of the model results to changes in exogenous assumptions, Scenario 3 was also simulated under alternative world price, quota rent and exchange rate assumptions.

Table 3-2: EU-25 dairy sector results for Scenarios 1 to 4, percentage deviation from baseline, 2016.

	Scenario1	Scenario2	Scenario3	Scenario4
Dairy cows	-0.3%	1.8%	2.5%	2.2%
Production/cow	-0.6%	-0.7%	-0.3%	-0.2%
Milk Production	-0.8%	1.1%	2.2%	2.1%
Cheese				
Production	0.1%	1.5%	2.7%	2.7%
Consumption	2.5%	3.6%	4.5%	4.5%
Imports	-2.1%	-2.9%	-3.4%	-3.4%
Exports	-49.0%	-41.6%	-36.1%	-36.0%
Butter				
Production	-3.8%	0.2%	1.8%	1.3%
Consumption	6.8%	7.8%	8.3%	8.2%
Imports	0.0%	0.0%	0.0%	0.0%
Exports	-70.7%	-49.0%	-40.1%	-42.9%
Skim powder				
Production	-9.0%	-7.2%	-6.0%	-6.0%
Consumption	-2.3%	-0.4%	0.8%	0.7%
Imports	0.0%	0.0%	0.0%	0.0%
Exports	-72.7%	-72.7%	-72.7%	-72.7%
Whole powder				
Production	-22.3%	-16.1%	-9.4%	-8.7%
Consumption	3.5%	3.9%	4.3%	4.3%
Imports	3.6%	3.9%	4.3%	4.4%
Exports	-71.3%	-54.1%	-35.6%	-33.6%
Prices				
Milk, 3.7% fat	-9.0%	-11.8%	-13.9%	-13.9%
Cheese market	-7.7%	-10.9%	-13.4%	-13.5%
Butter market	-28.2%	-31.5%	-32.9%	-32.6%
SMP market	0.5%	-4.2%	-7.2%	-7.0%
WMP market	-14.6%	-15.9%	-17.3%	-17.4%
Butter intervention	-30.0%	-35.0%	-35.0%	-35.0%
SMP intervention	0.0%	0.0%	0.0%	0.0%

The results of the four scenarios are presented in Table 3-2.[13] The elimination of quotas, under these assumptions regarding quota rents, and with export subsidies eliminated and tariffs reduced, increases milk production by approximately 2 percent. The increase in production is entirely comprised of an increase in cow numbers. As discussed below, this stems from a transfer of milk production to Poland and Ireland, where dairying is more extensive.

The elimination of export subsidies has little impact on dairy production as quotas continue to determine production (although it does move quota rents close to zero). In this baseline export subsidies were assumed for all of the commodities, and so if they are removed exports fall, with the reduction depending on the proximity of EU prices to world prices and the relative reliance on subsidies. For cheese, about half of exports have typically been achieved without subsidy, and so the fall is not as great as for the other products. WMP prices fall to world prices and therefore some exports are possible, but SMP and butter fall to minimum levels.

Butter prices fall hardest under this scenario, and it is necessary to reduce intervention prices by 30 percent to accommodate them. Butter production falls, and with it SMP production, the fall in SMP production is enough to offset the reduction in exports leaving price unchanged. Protein product prices fall less than fat product prices and so cheese production is unchanged. The reduction in milk price of 9 percent reduces quota

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[13] More details of the results are available from the author. The results are discussed in more detail in the Drew Associates report (*op cit*).

rents dramatically (the impact of eliminating export subsidies across all commodities has a small impact on feed prices, which are reduced by about ½ percent, Table 3-4).

Table 3-3: Country changes in milk production for Scenarios 1 to 4 percentage deviation from baseline, 2016.

	Scenario1	Scenario2	Scenario3	Scenario4
EU-25	-0.8%	1.1%	2.2%	2.1%
EU-15	-0.9%	-0.5%	0.7%	0.9%
France	-0.5%	1.5%	3.9%	4.5%
Germany	-0.5%	-3.4%	-2.3%	-1.7%
Ireland	-0.2%	15.5%	16.4%	11.8%
Italy	-0.9%	1.3%	2.7%	2.9%
UK	-3.5%	-6.0%	-6.7%	-6.4%
NMS-10	-0.5%	10.7%	11.4%	9.4%
Poland	-0.5%	19.5%	19.4%	15.5%
Hungary	-0.4%	-4.1%	-1.8%	-1.3%

In scenario 2, milk production increases by little over 1 percent. Yields fall, partially in response to lower milk prices, but also because milk production moves to countries with lower milk production per cow. Table 3-3 shows the impact of the scenarios on milk production in each of the countries. In the EU-15 as a whole production falls slightly as increases in Ireland[14], France and Italy offset falls in Germany and the UK. Most of the increase in EU-25 production is projected to come from Poland.

The increased production under Scenario 2 further pushes down commodity prices and therefore the milk price which is almost 3 percent lower than under Scenario 1, and 12

[14] The Irish component of the model was developed separately by staff at Teagasc, Ireland but simulated by the author. However, Teagasc staff provided input into the process and validated the results. It is widely accepted that Ireland would increase production significantly as a result of quota elimination, but this would also entail widespread restructuring of the industry within Ireland (Hennessy, 2007).

percent below the baseline. Prices drop for all products, and the further reduction is sufficient to allow unsubsidized exports of butter and WMP to be made. SMP prices stay above world levels and therefore do not benefit from any increased exports. The additional fall in butter prices means that butter support prices must be further cut, with intervention prices reduced by 35 percent.

In Scenario 3 tariff reductions are phased in between 2008 and 2013. The elimination of export refunds in Scenario 1, coupled with the ending of quotas in Scenario 2 leaves dairy products at or close to their world level. Tariffs in the dairy sector are very high, typically around 100 percent of their pre-2007 levels. Therefore reducing their value by 65 percent (60 percent for cheese) still leaves a tariff that can protect the EU market. Therefore there is no influx of product on to the EU market. In fact, milk production actually rises. Why?

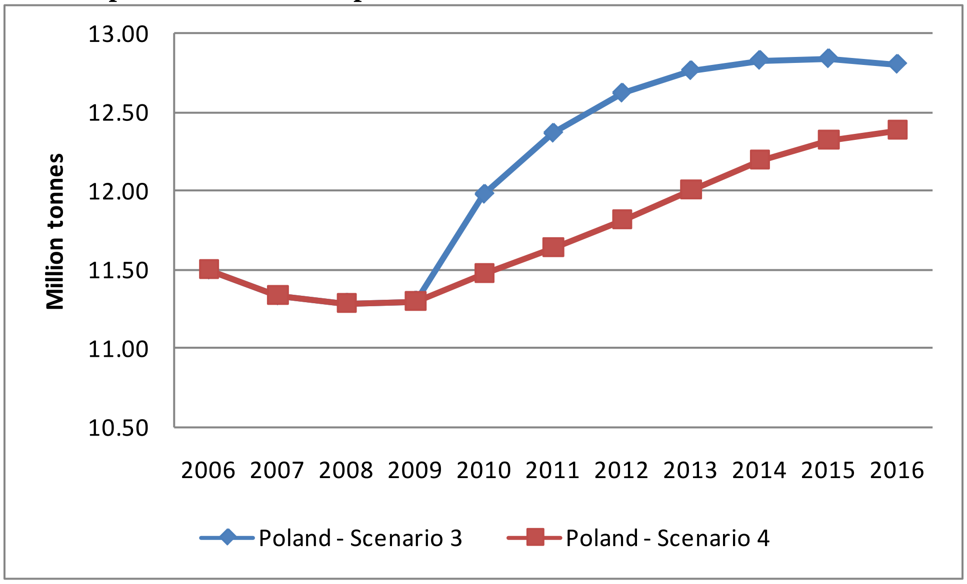
Table 3-4 shows the impact on the other sectors of the scenarios. In the baseline, export refunds are used sparingly for the commodities other than dairy and so in Scenario 1 changes are under 1 percent. The reduction in import tariffs, however, has a big impact on the beef sector. Like the dairy sector, the beef sector has tariffs that are close to 100 percent, but unlike dairy, these tariffs are not enough to protect the market. Therefore a reduction in tariffs is likely to have a big impact on prices, and in these scenarios the price reductions approach 20 percent. After quota is eliminated, the dairy sector will compete more directly with the beef sector. The price drop for beef *between Scenario 2 and Scenario 3* is bigger for beef than it is for milk, and therefore there is some shift of pasture into dairying, dairy cows replace beef cows, and milk production expands.

Table 3-4: Impact of scenarios on other commodities at the EU-25 level percentage deviation from baseline, 2016.

	Scenario1	Scenario2	Scenario3	Scenario4
Prices				
Wheat	-0.4%	0.6%	-0.9%	-0.9%
Barley	-0.4%	0.6%	-0.9%	-0.9%
Corn	-0.4%	0.7%	-0.9%	-0.9%
Beef	-0.2%	0.8%	-17.6%	-18.6%
Pork	-0.3%	0.0%	-2.2%	-2.4%
Poultry	1.1%	1.7%	-1.2%	-1.3%
Production				
Beef	-0.4%	-1.1%	-5.3%	-4.5%
Pork	-0.7%	-0.3%	-2.0%	-2.1%
Poultry	1.0%	1.0%	-0.5%	-0.6%

Having a phased elimination of quotas, like that of Scenario 4, will eventually produce identical results in the model as an elimination. But, over the time frame of these projections there are still some differences at the end. The path of production for the different countries will be different under Scenario 3 and Scenario 4. This is because the degree to which Ireland and Poland can increase production is constrained. The dynamic path of milk production in Poland is shown in Figure 3-4. Under the quota elimination scenario milk production rises rapidly, and all of the adjustment is carried out within 5 years. In the quota phase out scenario, however, milk production rises steadily over the period and there does not reach the Scenario 3 level by the end of the production period. This suggests that under the market conditions that are projected, Poland would prefer a rapid phase out of quota.

