

Modelling the Effects
of the EU Common
Agricultural Policy

Productivity Commission
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Key points

- The Common Agricultural Policy (CAP) of the European Union has undergone significant reform since the early 1990s, with the aim of improving its market orientation.
 - There is an increasing focus on breaking the link between direct income payments and production decisions — so called ‘decoupling’.
- Expenditure on the CAP accounts for about 46 per cent of total EU budgetary expenditure, or over 50 billion Euros.
 - The majority of expenditure is in the form of direct income payments to farmers. Expenditure also includes market price support and rural development programs.
- The European Union also assists its agricultural sector with various border protection measures including import duties and other non-tariff barriers.
- In this study, economic impacts of the CAP are evaluated using the GTAP model. According to the modelling results, the effects of the CAP include:
 - higher output of the farm and food processing sectors in the European Union, of about 8 and 6 per cent respectively
 - lower output of the EU manufacturing and services sectors
 - lower GDP in the European Union of about 0.3 per cent, or \$US 52 billion.
- The additional farm and food output in the European Union is estimated to depress world prices for these goods by between 1 and 4 per cent. World prices for manufactured goods and services increase. These price movements induce a contraction in agriculture and food processing in non-EU regions, and an expansion in the manufacturing and services sectors.
 - Some of the largest contractions occur in the livestock sectors in Latin America (12.7 per cent) and Australia–New Zealand (4.9 per cent) and in the food processing sectors in most regions.
- The estimated net effect of the CAP is to reduce global welfare by about \$US 45 billion, with a cost to the European Union of \$US 30 billion. The largest contributor to this welfare loss is the border protection component of the CAP.
- Important caveats to these modelling results apply. The estimates are sensitive to parameter choices, specific model features, and the structure of the database. In addition, the modelling does not capture some aspects of the CAP including the effects of cross-compliance measures, any impacts on productivity in the agricultural sector, and positive and negative externalities associated with the policy. Therefore, these results should be interpreted as only indicative of the magnitude of the economic impacts of the CAP.

Preface

This report is part of a project that was conducted in collaboration between the Productivity Commission and the Groupe d'Economie Mondiale (GEM), where Patrick Jomini from the Productivity Commission was on secondment, and co-author Pierre Boulanger is a research and teaching fellow.

GEM is an independent and non-partisan European, Paris-based research centre that seeks to promote debate on international economic integration. Its director is Professor Patrick Messerlin.

Acknowledgments

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The views in this paper remain those of the authors and do not necessarily reflect the views of the Productivity Commission, GEM or of the external organisations and people who provided assistance.

1 Introduction

The Common Agricultural Policy (CAP) is multi-faceted and in constant evolution. Successive reforms have changed the market incentives faced by producers, consumers and industrial users of agricultural commodities. Since its inception, the CAP has evolved from a set of commodity-specific programs designed to improve food security and support farm incomes in Europe, to a system of industry assistance with multiple objectives.

Relatively recent developments of the CAP have included:

- the partial decoupling of direct income payments to farmers from production
- an increased focus on using assistance to achieve rural development and environmental objectives.

In addition to changes in policy, the membership of the European Union itself has changed dramatically with successive enlargements. For example, enlargement of the European Union from 15 to 25 member states added 4 million farmers to the existing 7 million, and increased the cultivated farming area by around 30 per cent to 130 million hectares (European Commission 2009a).

Changes in policies and membership have influenced how the CAP affects EU economies and, through global markets, economies around the world. The purpose of this paper is to estimate the likely benefits and costs of the CAP to the European Union and to the global economy.

Approach

The economic impacts of the CAP are evaluated using a computable general equilibrium (CGE) modelling framework. The Global Trade Analysis Project (GTAP) comparative static CGE model is used, together with the latest version of the GTAP database (version 7), which has a base year of 2004.

To evaluate the impact of the current regime on economic outcomes, a counterfactual scenario is modelled, where elements of the CAP are removed. Although the components of the CAP are interdependent, the main components

have been modelled separately in order to interpret better their roles and contributions to the overall effects of the CAP.

The modelling results provide an indication of the aggregate allocative efficiency and welfare effects, along with sectoral effects — both within, and outside of, agriculture — on the European Union and on other parts of the world.

Economic modelling is limited in its ability to replicate the detail and complexity of the CAP, as well as the complex interactions of the global economy. Although CGE modelling is the most useful tool available for assessing the global and allocative economic effects of the CAP, it can only do so in a stylised way. It requires many simplifying assumptions, and cannot directly estimate many potentially important effects of the policy, such as positive or negative externalities and adjustment costs. This means that although the modelling can be used to provide insights for policy analysis, for a complete analysis, it should be complemented by consideration of additional factors that are not accounted for in the modelling.

Scope

In this paper, the CAP is analysed in terms of a 2007 reference year. The effects of three major components of the CAP — direct income payments, export subsidies, and border protection — are analysed. Rural development spending is not modelled because the effects of this class of spending are too complex and uncertain, and difficult to value (for example, the value of animal welfare or some environmental values). For these reasons, it is difficult to represent this class of expenditure and its effects within the existing GTAP database structure and model.

All 27 members of the European Union are covered in this study. This includes the EU15 member states¹ and the 12 new member states (NMS).² In the case of direct payments, however, the focus is only on the EU15 as, for now, the NMS account for only a small share of direct payments. The main focus of CAP expenditure in the NMS is on rural development.

The impacts of assistance to agriculture on both the European Union and other parts of the world are evaluated. Assistance to agriculture covers the crop, meat, dairy and wool sectors. Recognising, however, that protection for agriculture is also

¹ Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

² Ten of the NMS joined in 2004: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. Two more states joined in 2007: Romania and Bulgaria. These are collectively referred to as the NMS.

implemented at the stage of processing agricultural products, the relevant food processing sectors are also covered in the case of export subsidies and border protection.³

The remainder of this paper is set out as follows. Chapter 2 contains an overview of the current CAP and a discussion of the likely effects of elements of the CAP. In chapter 3, the GTAP model and database are outlined, and the methodology for implementing the policy scenarios is discussed. Chapter 4 is dedicated to the presentation and interpretation of results, and chapter 5 concludes.

³ Fishing has its own assistance program called the Common Fisheries Policy, and forestry is affected indirectly by some CAP policies (such as land set-aside and rural development; see chapter 2).

2 The Common Agricultural Policy

The European Common Agricultural Policy (CAP) was developed as part of the 1957 Treaty of Rome that established the European Economic Community. The objectives of the CAP are set out in Article 39. Its original purposes included guaranteeing food supplies and providing a fair standard of living for farmers in post-war Europe. It did this primarily with price guarantees and income subsidies to farmers. Over time, these policies led to ongoing food surpluses, which were exported with the aid of subsidies, destroyed, or stored and sold in subsequent years.

The CAP has undergone significant reforms since the early 1990s, with the aim of improving its market orientation (box 2.1). While efforts to simplify the CAP are ongoing,¹ in some ways it is becoming more complex, providing EU member states with increased flexibility to choose and implement CAP policies within a common EU legal framework.

In this study, the focus is on the present policy framework — with a reference year of 2007 — which mostly reflects policy from the major reform program implemented in 2003. It is important to note, however, that the CAP is continually evolving and, while some of the 2003 reforms are yet to be fully implemented, other reforms have been agreed to since then and are being implemented.

The main elements of the current CAP are outlined in sections 2.1 to 2.4 of this chapter. The likely economic effects of these are then discussed in section 2.5.

¹ For example, during the course of 2008, a single Common Market Organization (CMO) — the market regulatory tool governing the production of, and trade in, agricultural products in the European Union — was instituted progressively for all agricultural products, replacing 21 sector-based CMOs, so that a single set of harmonised rules is now applied by the single CMO in the areas of market policy.

Box 2.1 Major CAP reforms

- **1992** — The ‘MacSharry’ reforms reduced the reliance on market price support and introduced a greater emphasis on direct income support to farmers that was tied to producing certain goods. They also included limits to production to reduce surpluses, including through mandatory land set-aside. In addition, rural development measures were implemented, with a focus on improved environmental outcomes.
- **2000** — The ‘Agenda 2000’ reform enhanced the market orientation and environmental focus of the CAP. It integrated rural development policy within the institutional CAP framework, and implemented further reductions in intervention prices which were compensated for by direct income payments to farmers.
- **2003** — These reforms initiated the process of decoupling direct income payments from production, giving farmers the incentive to make their production decisions according to prevailing market conditions. They also redirected funding away from direct payments, toward rural development policies. Since 2003, there have been subsequent, more targeted reforms of the wine, fruit and vegetable and sugar sectors, aimed at increasing their exposure to market forces.
- **2008** — A ‘Health Check’ was introduced to adjust and extend the implementation of the 2003 reforms (appendix table A.1).