Figure 3-4: The path of Polish milk production under Scenarios 3 and 4.



Therefore in the other countries with positive rents, production will be higher in the earlier years. Since animals persist in the model for several years, the different paths of the dairy sectors for each country can persist, although they will converge in the end. One of the strengths of this modeling approach is that it can incorporate behavior such as this, which is important information to the policy makers in the Member States.

As has already been noted, in the scenarios, the model is simulated in conjunction with a reduced form model of the rest of the world, which mimics the response of the FAPRI world system to changes in EU trade. It is not possible in this model to incorporate the impact of changes under the WTO on other countries, so the changes in Table 3-5 are the response to EU trade only. The world market responses are modest, since although the percentage changes shown above are large, the actual tonnage in comparison to the world market for dairy products is small. This is an area of much uncertainty, however, and it has already been noted that the fact that the EU reduced its export subsidies to zero in 2007 was likely a contributing factor to the big run up in prices that year.

Table 3-5: Impact of scenarios on world commodities prices, percentage deviation from baseline, 2016.

	Scenario1	Scenario2	Scenario3	Scenario4
Butter	12.3%	8.0%	6.1%	6.5%
Cheese	2.1%	1.9%	1.3%	1.2%
SMP	1.4%	1.9%	1.6%	1.5%
WMP	6.9%	5.5%	3.9%	3.8%

Partly in order to address the concerns over world price levels, and also to isolate the importance of various assumptions, a sensitivity analyses was undertaken with respect to Scenario 3. The model was re-run using both higher and lower quota rent values.[15] Higher quota rents came from the INRA study[16] and are compared to those of Lips and Rieder in Table 3-1.[17] Zero quota rents in the baseline are also used. The results for the alternative quota rents, plus those for the other sensitivities are presented in Table 3-6.

[15] Due to the way that quota rents were calibrated, quota rent sensitivity analysis was carried out on the June baseline, but the results would not be significantly different to those that would have come from the using this baseline.
[16] Rents were adjusted for market developments since the estimations of rent were made, which accounts in part for the smaller production response shown here than studies based on the same rent estimates such as those published by the European Commission (2002).
[17] Note that both studies only produced rents for the EU-15. Rents for both the UK and the NMS-10 regions were the same in both simulations.

Table 3-6: EU-25 dairy sector results for sensitivity analysis, percentage deviation from baseline, 2016.

	Scenario3	INRA Rents	Zero Rents	Exchange Rate	World Price
Dairy cows	2.3%	4.6%	-1.7%	2.6%	0.8%
Yields	-0.7%	0.2%	-1.0%	-0.7%	-1.3%
Production					
Milk	1.6%	4.8%	-2.7%	1.9%	-0.5%
Cheese	2.4%	5.7%	-1.6%	2.0%	1.0%
Butter	1.0%	6.5%	-6.6%	1.9%	-2.4%
SMP	-4.7%	-1.5%	-15.3%	-3.1%	-18.9%
WMP	-14.9%	3.3%	-31.7%	18.7%	-40.8%
Price					
Milk	-13.2%	-18.5%	-5.7%	-3.8%	-15.4%
Cheese	-12.5%	-19.0%	-3.6%	-3.8%	-13.7%
Butter	-33.0%	-37.2%	-23.5%	-14.1%	-37.4%
SMP	-5.7%	-12.1%	1.2%	1.0%	-9.9%
WMP	-18.6%	-22.3%	-14.0%	2.6%	-26.7%
Butter Int.	-35.0%	-37.5%	-25.0%	-20.0%	-37.5%
SMP Int.	0.0%	0.0%	0.0%	0.0%	0.0%

Under the INRA rents, the increase in milk production is 4.8 percent in comparison to 1.6 percent under the Lips and Rieder rents. Production of all products is higher, and so prices are lower, with the milk price falling by 3 percent more than in Scenario 3 above. Clearly, quota rents are important. Two factors were considered when making the decision of which rents to use in the baseline. One was the input of industry experts in review groups. The other was the fact that we can observe rents in some markets, especially the UK. Both these sources suggested that these particular INRA estimates of milk quota were high. Colman (2007) argues that there is a systematic tendency to set quota rents too high.

In order to test the response of the model to lower rents, quota rents were set at zero in the baseline. The impact of the elimination of export refunds results in a reduction in milk production of 2.7 percent. In this simulation, since rents are equalized across regions, the drop in production is much more equally spread between a drop in cow numbers and a reduction in yield. The fall in prices is mitigated, with milk price only down by 5.7 percent in this simulation. Regional changes in milk production in the sensitivity simulations are shown in Table 3-7. It can be seen that the regional pattern of production changes is much more constant for zero rents in comparison to the other scenarios.

Table 3-7: Region changes in milk production for sensitivity analysis, percentage deviation from baseline, 2016.

	Scenario3	INRA Rents	Zero Rents	Exchange Rate	World Price
EU-25	1.6%	4.8%	-2.7%	1.9%	-0.5%
EU-15	-0.2%	4.4%	-2.7%	0.6%	-2.4%
France	2.7%	13.1%	-4.1%	3.6%	-0.3%
Germany	-2.5%	-1.8%	-3.6%	-0.8%	-5.1%
Italy	2.4%	-1.2%	-1.1%	0.1%	1.7%
NMS-10	12.9%	7.2%	-2.4%	9.6%	11.2%
Poland	22.2%	15.9%	-3.7%	17.0%	20.5%
Hungary	-2.0%	-7.6%	5.3%	-3.9%	-3.7%

The most important macro variable in the model is the Euro/dollar exchange rate, as it determines the competitiveness of EU products on world markets (in the model all world prices are denominated in dollars). In the baseline the Euro strengthens against the US dollar, moving from 0.80 Euro/dollar in 2006 to 0.71 Euro/dollar in 2016, so EU commodities become less competitive on world markets. Scenario 3 was re-simulated using a parity exchange rate, i.e. the Euro weakens relative to the dollar.

The weaker Euro increases the prices of all commodities in Europe, through an increase in the demand for exports. Prices rise most for cereals which are most closely integrated with world markets. Dairy product exports rise and with them prices, with the milk price about 10 percent higher in the exchange rate simulation relative to Scenario 3. Given that input prices rise further than the milk price, the impact on production is a more modest 0.3 percent.

Even though in the baseline world prices are projected to be below their 2007 highs for the projection period, they are still all above their respective levels in the early part of this decade. Therefore, the model was simulated with a 20 percent reduction in world dairy product prices. However, import tariffs are still large enough to protect EU dairy product margins, so the full 20 percent reduction in prices is not passed on to the EU market. The only impact that the reduction in price has is on exports. The impact is most fully felt by WMP and butter where in Scenario 3 price falls had been sufficient for the EU to export without subsidies, but the drop in prices meant that this was no longer possible. Exports of these bulk commodity products are assumed to be more elastic than those for cheese, where the products of the sector are more heterogenous.

Conclusions

The analysis of the ending of dairy quotas is highly problematic. Dairy quotas have been in place in most of the EU for over 20 years. The details of how they have been implemented in each of the member states are different. Sometimes, quota is traded freely, yielding an estimate of its underlying value, but more often there are restrictions to its transfer. Since estimation of quota rents for all of the countries is beyond the scope of this paper, estimates from the Lips and Rieder study are used as a basis for quota rents that are adjusted for market developments, with the results validated through industry expert groups.

The analysis suggests that even with projections of world dairy prices that are higher than those which prevailed in the early part of this decade, the elimination of export refunds would leave quota rents at close to zero. Milk production is only projected to increase by the order of 2 percent. However, this modest change at the EU level hides more dramatic restructuring of production between member states, with Ireland and Poland projected to increase production significantly, and within member states, as restrictions associated with quotas are removed.

In fact, under world prices that are at or below historical averages, it is changes that are made regarding WTO commitments that are likely to have a bigger impact. Under these conditions quota rents will be small, export subsidies will be needed to export products, and tariffs need to be significant to keep out imports. At high world prices, quota rents would be high, export subsidies are not needed, and lower tariffs are required to protect markets, so the elimination of quotas will have the bigger effect. Of course world prices are themselves linked to EU exports, and after the big price spike in 2007, the response of world markets to changes in EU policy is a potential source of significant market volatility.

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Appendix 3.1 Baseline Projections for the Dairy Sector.

Table A. Milk baseline projections.

	2005	2006	2007	2008	Average 2014-2016
			thousand head, end of year		
Dairy cows	23,389	22,971	22,207	21,931	20,106
			kg/head		
Production/cow	6,084	6,095	6,346	6,473	6,986
Fluid milk			million tonnes		
Cow's milk production	142.3	140.0	140.9	142.0	140.4
Milk quota	138.0	138.3	138.8	139.3	139.5
Other milk production	4.1	4.1	4.1	4.1	4.2
Fluid consumption	39.9	39.7	39.7	39.6	39.0
Manufacturing use	99.9	99.0	99.0	100.2	99.9
Feed use, net exports	6.5	5.5	6.4	6.3	5.7

Table 3B. Dairy product baseline projections.