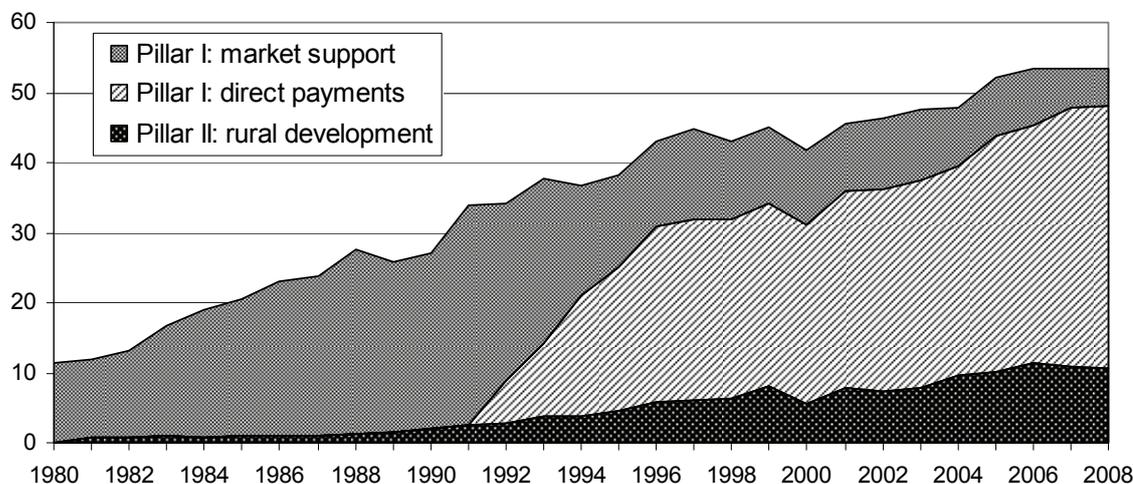
2.1 The current policy situation

Expenditure on the CAP accounts for around 46 per cent of total EU budgetary expenditure. It is characterised by two CAP ‘pillars’:

- Pillar I — comprising market support and direct income payment programs, funded through the European Agricultural Guarantee Fund (EAGF)
- Pillar II — rural development programs, funded through the European Agricultural Fund for Rural Development (EAFRD).

Pillar I currently represents around 80 per cent of the EU budget devoted to the CAP, mostly in the form of direct income payments, with the remainder used to fund market support programs (figure 2.1). The declining share of expenditure on market support reflects reforms that reduced the reliance on market support and compensated farmers with direct payments. It also reflects high world prices for agricultural goods, which reduced the amount of market support as the gap between market and support prices narrowed (see section 2.2).

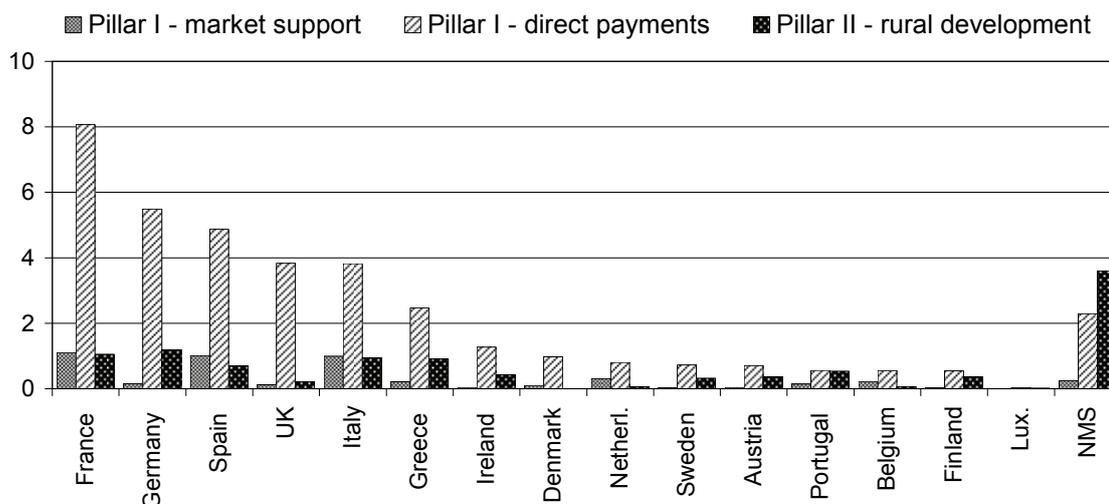
Figure 2.1 European CAP expenditures by measure
Billion Euros



Data source: European Commission, DG AGRI, Unit I.1, pers. comm., 18 August 2009.

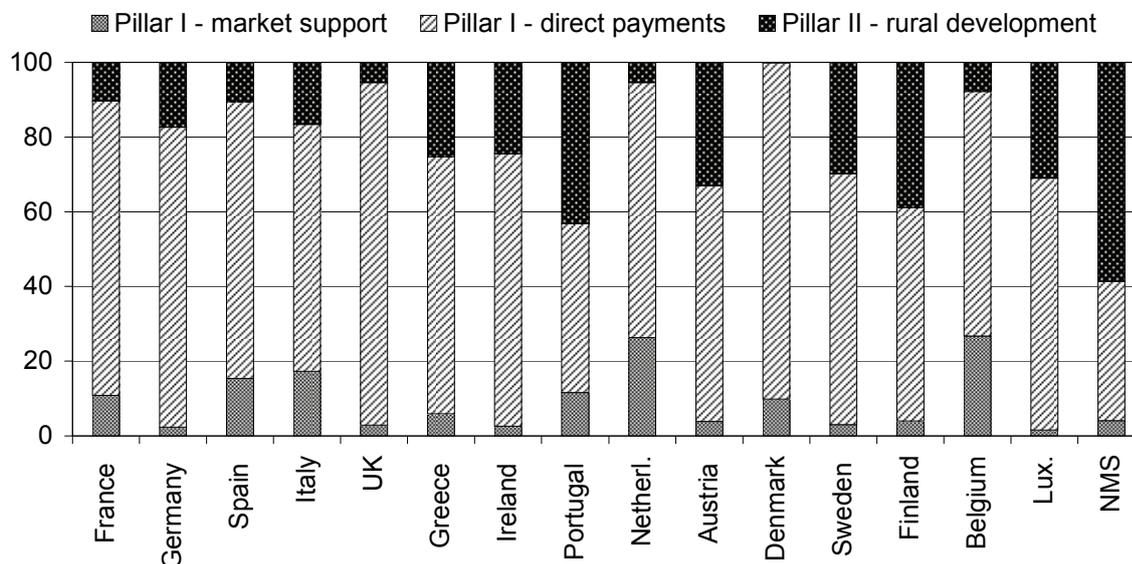
With the increased flexibility of EU members to implement and monitor their own CAP policies, relative spending between the first and second pillars varies greatly across member states (figures 2.2 and 2.3). Although most expenditure is on direct income payments in each of the EU15 countries (except Portugal), rural development expenditure accounts for a sizeable share in the NMS.

Figure 2.2 CAP expenditures by member state: Pillar I and Pillar II
Billion Euros, 2007



Data source: European Commission 2008c.

Figure 2.3 CAP expenditures by member state: Pillar I and Pillar II
Relative share, 2007



Data source: European Commission 2008c.

2.2 Pillar I

Market support measures

The predominant market support measure is the price guarantee to farmers for certain commodities. The level of the guaranteed price has been reduced steadily since the 1990s, but still remains significant for certain commodities.

Under the scheme, when the domestic price falls below the guaranteed price, the government intervenes to deal with any excess production until the domestic price returns to the guaranteed price. The excess production can be stored, destroyed or exported.

In the latter case, export subsidies are paid by the government to bridge the gap between EU guaranteed prices and world market prices. As a consequence, the unit cost of the subsidy and its total cost vary with changes in world prices, exchange rates and domestic prices. A necessary condition for maintaining guaranteed prices is the presence of trade barriers to prevent cheaper imports. This aspect of the CAP is discussed in section 2.4.

High world food prices over recent years have reduced expenditure on price guarantees, and recent CAP reforms have reduced the number of commodities eligible for price support.² Nonetheless, a range of products, including beef and cereals, retain price guarantees that give rise to budgetary expenditure. In recent years, budgetary expenditure has been mainly for export subsidies of sugar and milk (figure 2.4).³ When world food prices decrease, however, expenditure to maintain price guarantees on commodities that are still supported would be likely to rise.

Market support measures other than guaranteed prices are diverse and sector-based, and can include:⁴

- funds for fruit and vegetable producer organisations designed to assist producers in marketing their output, especially in light of increased concentration in the retail sector
- distilling surplus wine into alcohol for consumption or for fuel, and removing vines in the wine sector⁵
- production quotas (mainly for sugar and milk),⁶ which do not involve public funding
- land set-aside programs (compulsory or voluntary) with budgetary expenditures that are integrated into direct payments.⁷

These last two measures aim to reduce supply and raise prices, thereby supporting farm incomes.

² For example, price support for pigmeat, maize, barley and sorghum has been abolished.

³ The market support expenditure presented in this chapter is distinct from the Market Price Support (MPS) estimates produced by the OECD. The OECD MPS includes price intervention measures, and also trade barriers, which are discussed separately in this paper (section 2.4). In addition, the MPS includes consumer transfers associated with higher domestic prices, which in this paper are discussed in section 2.5.

⁴ Appendix table A.2 contains a breakdown of market intervention expenditure by EU member state and sector.

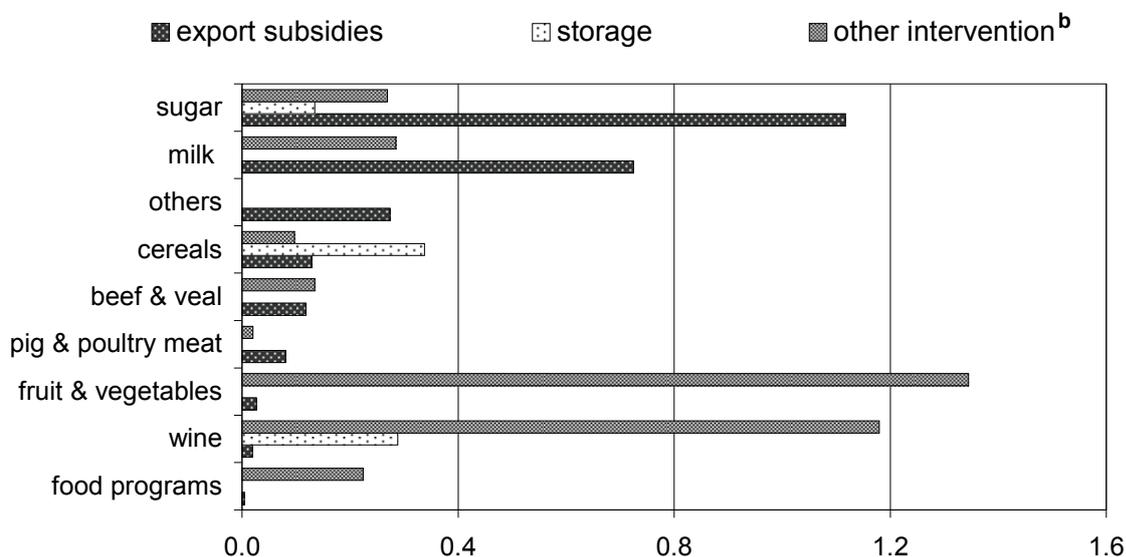
⁵ Under a 2008 reform of the wine market, distillation schemes will be gradually withdrawn over the four years to 2012.