	2005	2006	2007	2008	Average 2014-2016
Cheese			thousand tonnes		
Production	8,481.1	8,652.3	8,788.9	8,892.0	9,388.9
Non-EU imports	88.0	90.0	88.3	89.4	107.2
Domestic use	8,091.1	8,230.6	8,409.0	8,427.0	9,053.8
Non-EU exports	478.1	511.7	483.8	560.4	439.2
Ending stocks	497.6	497.6	482.0	476.1	511.6
Butter					
Production	2,179.4	2,080.6	2,100.1	2,066.0	2,098.2
Non-EU imports	74.0	80.0	80.0	80.0	80.0
Domestic use	1,946.5	1,924.6	1,808.9	1,870.2	1,890.8
Non-EU exports	337.9	276.0	409.3	294.8	286.3
Ending stocks	223.6	183.6	145.5	126.5	126.9
Skim powder					
Production	959.0	838.0	967.4	1,001.1	786.5
Non-EU imports	9.0	22.0	22.0	22.0	22.0
Domestic use	833.5	760.2	769.0	722.7	732.6
Non-EU exports	199.5	139.8	266.7	332.0	76.7
Ending stocks	197.2	157.2	110.9	79.2	49.8
Whole powder					
Production	792.6	773.5	746.4	845.7	500.3
Non-EU imports	20.0	20.0	14.7	14.9	16.7
Domestic use	301.8	305.6	303.4	307.8	340.6
Non-EU exports	510.9	487.9	467.3	555.9	176.0
Ending stocks	42.3	42.3	32.8	29.7	49.2
Consumption			kilograms per capita		
Fluid milk	78.3	77.3	77.0	76.6	74.4
Cheese	15.9	16.0	16.3	16.3	17.3
Butter	3.8	3.8	3.5	3.6	3.6
Prices			euro per 100 kilograms		
Milk, 3.7% fat	28.9	27.6	33.1	33.0	31.1
Cheese market	388.2	384.4	427.9	442.8	432.7
Butter market	322.5	290.3	382.3	322.5	278.0
SMP market	209.0	219.4	307.1	311.0	273.3
WMP market	242.0	247.9	319.1	311.7	244.8
Butter intervention	282.3	259.3	246.2	246.2	246.2
SMP intervention	185.0	174.7	174.7	174.7	174.7

4. LINKING A PARTIAL EQUILIBRUIM MODEL OF BIOFUELS TO EU AGRICULTURE MARKETS AND BEYOND.[18]

Abstract

In this paper a partial equilibrium model of biofuels in the EU is presented. The model runs simultaneously with FAPRI's pre-existing partial equilibrium model of the EU-27 agriculture sector, the GOLD (grains, oilseeds, livestock and dairy) model. The model is simulated to examine the impact of requiring that biofuels account for 10 percent of total transport fuel energy. The results illustrate the importance of biofuels policy on agriculture markets within the EU, as well as producing an estimate of the impact on world markets of changing biofuels targets. The introduction of the mandatory target significantly increases the demand for both cereals and vegetable oil. World cereals trade is more elastic with respect to price than in the case of oilseeds and therefore vegetable oil prices increase much more than their cereal counterparts.

Keywords: Biofuels, agriculture policy, partial equilibrium model

The impact of biofuels policies on agricultural markets is an issue that has received a great deal of recent attention beyond the agricultural economics profession. Despite some

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[18] A version of this paper, "Incorporating Biofuels into a Partial Equilibrium Model of the EU Agricultural Sector" by J. Binfield, P. Westhoff and E. Le Cadre, was published as part of the proceedings of t the 107th EAAE Seminar, Seville, Spain, 2008.

protestations that the impact that biofuels have had on agricultural markets are minimal, it is clear, particularly in the case of the oilseed market, that demand for crops as a feedstock for biofuels has been a major contributor to the record prices that these and other commodities command in 2008. It is therefore imperative that models of the agricultural sector, especially those for regions where there are significant biofuels industries such as the US or the EU, incorporate the demand for feedstocks for biofuels. The incorporation of the biofuels sector into the models, however, poses a number of challenges, especially through the rapid development of the sector, and the associated paucity of available data. In the EU modeling is complicated by the variety of policies that are in place, given that the different member states have chosen a variety of routes to achieving targets.

The 2003 Biofuels Directive (European Commission, 2003) prompted EU member states to introduce a variety of policies in order to meet their national targets for biofuel consumption. These policies were a combination of exemptions to specific taxes applied to fossil fuels, mandated levels of biofuel incorporation, and more complex policy tools combining these. It will be argued that the FAPRI approach and the GOLD model structure are appropriate for modeling the biofuels sector. The model comprises of a system of simple, single equations that allows the explicit incorporation of the important economic, biological, and policy relationships of the sector.

In the model the production of biofuels feeds into the agricultural sector through the conversion of biofuels production into its feedstock requirement. The GOLD model allows vegetable oil or cereals to be sourced either domestically or through imports. Increased demand for biofuels is therefore translated into increased prices for cereals, vegetable oil and oilseeds in the GOLD model. In the model, therefore, a policy increasing the demand for biodiesel can result in an increase in the import of either biodiesel, vegetable oil (either rapeseed, soy, or sunflower), or oilseeds. In addition it will stimulate EU oilseed production.

At present the model only incorporates the production and use of first generation biofuels. It is impossible to say if or when commercial production of second generation biofuels such as that derived from cellulosic material will occur. In addition, the fact that targets are expressed in terms of "renewable energy" has been stressed by the Commission and there is therefore a variety of options beyond biodiesel and ethanol available to member states to meet targets and none of these are modeled. The scenarios presented here therefore only address changing volumes of first generation biofuels and it is acknowledged that it was never the intention of the European Commission when formulating energy policy that all of the target for biofuels as a proportion of transport usage would come from these fuels.

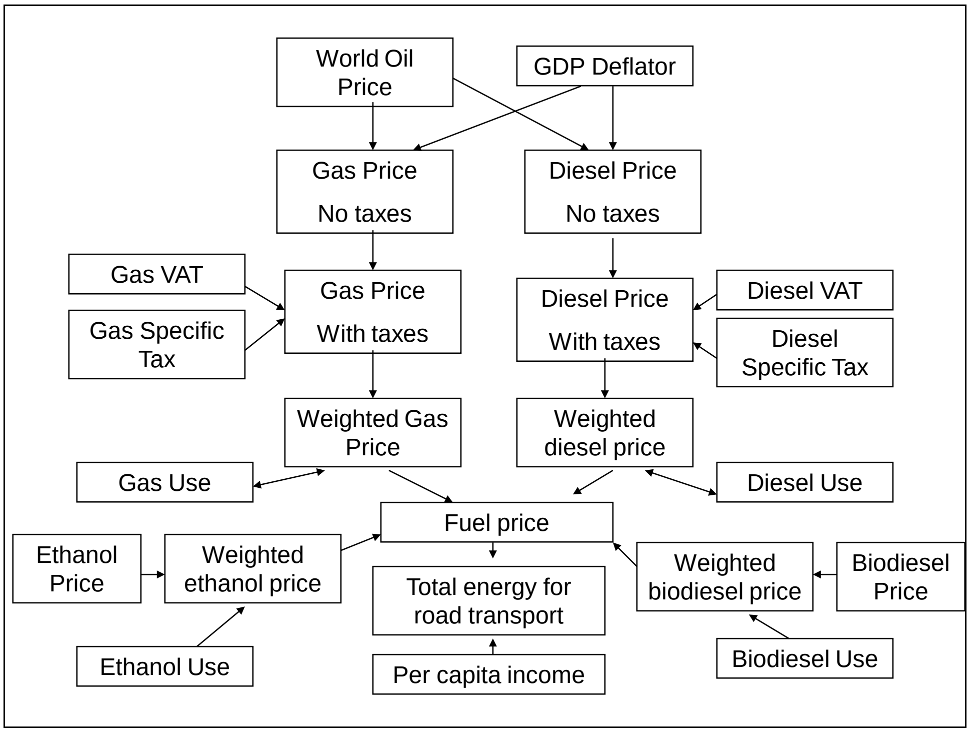
The Biofuels Model

Given that the national policies differ in each member state, an ideal biofuels model of the EU would require that each of the countries should be modeled, but that would lead to a model that would be too unwieldy to simulate in conjunction with the rest of the agricultural model. The model therefore separates some of the most important markets of France, Germany, Italy, the UK, and a 'rest of the EU' region. Within the rest of EU region an attempt is made to aggregate the policies imposed and weighting these where appropriate. The model estimates gasoline and diesel prices, fuel use for the transport sector and the supply and demand of ethanol and biodiesel for each of the regions. The model solves for EU ethanol and biodiesel prices by determining trade at the EU level.

A simple representation of the interaction between the biofuels model and the GOLD model is presented in Figure 4-4. The biofuels model takes the prices of feedstocks used for biofuel generation from the GOLD model, and the subsequent feedstock demand from the biofuels model is added to food and feed demand determined in the GOLD model. Data for the biofuels models comes from EUROSTAT, *Biofuels Barometer* (various years), F.O. Lichts' *World Ethanol and Biofuels Report* and various other *ad hoc* sources.

In the model an attempt has been made to endogenize certain aspects of the transport energy market, which allows different types of scenarios to be attempted. For example, it is envisioned that an oil price shock would be of interest. The influence of the transport sector on biofuels differs according to which type of policies the member states choose to attempt to meet their targets. If a tax exemption is chosen, then the price of fossil fuels is very important and the oil price will have a very direct impact on biofuels consumption. If mandatory blending rates are the preferred policy, then the oil price will have little impact if demand for transport fuel is inelastic, but in that case projections of total fuel use is needed. A simple model is developed, that can be aligned with external projections where available (for example, European Commission, 2006).

Figure 4-1: Energy market component of biofuels model.



In the energy model the world oil price and GDP deflator come from Global Insight, Inc. The gasoline and diesel price are from EUROSTAT and are determined by the oil price and the GDP deflator. At present in the model gasoline and diesel prices move together, but it is expected that as the proportion of diesel vehicles continues to rise then there could be some divergence between the price of the two fuels (Kavalov, 2004). In order to capture this correctly, however, a global energy model would be required.

For the most part the GOLD model is not estimated. Given the number of equations, estimating the whole model would be a massive undertaking. Also, data limitations mean that estimation is not possible for many variables where time series may only go back a few years. Even for agriculture there are questions whether estimation over a 20 year period is really meaningful, especially given the changes to the CAP and more importantly the economic transformation in the new member states. For biofuels, the lack of data and the recent change in policy means that estimation is not attempted. The approach in GOLD is to calibrate the model using parameters that are taken from the literature, or based on modeler judgement, and then the results are reviewed by experts including academics, policy makers and industry. Where there is enough data some estimation is carried out to validate the assumptions and this is the case for some of the equations in the transport energy sector where long time series are available.

The important equations from the energy model are:

$$\text{MGPRi} = f(\text{POILERAP}, \text{G3EITi}), \quad \text{DIPRi} = f(\text{POILERAP}, \text{G3EITi})$$

$$\text{FUTOTCi} = f(\text{FUWPRi}, \text{RGDPCi})$$

$$\text{DIPROPi} = f(\text{DIPRi}/\text{MGPRii}, \text{trend})$$

MGPRi = gasoline price; DIPRi = diesel price; POILERAP = oil price; G3EITi = GDP deflator; FUTOTCi = total energy use in transport; FUWPRi = weighted fuel price; RGDPCi = GDP per capita; DIPROPi = proportion of diesel in fossil fuel use.

The weighted fuel price is calculated by taking the prices of all the fuels, fossil and biofuels, and weighting by their level of use. Since the biofuels prices are determined endogenously in the model, changes in biofuels policies or agricultural markets can impact the total demand for transport energy, although that impact is small. The trend that is chosen for the proportion of diesel in fossil fuel use is an important variable, as it has a direct impact on biodiesel demand where there are mandatory incorporation rates. In these projections a trend is chosen so that diesel's share of total fuels increases at a decreasing rate, but still rises to 70 percent at the end of the period. Over the projection period the taxation policies of the member states with regard to fossil fuels are kept at current levels, although in the past in many countries the tax advantage for diesel has been reduced over time.

The way that the model is constructed means that any change in the price of biofuels is passed on to the consumer, implicitly through an equivalent change in the pump price. This is a significant shortcoming of the model; a more satisfactory structure would model margins along the fuel chain, but this would require more data. Also, the gasoline and diesel prices are assumed not to be influenced by the volume of biofuels sold. Making changes to the model to better reflect fuel market characteristics might not change the estimated overall impacts of policy change for agriculture, but it would have major welfare implications as to who ultimately shoulders the burden of policies.

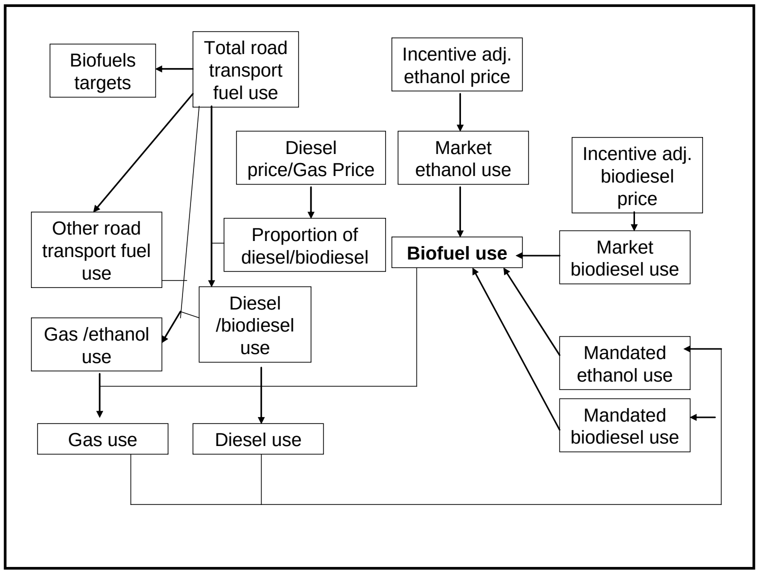
The output from the energy part of the model is an important determinant of the level of demand for biofuels. An attempt is made in the model to separate the demand for biofuels into three distinct categories:

i. Demand for biofuels that comes from sources such as public fleets where policies require that vehicles will always be operated using biofuels. Demand is very inelastic with respect to changing prices in this market.
ii. Markets where biofuels compete directly with fossil fuels (mostly with the aid of tax incentives), such as in the E-85 or B-100 markets, or when a blending rate decision is made based on relative competitiveness. This market will be much more elastic than (i).
iii. Mandatory incorporation or blending rates imposed by the member states, or by the EU in the case of the Renewable Energy Source Directive. Here demand is very inelastic, though in practice in the model there is a small response, in that higher biofuel prices will lead to an increase in the weighted fuel price and therefore a drop in the total demand for fuels. This effect is small given the low elasticity for total transport energy usage and the small role that biofuels take in meeting that demand.

A simplified diagram of the demand for biofuel is given in Figure 4-2. In practice, the demand equations are made more complicated by the diverse policies operated at a member state level. The schemes in operation in the UK and France operate like a mandatory level that is binding for a range of biofuel prices. If biofuels prices rise to a very high level then the limits under the Road Transport Fuel Obligation (RTFO) and Tax Generale sur leas Activites Pollutants (TGAP) will not be binding. The different demand equations for the countries attempt to take this heterogeneity into account.

Separating demand and supply in this way, and in particular the modeling of policy appropriately as impacting on demand or supply has the ability to capture facets of market behavior not addressed by models that do not make this decomposition. For example, the model projected a drop in both consumption and production of biodiesel in Germany for 2007. The former was due to a change in policy away from tax incentives to a mandate and a reduction in the competitiveness of B-100, and the latter was due to an erosion in returns as vegetable oil prices were projected to rise faster than biodiesel prices as a result of excess capacity. This example illustrates the benefits of using this type of model structure.

Figure 4-2: Biofuel demand in the model.



The equations for the demand component of the biofuel model can be summarized as:

BDTOTCi = f(max((biodiesel/diesel pump price, biodiesel/diesel refinery price), country level mandated volume, EU mandated volume)))

ETTOTCi = f(max((ethanol/gasoline pump price, ethanol/gasoline refinery price), country level mandated volume, EU mandated volume)))

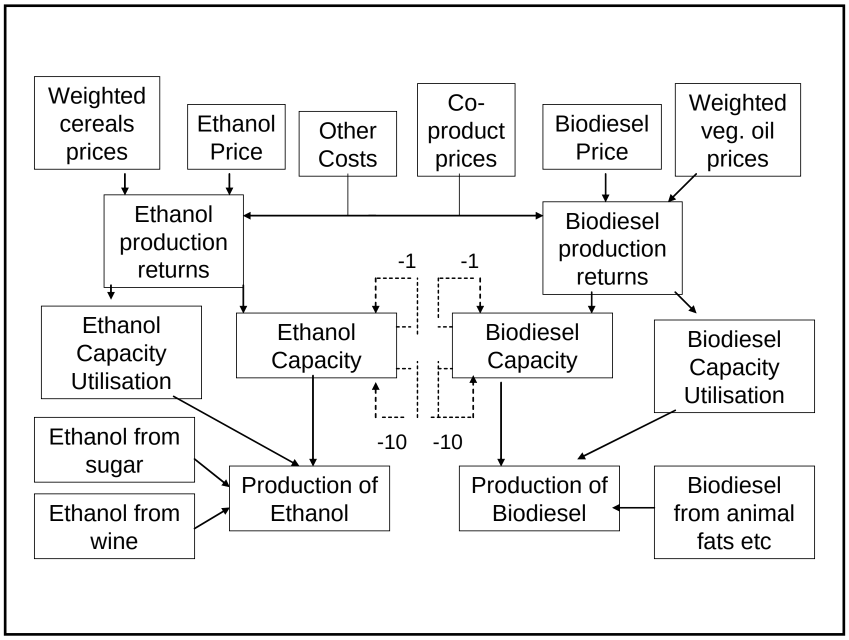
BDTOTCi = biodiesel transport energy usage, ETTOTCi = ethanol transport energy usage

The specific structure of the country and regional models differ, but in each case several markets are assumed to operate. The lack of data for these different markets makes the calibration of this part of the model difficult. However, there is some historical and *ad hoc* data on which to base assumptions. The actual specification of the equations in the model incorporate estimates of each of the market so that where there is no mandate, or where biofuels are very cheap relative to fossil fuels, demand can be very responsive to changes in fossil fuel prices or changes in the price of biofuels. Over the range of biofuel/fossil fuel prices that means that when mandates are binding demand becomes very unresponsive to price changes.