⁶ Under the 2008 CAP Health Check, milk quotas will be increased by 1 per cent a year between 2009-10 and 2013-14, before being terminated by 31 March 2015. Under a 2006 reform of the sugar sector, sugar quotas are being reduced by around one third between 2006-07 and 2009-10 (WTO 2009).

⁷ Land set-aside was first introduced to prevent surpluses accumulating and was compulsory for large producers. Compulsory land set-aside was abolished under the CAP Health Check in 2008.

Figure 2.4 Expenditure by sector and type of market support measure^a

Billion Euros, 2006



^a Export subsidies for pig meat, fruit and vegetables and wine have now been abolished (WTO 2009).

^b Other intervention includes, for example, funding for producer organisations in the fruit and vegetable sector, and funding for the wine sector to distil surplus wine and grub up vines.

Data source: European Commission 2008a.

Direct income payments

Direct income payments were designed to compensate farmers for the decrease in guaranteed prices that began in 1992. They have traditionally been ‘coupled’ — that is, tied to either producing certain commodities (measured by areas planted to specific crops, or livestock animal numbers) or to using certain inputs in the production process.

While originally intended to be a compensatory entitlement, direct payments now resemble ongoing income support. There have also been efforts to break the link between income support and agricultural production to move toward more decoupled direct payments (box 2.2). Decoupled payments are designed to give farmers a guaranteed minimum level of income without the market distortions created by linking payments to the production of targeted commodities (see section 2.5).

Box 2.2 Defining decoupled payments

The definition of a decoupled payment can vary. There are two generally accepted definitions, one by the WTO and the other by the OECD.

The WTO's definition is more legal in nature, and based on ex ante policy design. It is essentially a checklist of requirements that a payment must fulfil to be considered decoupled. The economic effects of payments that fulfil these requirements, however, can still distort markets.

The OECD defines two forms of decoupling, based on ex post policy effects:

- fully decoupled — the equilibrium level of production, and any adjustments due to an external market shock, are unaffected by the measure
- effectively fully decoupled — the level of production is not affected by the measure, but the adjustment to an external market shock may be affected.

Full decoupling is more of a theoretical concept that is difficult to operationalise. Therefore, 'effectively fully decoupled' is used by the OECD as the practical definition of decoupling.

Source: Frandsen, Gersfelt and Jensen (2002).

The 2003 CAP reforms⁸ strengthened the move toward decoupling payments by introducing the Single Payment Scheme (SPS), in which direct payments are unrelated to current production decisions (box 2.3). Also introduced were 'cross-compliance' conditions for payments, whereby payments are linked to farmers achieving certain environmental, animal welfare and quality standards. Cross-compliance makes full payment conditional upon land being maintained in good agricultural and environmental condition (according to standards established at national levels), and adherence to the pre-existing EU statutory management requirements regarding the protection of the environment, public, animal and plant health, and animal welfare.⁹ Direct payments are funded entirely from the European budget, unlike the Pillar II rural development measures that are co-funded by each country.

⁸ For a detailed analysis of the 2003 CAP reforms, refer to OECD 2004.

⁹ Designed as additional incentives to comply with pre-existing regulation and often requiring little change to farm practices, cross-compliance payments can be interpreted as a subsidy that reduces farmers' out-of-pocket cost of operating in the existing regulatory environment (Alliance Environment 2007).

Box 2.3 The Single Payment Scheme

The Single Payment Scheme (SPS) is designed to cut the link between income support and production decisions. There are two basic SPS models:

- an historic model, in which payments to each farm are based on the amount of payments it received during a reference period (2000–2002), divided by the number of hectares farmed in the reference period
- a regional model, in which a flat rate of entitlement per hectare is paid based on the total amount of payments received in the region during the reference period, divided by the total number of eligible hectares declared in that region in the year the SPS was introduced.

Where the historic approach is applied, farmers who did not receive direct payments in the reference year are not eligible for payments under the SPS. However, entitlements are transferable in most countries.

Hybrid models have also been implemented, where a part-historic, part-regional model is used. These can be static or dynamic. In the static version, the entitlements remain the same over time. In the dynamic version, a proportion of the entitlement is based on an historical reference period, which is then phased out over time. A compensating flat rate payment increases concurrently, until the full entitlement is based on the flat rate. The most common SPS model is the historic model (table below).

The SPS exists in the EU15 member states and two of the NMS (Slovenia and Malta), and a transitory Single Area Payment Scheme (SAPS) exists in the remaining 10 NMS. The SAPS is a uniform payment per hectare of agricultural land, up to a national ceiling. The direct payments will be fully paid by the EU budget to the NMS once a phasing-in period is completed (2013 for all except for Bulgaria and Romania, for which the period ends in 2016).