As most countries switch to some sort of mandatory use or blending rate approach, the need to segregate the markets like this becomes less important. One reason the policy change has occurred in the case of biodiesel is that increases in biofuels prices have increased the cost of maintaining the competitiveness of biofuels with their fossil fuel counterparts.

The production component of the model is based on the approach taken by FAPRI-MU in their US modeling system. In this approach shown in Figure 4-3, the capacity of the industry is estimated first, then capacity utilization, which together give production. Separating production into these two components separates investment and current production decision and more closely approximates to the way that the industry actually works. In our baseline projections, for example, capacity growth stalls in the near future given low margins in the industry, but as mandated blending rates push up prices, margins recover and the industry expands.

Figure 4-3: Production of biofuels in the model.



The equations of the model can be summarised as:

BDCAPi = BDCAPi(-1) – 0.05*BDCAPi(-10) + f(BDNRTi/GDPDi (lag 0 – lag3))

BDUCROi = f(BDNRTi/GDPDi)

ETCAPi = ETCAPi(-1) – 0.05*ETCAPi(-10) + f(ETNRTi/GDPDi (lag 0 – lag3))

ETUCROi = f(ETNRTi/GDPDi)

BDCAPi = biodiesel capacity, BDNRTi = biodiesel net returns, ETCAPi = ethanol capacity, ETNRTi = ethanol net returns

The capacity in the current period is therefore determined by the capacity in the previous period minus some loss in capacity that is assumed to become obsolete, plus additional capacity (which could be zero) based on a set of lagged returns to the industry. The coefficients on these returns in the equations are weighted to represent the fact that it takes several years to plan and build capacity. Utilization is based on current period returns and is constrained between 0 and 100 percent using a logistic function.

Returns are the key variables in these equations and it is difficult to obtain comprehensive data on the costs and profits of the industry. The returns that are used in this simulation come after a review of the various published estimates of returns that are available in the public domain (such as International Energy Agency, 2004; FAS/USDA, 2003). At present in the model virtually identical returns are used for each of the countries (differing only by the cereals prices produced for each country by the GOLD model), and are based on producing ethanol from wheat and biodiesel from rapeseed. This is an area where greater access to data will improve the model significantly.

Once the volume of ethanol produced is determined then that is converted into cereal equivalents. The cereal demand is divided up into demand for wheat, barley and maize on the basis of historical use. Some substitution between the cereals is allowed on the basis of relative prices. Biodiesel comes from rapeseed, soybean or palm oil (or an “other” category). Limited substitution is allowed but, overall, the fact that there are technical restrictions on the type of biodiesel that is used is respected and most of the biodiesel comes from rapeseed in both the baseline and the scenario below.

At present non-cereal sources of ethanol are determined outside of the biofuels model. There is no wine model and ethanol from that source is assumed exogenously. Ethanol from sugar is determined in the sugar model, and there is feedback between that model and both the rest of the agricultural sector through crop returns and the biofuels model through the price of ethanol, which together determine the amount of non-quota beets that are produced. All non-quota beets are assumed to be converted to ethanol.

Production and consumption are estimated at the country/region level detailed above but the model is solved for prices at an EU-25 level. At present in the model stocks are ignored due to lack of data and the model is balanced on net trade. The net trade equations are simplified as:

BDNED25 = f(preferential agreements, world biodiesel price/EU biodiesel price)

ETNED25 = f(preferential agreements, world ethanol price/EU ethanol price)

BDNED25 = biodiesel net trade for the EU-25, ETNED25 = ethanol net trade for the EU-25

Net trade is estimated using the volume imported under trade agreements and then on the basis of the relationship between the world price and the EU price comparison, taking into account the cost of transportation and tariffs. The trade equations are a key part of the model but also one of the most difficult to specify. Firstly biofuels can be imported in a variety of forms such as B-100, B-99, or B-5 in the example of biodiesel and these face different tariff restrictions. As far as the EU targets are concerned, imported biofuels count as much as their domestic counterparts. However, in some cases imported fuels may not receive the same benefits as domestically produced fuels in terms of tax incentives, and may also be hindered by the variety of different standards that are applied across the EU. Import demand, therefore, may not be perfectly elastic with respect to relative prices of domestically produced and imported biofuels.

Additionally, in the case of biodiesel, the countries most likely to export directly to the EU are the US, Brazil and Argentina, countries who are most likely to make their biodiesel from soybeans. Biodiesel from soybeans has been blended in increasingly high proportions.

The GOLD Model

The GOLD model is a partial equilibrium model of the EU agricultural sector that has been used in the past to examine policy changes such as proposed changes under the Doha Development Round and the reform of the CAP under the Mid Term Review. It includes corn, barley, wheat, rye, rapeseed, sunflower seed, soybeans, beef, sheepmeat, pork, milk, butter, cheese, skimmed milk powder (SMP) and whole milk powder (WMP). In able to address the biofuels market the commodity coverage has been extended to include sugar.

The GOLD model country coverage for the supply side is greater than in the biofuels component, with Europe disaggregated into France, Germany, Ireland, Italy, the UK, other EU-15, Poland, Hungary, the other NMS-10, and the NMS-2 (Bulgaria and Romania). Due to a shortage of data, the demand side of the GOLD model is restricted to EU-15, NMS-10 and NMS-2. The model solves for prices by determining net trade for the EU-27 as a whole.

The introduction of targets for biofuels is only one of several significant changes that have impacted on the EU-27 agricultural sector in recent years. In 2004 the EU enlarged to 25 countries, and then Romania and Bulgaria joined in 2007. Modeling enlargement has its own challenges (Binfield et al, 2005), and this has been compounded by a reduction in data availability. Presently the model uses EUROSTAT data wherever this is available, and supplements it with data from the European Commission and the USDA PS and D where appropriate.

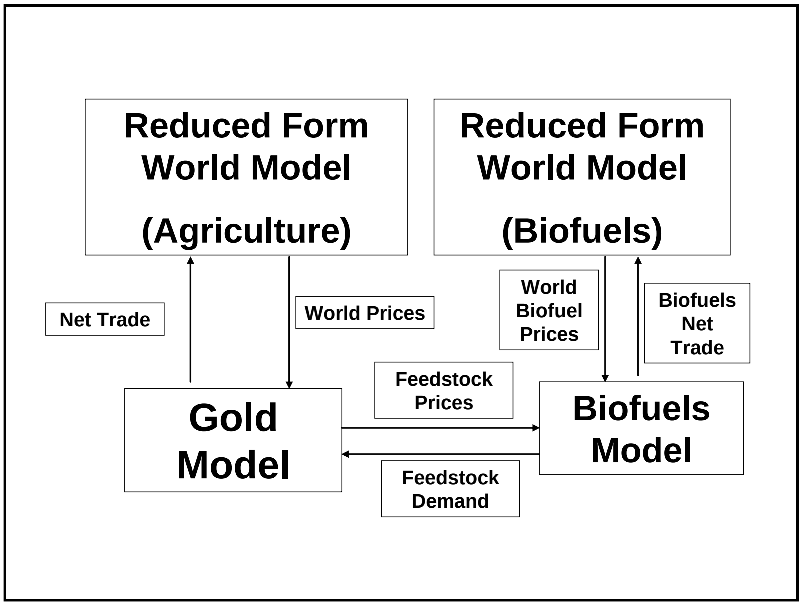
The CAP has also seen significant changes in recent years with the Mid-Term Review (MTR). Many of the direct payments that were formerly linked to production through their payment on a per-hectare or per-head basis, are now incorporated into the Single Farm Payment (SFP). Political compromise resulted in the ability to pay some of the money in the old, more coupled manner and this has reduced any production reducing impact that the reform would have had (see Binfield and Westhoff, 2003, for an analysis of the MTR using GOLD).

It is still early to assess the actual impact of the reforms under the MTR, which were arguably likely to be small for most commodities. The old payments were already significantly decoupled and the countries took the option to retain coupled payments where they were projected by FAPRI to have the biggest impact – the beef sector. In any case, developments in commodity markets, in some cases as a result of biofuels policy in the US and the EU, have dwarfed the impact of enlargement and CAP reform.

Interaction with World Markets

The GOLD model is capable of operating simultaneously with FAPRI's global modeling system, but in most cases this is not practical given the degree of manpower needed to simulate the whole modeling system. For the baseline (a constant policy, normal weather simulation that forms a yardstick for policy evaluation), world prices are determined as exogenous and come from the FAPRI global system. When the model is used to generate a policy scenario, reduced form equations that mimic behavior of the global system are used to estimate the impact of changing EU biofuels trade on world prices.

Figure 4-4: Biofuel/GOLD model interaction.



In the scenarios that are outlined below, the interaction of the EU model with the rest of the world is crucial. Unlike the US, where a much greater proportion of biofuels and their feedstocks are sourced from within the country, the EU imports a great deal of the biofuels requirement, given land constraints, this proportion is likely to increase. However, developments on world markets in the past year mean that we have to question the validity of the reduced forms that we have for the rest of the world.