SPS implementation models

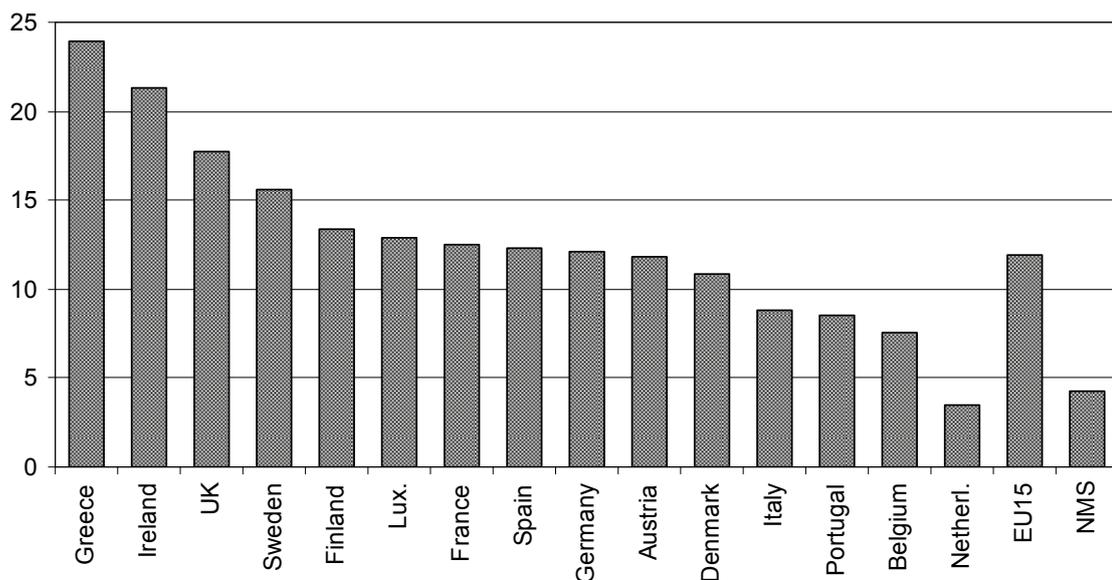
<i>Historic</i>	<i>Regional</i>	<i>Static hybrid</i>	<i>Dynamic hybrid</i>
Austria	Malta	Denmark	Finland
Belgium	Slovenia	Luxembourg	Germany
France		Sweden	UK-England
Greece		UK-N.Ireland	
Ireland			
Italy			
Netherlands			
Portugal			
Spain			
UK-Scotland			
UK-Wales			

Sources: European Commission 2008e and 2009c.

Rates of assistance

The value of direct payments to each EU member, divided by the gross value of assisted agricultural output for that member, gives a measure of the relative level of assistance across the European Union.¹⁰ Figure 2.5 shows that the most heavily assisted countries are Greece and Ireland, with rates of assistance above 20 per cent. This compares with the EU15 average of 12 per cent. The rate of assistance for the NMS is very low, at less than 5 per cent, both because these members are phasing-in direct payments since joining the European Union, and because they have a greater emphasis on rural development spending.

Figure 2.5 Rate of assistance to agriculture from direct income payments^a
Per cent, 2006-07



^a Direct payments divided by the gross value of assisted agricultural output.

Data source: European Commission 2008c, Eurostat 2008.

¹⁰ The gross value of assisted agricultural output used in these calculations includes gross output of fruit and vegetables, even though this sector does not receive much by way of direct income payment support. Under a 2008 CAP reform of the fruit and vegetable sector, land devoted to fruit and vegetable production will become eligible for payments under the SPS, replacing existing support, mainly in the form of operational funds to producer organisations, currently worth around 800 million Euros.

Commodity-specific payments remain

Despite the implementation and management of direct payments occurring within an EU-wide framework, the 2003 CAP reforms provide member states with some flexibility in implementing the SPS, including the scope to retain a proportion of commodity-specific payments. Therefore, while there has been a large move toward a more decoupled payments system, direct links between support and production remain in some countries.

- Member states can maintain a proportion of product-specific direct support when production abandonment or severe market disturbances might result from moving to the SPS. The option applies to beef, cereals, cotton, goats, olive oil, seeds, and sheep, and the proportion allowed varies across commodities (appendix table A.3). Member states may also grant ‘additional payments’ to specific types of farming that are considered important for the protection or enhancement of the environment, or for improving the quality and marketing of agricultural products. These additional payments can use up to 10 per cent of the funds available under national ceilings in the SPS.¹¹ Additional payments therefore reduce the funds available for basic SPS and product specific payments.

Where commodity-specific subsidies still exist, they are generally defined per hectare for land-based commodities such as energy crops,¹² durum wheat, protein crops, and rice. In the animal husbandry sector, payments are generally based on herd size.

In the 2007 financial year, around 20 per cent of direct payments made in the EU15 remained commodity-specific, though this masks large differences in the shares across the EU15 member states (figure 2.6). Only Ireland, Luxembourg, Malta and the United Kingdom have moved fully to the SPS. Others have retained a sizeable proportion of commodity-specific coupled payments, including Portugal, Spain and the Netherlands (though absolute amounts are small, and therefore the effects are likely to be limited).¹³ Of the payments that remain commodity-specific, more than 50 per cent are allocated to the crop and beef sectors (table 2.1).

The 2008 CAP Health Check introduced measures to move most payments that remain commodity-specific into the SPS by about 2012. According to the European

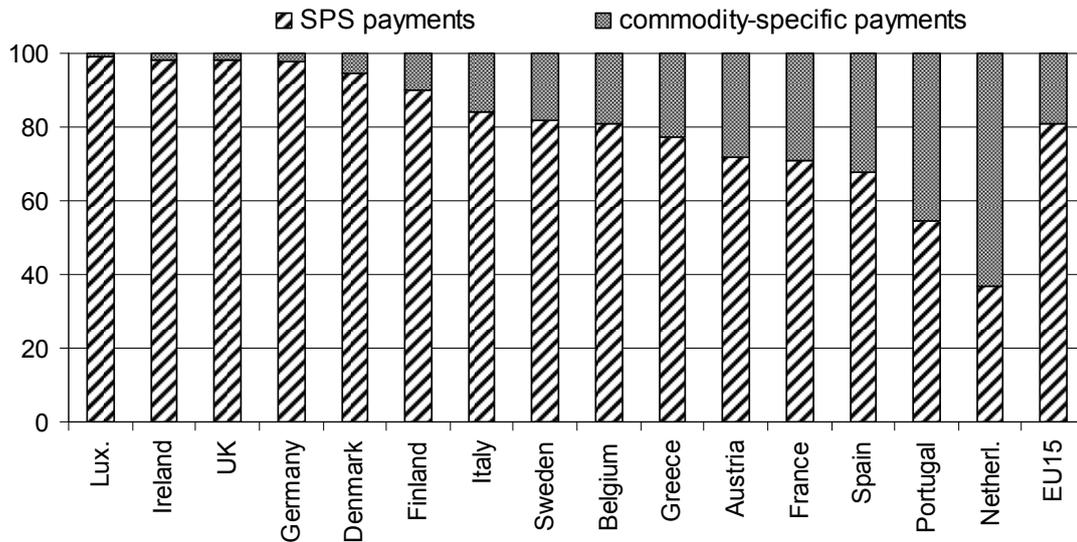
¹¹ Article 68 (previously Article 69) of Council Regulation (CE) 1782/2003.

¹² These are energy crops for the production of biofuels, and that provide biomass for the production of electrical and thermal energy.

¹³ See also appendix table A.3.

Commission, this will increase the level of ‘decoupled’ support as a percentage of all direct payments to over 90 per cent (WTO 2009).

Figure 2.6 SPS and commodity-specific payment shares^a
Per cent, 2006-07



^a The high share of commodity-specific payments in the Netherlands in 2006-07 reflects the decoupling of the dairy premium in the following year; the dairy premium accounted for around one quarter of all direct payments made in the Netherlands in 2006-07.

Data source: European Commission, 2008b.

Table 2.1 Share of total commodity-specific payments by type^a

Per cent, 2006-07

	Aus	Bel	Den	Fin	Fra	Ger	Grc	Ire	Ita	Lux	Net	Por	Spa	Swe	UK	EU15
Cereals, oil seeds & protein crops	1.2	0.9	1.6	3.4	50.3	9.6	3.7	16.9	9.4	16.7	0.4	0.2	29.5	1.7	26.8	27.3
Beef	47.2	98.9	73.9	51.2	38.1	0.9		70.8	4.6	33.3	19.8	37.4	21.8	29.5	2.8	27.2
Sheep & goats			1.6	1.6	3.4		0.1	5.8	0.2			11.0	14.8		0.4	5.3
Dairy	50.0	..	..	..	..	..	4.2	0.6	0.1	..	75.5	25.6	..	62.3	..	10.1
Potatoes	1.4	..	19.5	7.8	0.7	43.1					4.2			2.6		1.4
Rice					0.4		2.2		17.1			4.4	3.2			2.8
Olive groves					..		2.3		..			0.2	7.2			1.9
Tobacco					1.9	24.4	4.8		31.9			2.8	4.3			5.4
Hops	..				..	2.8										..
Nuts	..				0.1	0.1	0.9		2.7		..	1.7	4.2		..	1.4
Energy crops	0.3	0.2	3.4	1.4	0.7	19.1		5.8	..	50.0	..	..	0.6	1.6	14.8	0.9
Silkworms							0.1						..			..
Dried grapes							22.2					..	0.1			1.8
Bananas							0.1					1.0	2.9			2.0
Sugar beet & cane					3.3				3.1							0.3
Cotton							38.4						4.0			4.1
Country specific payments				34.6			18.7		31.1			3.8	6.6	2.3	55.2	6.7
POSEI ^b					1.1		2.7		..			11.8	0.9			1.3
Other					..		..						..			..
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

^a Blank cells indicate that no coupled payments are made in that country for that commodity. ^b The POSEI measures target agriculture in the European Union's remote regions, taking into account geographical and economic disadvantages.