The reduced form model responds in a linear fashion to changes in trade from the EU. In the case of wheat we have seen that as the world price rises, countries erect barriers to exports and reduce barriers to imports and therefore change the response of the world market to trade from the EU. For biofuels, as demand for rapeseed has increased, there has been substitution in food use for other vegetable oils, but it is likely that as demand for biofuels increases this substitution will become more difficult. In the future, therefore, it is likely that a more complex specification of the reduced form world model will be desirable.

Deriving a reduced form for the biofuels world biofuels market is also problematic. The global biofuels model for the FAPRI global system is still under development so the equations that are used here have been constructed independently. The specification of the models is complicated by the fact that an increase in the demand for imports of biodiesel will also impact on the world price of vegetable oils, therefore requiring linkage between the reduced forms for agricultural products and for biofuels. Estimating trade in biofuels is difficult itself, given the policy environment, but it is also difficult to project how the rest of the world will react. Will the US or South America provide the fuel, or could Russia or the Ukraine provide significant quantities of rapeseed derived biodiesel, given an ambitious EU policy and corresponding prolonged high prices of biofuels?

The Impact of Meeting Different Targets

FAPRI has never projected in its baselines that the EU meets any of the biofuel use targets that it has set through first generation biofuels. This can be interpreted in two different ways. A serious attempt to meet the 10 per cent target would have significant impacts on the prices of feedstocks that would be unacceptable politically within the EU. Alternatively, the projections can be consistent with the EU meeting its targets, but with the missing biofuels coming from outside the system in the form of second generation fuels or, say, electric vehicles powered by electricity from renewable sources.

In this paper three sets of figures are presented. In the current baseline (FAPRI, 2008) the share of biofuels in EU transport fuels is projected to be 5.7 per cent in 2018. This number is higher than that in previous baselines on the basis that the EU has been aggressive in sticking by its biofuels policy even in the face of much criticism. By increasing our baseline usage to this level it may be that FAPRI has moved from being projecting one of the lowest share of biofuels to transport fuels to one of the highest, given the current feelings surrounding the industry. Against this yardstick two scenarios are run: one where 10 per cent of the total transport fuel comes from biofuels, and one where this is assumed to be 2 per cent. For simplicity it is assumed that each of the fuels contributes the same proportion of its total fossil fuel equivalent usage. Since the baseline was generated using an aggregated EU-27 model the more disaggregated country level model was calibrated to the baseline for the production sector.

The results of the scenarios for the biofuels sector are given in Table 4-1. Achieving the 10 per cent target requires ethanol consumption to rise by 61 per cent from the baseline, and 91 per cent for biodiesel. Production of biodiesel rises by more than ethanol. The model is specified in such a way that imported ethanol is a closer substitute for domestic biofuels than biodiesel (given the restrictions on using soybean based biodiesel), so more of the increase in ethanol consumption is filled by imports than in the case of biodiesel. The price of ethanol rises by 97 percent and the price of biodiesel rises by 60 percent. If all of this price increase were passed on to fuel consumers then this implies an increase in fuel prices of 7 per cent over those in the baseline, before considering the impact of biofuels on the price of gasoline and diesel fuel. Increased biofuel use should, all else equal, slightly depress prices for fossil fuels, but there are no estimates as to the magnitude of this effect.

The results of restricting biofuels consumption to just 2% of the total are the mirror image of the 10 per cent scenario. The big difference is that the price fall is much smaller than the increase under the 10 per cent scenario. The reason for this is that under the 10 per cent scenario utilization rates have to rise to very close to 100 percent which, given the non-linear nature of the utilization function requires a very high price. This example isolates two important issues with the models. The first is in a situation like this, the price rise depends on the evolution of capacity in the industry. If the Commission stated (and producers believed) that the targets would be met no matter what happened to agriculture markets or what the price of biofuels might be then it would be reasonable to assume that the industry would expand in anticipation of higher returns.

The other issue is the response of imports. Implicit in the model is that there are restrictions on the volume of imports given the feedstock that is thought likely to predominate in large exporting regions. Obviously, what is assumed here is crucial to the results of the model.

Table 4-1: Results of alternative binding targets on the biofuels sector.

	Baseline	10% of Total	2% of Total
Ethanol	000 tonnes	% change from Baseline	
Production	8,347	54	-59
Capacity	10,199	27	-41
Utilization	82%	(99%)	(57%)
Consumption	9,490	61	-68
Net imports	1,143	110	-135
	euro/m3		
Price	649	97	-34
Biodiesel	000 tonnes		
Production	12,854	94	-62
Capacity	15,708	59	-42
Utilisation	82%	(100%)	(53%)
Consumption	13,695	91	-62
Net imports	841	46	-57
	euro/m3		
Price	1,254	60	-32
Biofuels of total fuel	5.50%	(10%)	(2%)

Figures in parentheses are levels rather than changes from the baseline.

From the standpoint of the industry, the price increases for the biofuels are large, but it is not unreasonable to assume that a 7 per cent price increase could be passed on to the public if they thought that there was genuine benefits in terms of greenhouse gas savings. However, Table 4-2 shows that the impact on the oilseed markets is improbable.[19] Although higher rapeseed prices do result in a higher rapeseed area, 13 per cent extra area is nowhere near enough to produce the necessary feedstock for the biodiesel industry. There is therefore a need for a trebling of imports of rapeseed oil. The reduced form model suggests that this would result in a rise in price of nearly 40 per cent for rapeseed

[19] At least in the short run. In the longer run a sustained very high vegetable oil price could increase expansion of vegetable oil production into other regions.

oil but this seems small as it is difficult to imagine where this extra oil could come from. What is crucial here is the ability of other users to switch away from rapeseed oil to other vegetable oils. The reduced form should be able to capture some of this impact, but ability of the reduced form to capture the impact of disruptions on this scale has to be questioned. As the EU biofuels industry has expanded then some substitution out of rapeseed oil has already occurred, and it is likely that in the future further shifts will require a bigger price differential as the elasticity of substitution falls.[20]

Table 4-2: Impact on the agricultural sector of meeting alternative targets.

	Baseline	10% of Total	2% of Total
	000 ha	%	%
Rapeseed area	7788	16	-13
	000 tonnes		
Rapseeed oil imports	3164	293	-187
	euro/tonne		
Rapeseed oil price	1134	39	-25
	000 ha		
Wheat area	26217	0	-1
	000 tonnes		
Wheat net exports	3.21	-148	146
	euro/tonne		
Wheat price	146	13	-11

In the cereals market, however, the extra ethanol can be produced by reducing the surplus of grain. Under this scenario the EU becomes a net importer of grain, and the wheat price only rises by 11 per cent.

[20] The asymmetry in rapeseed oil imports reaction is due to the fact that under the higher target, most of the additional production is imported in one form or another while under the lower target the proportion of domestically sourced fuel increases.

It is clear from the results that the EU biofuels policy can have a significant impact on world markets. Nonetheless the results here tend to reinforce the argument that they are probably not the sole reason for record highs seen in commodity markets. Indeed in reality in the cereals market, for example, it is likely that the weather problems in Australia and Europe were major contributors, with US policy and its focus on ethanol having a greater effect than the EU's. Chinese imports of vegetable oils have continued to grow despite rising prices at a rate similar to the increase in the use of vegetable oils for biofuels.

A major reason why prices for commodities increased, especially wheat, was the policy response to the higher prices. Importers such as the EU increased access to their markets as prices rose through reducing tariffs. Meanwhile, major exporters such as the Ukraine placed restrictions on their exports in an effort to keep domestic prices down. In the current reduced form world model the response of world prices for commodities is linear in response to changing trade from the EU, but in practice supply and demand can become increasingly inelastic as prices rise. In the rice market prices increased dramatically in the early part of 2008, and this is often held as an example of why the impact of biofuels has been exaggerated, but there has been a substitution of wheat and rice in diets, especially in countries like India and China and it may be that the escalating wheat price increased peoples' fears of this happening in the rice market. If part of the wheat price spike was caused by biofuels then they could also be argued to have had an influence on the rice situation.

Conclusions

Any model for the analysis of agricultural markets needs to incorporate the biofuels industry. Unfortunately the sophistication of these models is hampered by the lack of data, particularly historical data, for biofuels production. Models cannot therefore be econometrically estimated. In the EU the problem is a complex one since although the EU has issued a target, each of the member states have their own policies for reaching their targets. There are a plethora of agricultural products used and produced by the industry and there is not a single commodity that is not influenced in some way by biofuels.

In particular, the results from the model are sensitive to the conditions under which trade in biofuels is undertaken. While there are clearly established tariffs for ethanol and biodiesel there are still issues regarding technical specifications that will influence the ability of other countries to supply the market. Also, some countries are already arranging to import Brazilian ethanol under bilateral agreements.

The results of the model suggest that it is unlikely that the EU will be able to reach a 10 per cent target of biofuels usage of transport fuels with just first generation fuels given the likely impact on the vegetable oil markets. That in itself is not a surprising conclusion and it was probably never the intention of the Commission that this would be the case.

Whether or not the target will be reached will depend on the extent to which alternative technologies can be harnessed.

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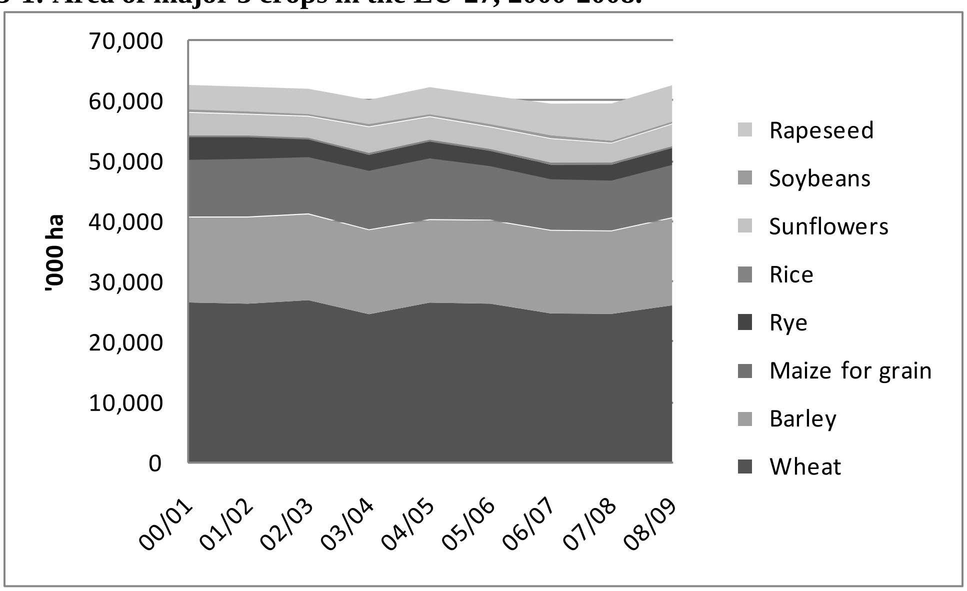
5. CONCLUSIONS AND FURTHER WORK

It is hoped that the preceding papers have given an insight to the huge changes to policy that impact agriculture in the EU over the last 10 years. In evaluating the impact of these changes it is instructive to look at the evolution of key variables for the EU-27 over that period. Consider the path of crop area shown in Figure 5-1. Despite the major changes that have been made to policy influencing the sector, and the volatility in prices in the sector, area planted to the main crops has been remarkably stable, with most of the variation due to drought in southern Europe.

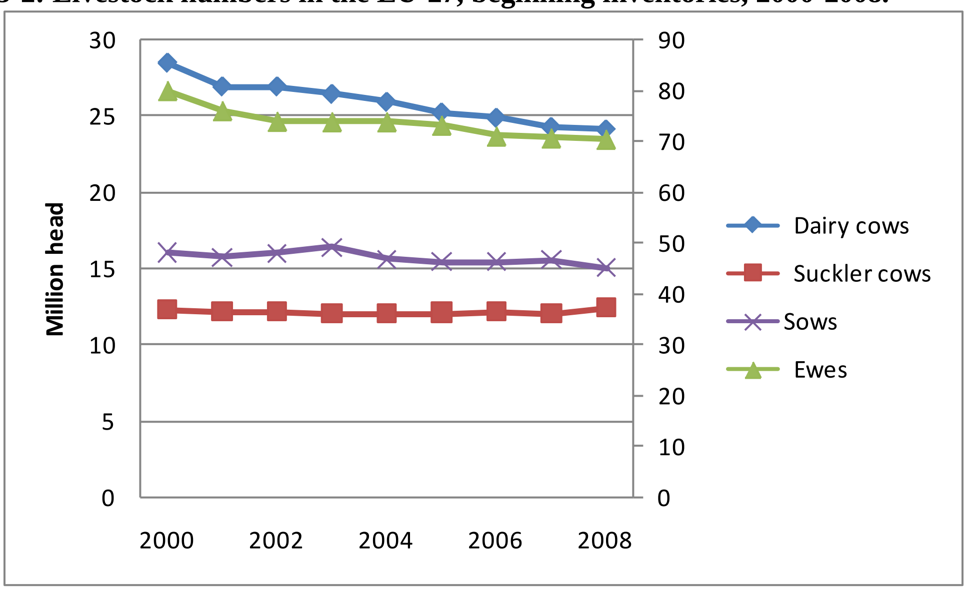
Figure 5-1: Area of major 3 crops in the EU-27, 2000-2008.



It seems reasonable to tentatively support the analysis of the first paper regarding the impact of decoupling of payments. There is a reduction in area in the years following 2004 but this can be attributed to an increase in the rate of set aside and harvested maize area falling due to drought in Southern EU. Higher prices and the phasing out of set aside resulted in the 2008/09 area increase. Growth in area in recent years was also fueled by an increase in rapeseed area as the biofuels industry in the EU expands.

Livestock and dairy cow numbers are shown in Figure 5-2. Dairy cow numbers have fallen in line with yield increases as quota has mostly bound production. A slowdown in the fall in cow numbers occurred in 2007 as a result of the high prices and the potential of increases in quota in the 2008/09 marketing year, but given current prices the downward trend in cow numbers will resume.

Figure 5-2: Livestock numbers in the EU-27, beginning inventories, 2000-2008.



Note: Ewe numbers correspond to right hand axis.

Ewe numbers have fallen since the introduction of the SFP, although this could also be viewed as a continuation in the downward trend. In countries like the UK and Ireland sheep numbers were expected to fall even without reform. Beef numbers were projected to fall significantly in the above paper, but in fact 2008 inventories are actually up on their 2000 level. Part of the reason for this has been the widespread use of the option to re-introduce the various coupled payments, and where full decoupling has been undertaken numbers have fallen. Beef prices have been strong (Figure 5-3). However, it is fair to say that the lack of response to decoupling in the beef sector has surprised many.

Was the model more successful in projecting the impact of the MTR than others? Results from some of the key studies at the time are presented in Table 2-1 and Table 5-2. The studies are of the MTR proposals (with the exception of the OECD paper which is an analysis of the final agreement) and use the following models:

i) GOLD, (FAPRI, 2003),

ii) ESIM, (European Commission, 2003),

iii) CAPSIM, (EuroCARE, 2003a)

iv) CAPRI, (EuroCARE, 2003b)

v) AGLINK, (OECD, 2004)

In order to facilitate comparison a different analysis of the MTR is presented here than the one used in Paper 1. The important differences are that the model reported in the tables below as "FAPRI" is of the EU-15, simulated for the proposals rather than the final agreement, and uses a different baseline. The results are different, therefore, but the broad conclusions remain the same.

Table 5-1: Results of CAP reform analysis for crop area.

	CAPRI	CAPSIM	ESIM	FAPRI	OECD	
					Max	Min
Wheat	-	-6.0	-5.4	-0.6	-0.5	-
Barley	-	-1.7	-	-2.7	-	-
Maize	-	-1.3	-	-0.4	-	-
Total cereals	-8.7	-4.0	-5.4	-1.7	-0.7	-0.7
Rapeseed	-	-0.6	7.1	-3.0	-	-
Total oilseed	-4.8	1.5	6.0	-3.7	0.0	0.1
Silage maize	-5.2	-5.3	-	-	-	-
Other fodder	15	9.2	-	-	-	-
Vol. set aside	-7.9	-	7.1	-	-	-

Both AGLINK and GOLD are dynamic partial equilibrium models. ESIM and CAPSIM are comparative static. The CAPRI model uses a two step approach with a linear programming component iterating with a market model. For the crop sector all the models derive yield and area separately. The models vary in the specification of the area allocation specification. CAPRI and CAPSIM have more coverage in their area allocation as they account for silage maize and other fodder, with CAPRI also covering pasture. The GOLD model does not address restrictions on total agriculture area, ESIM and AGLINK scale area allocated according to the total area available. CAPSIM models the land market endogenously, and CAPRI incorporates a land balance.

Direct payments are included in all of the models. How the SFP decoupling issue is handled varies between them. In the CAPRI and CAPSIM models SFPs are decoupled from the production of the commodity and instead linked to land. The ESIM model completely decoupled payments. Only the FAPRI and OECD models allow for the payments to remain linked to production in any way.

Regarding cereals, all the models show the same direction with cereal area falling as a result of the changes (introduction of the SFP and fall in intervention price). CAPRI shows the largest fall, followed by CAPSIM and ESIM. Both FAPRI and the OECD show more moderate changes. The results for oilseeds are mixed, with increases in area for CAPSIM and ESIM, and reductions projected in FAPRI and CAPRI. CAPRI and CAPSIM both show silage maize area falling, as a result of the introduction of the SFP. Other fodder area (and therefore total fodder area) is shown as rising.

The impact on beef cows is larger for all the analysis than that on crop area, which is not surprising given the sector's reliance on direct payment and the direct link between these payments and animal numbers. The OECD study impacts are much smaller than the other studies, with FAPRI showing smaller production impacts than the rest. Projected production impacts for the rest of the meats are broadly similar.

Table 5-2: Results of CAP reform analysis for livestock production.

	CAPRI	CAPSIM	ESIM	FAPRI	OECD	
					Max	Min
Beef cows	-17.5	-19.3	-	-11.6	-3.2	-
Ewes	-	-3.1	-	-5.5	-	-
Beef	-6.4	-9.3	-5.7	-3.1	-0.6	-0.1
Lamb	-6.0	-3.1	-	-4.6	-	-
Pork	0.1	0.2	-	0.5	0.1	-0.1
Poultrymeat	0.2	0.2	-	0.6	-	-

Given the radical nature of the reforms that were proposed in the MTR it could be argued that the differences between the studies are small. Qualitatively they are very similar, but even the magnitude of the projected responses are not great. In the crop sector two possible sources of the higher estimates of area reduction for cereals come from the fact that the three studies that have the largest effect also assume that the SFP is completely decoupled. The fact that CAPSIM and CAPRI both have pasture and/or fodder components in the land area allocation mechanism is also likely to increase response. Larger shifts between the crop sector and livestock sector are also a feature of GTAP analyses (e.g. Frandsen *et al*, 2003; Conforti, 2003).

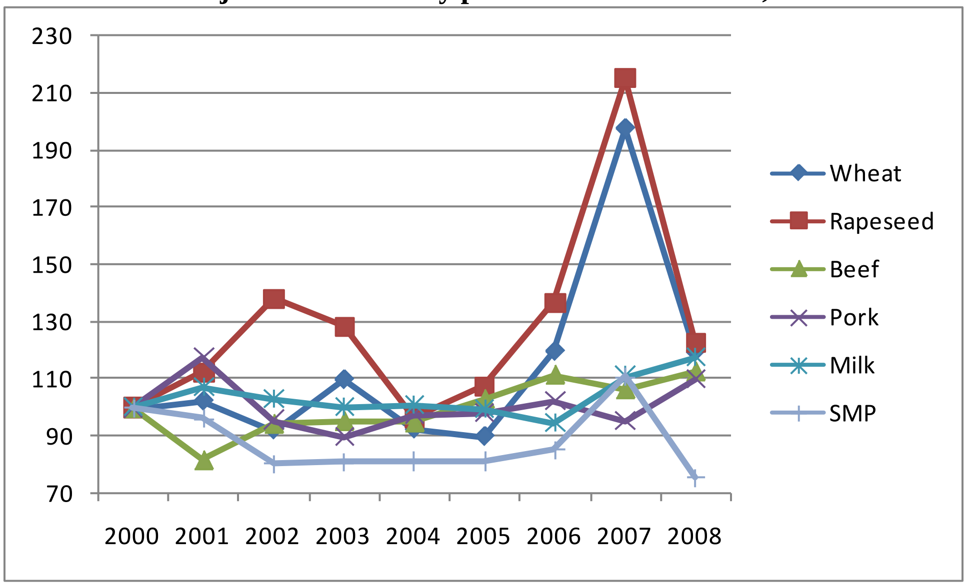
The SFP introduces area payments for land uses, such as some types of fodder production, where no area payment was payable under Agenda 2000. However, pasture and fodder area comprised the area that was used in the calculation for stocking density requirement for the headage payments made for livestock. In Agenda 2000 this link was strengthened in countries with extensive production systems with the introduction of the extensification premia. Therefore, the link between land and the payment occurred not only through the impact on gross margins of livestock production but also through the direct restrictions that surrounded the payment. In many cases the livestock payments were virtually area payments and this was reflected in land values (and rent).

Therefore, while the GOLD model might understate the pull effect of paying the SFP on fodder and pasture area, modeling the situation as one where the area payment goes from zero to some proportion of the SFP, will probably overstate it. In the CAPSIM model the introduction of a payment on fallow and grassland (EuroCARE, 2003a, Table 4) is responsible for some of the shift out of crops and into fodder area.

The low estimates of cereal area the FAPRI model projects is also a result of the fact that the Agenda 2000 payments in that sector are treated as more decoupled than in the other models. Also, the way that land allocation is handled appears to explain much of the difference between the CAPRI and CAPSIM approaches.

It is not possible at this stage to conclude which of the studies was more accurate in predicting the impact of the policy changes. Only a short time has passed since the SFP was introduced, and there have been significant changes in the market environment through price volatility, biofuels policy and also several years of drought in southern Europe. For the years 2006/07 to 2008/09 EU-15 average major crop area was 38.68 million hectares, with an average set-aside rate of 6.7 percent. The corresponding figure for the period 2001/02 to 2003/04 was 38.92 million hectares with an average set aside rate of 10%. So the set-aside corrected area change was around three percent, above the estimates presented above, but below those of most of the European studies. It will take more research to determine which modeling approach most correctly captured the influence of direct payments on the sector.

Figure 5-3: Indices of major EU commodity prices used in the model, 2000-2008.



Note: 2000=100.

As the EU has moved from support based on price support to (more) decoupled payments it is inevitable that the EU be exposed to increased volatility in prices. Price changes are no longer solely linked to changes in support prices. A good example is beef where the reduction in intervention price in Agenda 2000 had no impact on the market price. The boom in commodity prices in 2007 lifted all prices above their support levels and many thought that they would stay there, but 2009 has seen intervention purchases for grain and dairy products. The spike in prices was in part caused by developments within the EU; the ending of dairy export subsidies (dairy products), biofuels policy (vegetable oil) and drought (cereals, sunflowerseed). But the volatility also reflects the increase in exposure of the EU markets to non-EU developments. This will only increase if a WTO round is concluded.

Further Work

Further work related to these papers can be divided into three groups; improvements to the theoretical and empirical approach used here, examination of possible future policy, and the potential for further enlargement of the EU (and therefore the CAP).

Improving the theoretical and empirical foundations

It is clear that the literature surrounding the use of increasingly decoupled payments such as the SFP or direct payments in the US is in its infancy, and there is a large scope for future research in this area. Studies are necessarily undertaken using annual data, so it will be some time before the 2003 changes can be reliably examined. It is likely that the fact that the political compromise to these reforms resulted in a plethora of different payment schemes will help this analysis.

It is likely that the noise from the high prices in 2007 and 2008 and subsequent uncertainty over future levels will make the analysis of the impact of the SFP difficult for cereals. It is likely that the changes in CAP policy through the reduction of support prices and liberalization would have led to an increase in the volatility of prices in the EU eventually, but developments on world markets have led to volatility in internal EU prices well beyond that previously seen for most of the major commodities. This has accelerated the interest in producing projections beyond the deterministic point estimates that are outlined in the papers above to a more stochastic approach.

The number of different scenarios that were carried out as part of the dairy paper is a step in this direction. Inevitably, however, it would be advantageous to pursue the kind of stochastic model already developed by FAPRI for use in the USA to the European model. The resources needed to do this are considerable, as it requires the model to be simulated in different software and also all the Commission decisions (such as the level of export refunds in dairy) to be fully endogenised.

Examination of future policy

Despite the fact that the CAP was comprehensively reformed in the MTR, the Commission in the 2008 Health Check proposals sought to continue this process. Although the final agreement again diluted the proposals, the changes have the potential to be significant. Intervention prices for most grains are removed, and therefore the floor price for these commodities is lower than before. The Commission has also given up its ability to use set aside to manage the crops market.

There is also a new Renewable Fuels Directive that, depending on the final details of the package, has the potential to dramatically change the policy environment in Europe beyond that envisioned in the third paper. Under pressure from environmental groups (and some of the groups in the European Parliament) to place limits on the volume of fuel from “first generation” biofuels, the Council agreed that the 10 percent target for renewable fuels as a proportion of total fuels should stay. There is no limit on the proportion of "first generation" fuels, although "second generation" (cellulosic etc.) and electricity count double and 2.5 times respectively towards the target.

In response to environmental concerns regarding the efficiency of first generation biofuels, the Renewable Fuels Directive does include minimum levels of greenhouse gas savings (relative to fossil fuels) of at least 35 percent to 2017 and 50 percent thereafter.[21] There are also restrictions that are aimed at stopping forest or other carbon sinks being converted to biofuels production directly. In practice this is likely to make modeling trade in biofuels more complex as noted in Paper 3. A further complication will arise if the EU decides to address indirect land use issues (where the increase in demand for commodities pushes up prices and results in the conversion of land for commodities in general). As different countries put different policies like this in place, there is likely to be a variety of different prices for what might be essentially identical biofuels from different sources.

Potential for future enlargement

Although at time of writing there were still barriers to the passage of the Lisbon Treaty, without which there would likely be no further enlargement of the EU, it is likely that the issues will be resolved and some further expansion of the EU will be undertaken. First in the queue are likely to be some of the countries of former Yugoslavia which should prove

[21] 60 percent for installations built after this date.

easier with respect to the CAP than the previous two enlargements, given the relative size of the agricultural sectors.[22]

Turkey has been trying to obtain membership to the EU for decades. There are many reasons for its difficulty in gaining entry, and agriculture is not the biggest one. However, there are significant obstacles to be overcome if it were necessary to absorb Turkey's agricultural sector into the CAP. Previous enlargements have enshrined the principle that CAP payments are extended to new members, and given that Turkey has lower income levels than the current member states this would involve a transfer of money from current members.

According to the European Commission (2008), in 2007 Turkey employed 5.6 million people in "agriculture, forestry, hunting and fishing". The total for the entire EU-15 was 6.1 million. Accession would add around 40 million hectares of agricultural land to the EU, increasing it by about 23 percent. That would require a large increase in SFP/SAP expenditure. The potential for increased cereal output is there, but the main area that Turkey would compete with existing EU countries would be in fruit and vegetables. Enlargement would provide easier access for current EU countries to the large markets for meat and dairy products.

The analysis that has been carried out in these papers therefore is just the starting point in the ongoing process of evaluating policies impacting agriculture in the EU. Further

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[22] Although Serbia has typically planted about a million hectares of corn and has become a significant exporter to the EU in recent years.

enlargement, the CAP reform process, the WTO, and developments in biofuels policy will continue to provide employment for modelers of EU agriculture for many years to come.

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