.. between 0 and 0.05

Source: European Commission 2008b

2.3 Pillar II – Rural development programs

A comprehensive rural development policy was introduced in the Agenda 2000 reform package. It resulted in the second pillar of the CAP, which pulled together past and new agricultural environmental and territorial schemes. Further changes were introduced under the 2003 CAP reforms, to promote sustainable agriculture and rural development objectives.

The size of the EU budget allocated to the second pillar is significantly smaller than that of the first pillar. A modulation mechanism reduces the direct payments granted to the EU15 within the first pillar and transfers that amount to the rural development budget.¹⁴ The rate of modulation is 5 per cent per annum and, under the recent Health Check, this rate will increase progressively to 10 per cent per annum by 2012. The NMS are exempt from modulation until the transition to the full level of direct payments is achieved in 2013.¹⁵

Rural development measures are co-funded by the European Union and individual member states.¹⁶ On average, around half of the financing comes from the EU budget, with the other half financed by member states (WTO 2007), though the level of co-funding can vary significantly across member states.

Rural development measures are divided between three main axes corresponding to three core objectives:

- *Axis 1: Improving the competitiveness of agricultural and forestry sectors* — provides a range of measures to target human and physical capital in the agriculture, food, and forestry sectors, and high quality production.
- *Axis 2: Improving the environment and supporting land management* — provides measures to protect and enhance natural resources, as well as preserving forestry systems and cultural landscapes in rural areas.
- *Axis 3: Improving quality of life in rural areas and encouraging diversification of the rural economy* — develops local infrastructure and human capital in rural areas to improve the conditions for economic growth and job creation, and the diversification of economic activities.

There are two additional elements to the rural development program:

¹⁴ The modulation is applied to the entire annual amount of direct payments per farm, except the first 5000 Euros of direct payments per farm holding.

¹⁵ 2016 for Bulgaria and Romania.

¹⁶ Council Regulation (EC) 1698/2005 of 20 September 2005.

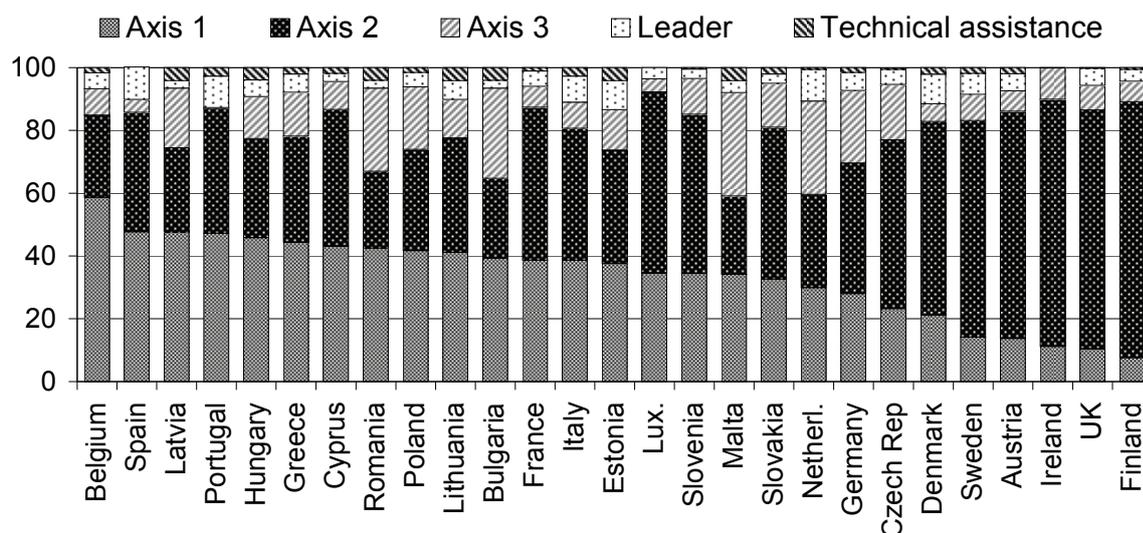
- *Leader Axis: Developing local partnerships to mobilise and develop rural communities* — complements the three axes by introducing locally based, bottom-up approaches to sustainable rural development, with a focus on partnership and network exchange experiences.
- *Technical assistance: support to ensure that synergies between and within the axes are maximised and potential contradictions are avoided.*¹⁷

The selection and implementation of rural development measures is decentralised in order to consider better the needs of individual rural areas. Accordingly, member states are responsible for setting their own rural development strategy plan, at the national or regional level, for a seven-year period (the policy is currently in its second programming period). Nonetheless, the European Commission imposes minimum shares of expenditure for each axis — 10 per cent for Axis 1, 25 per cent for Axis 2, 10 per cent for Axis 3 and 5 per cent for Leader Axis — and each member state’s programs must be approved by the Commission.

There is significant divergence between member states in their rural development policy focus, as reflected in the distribution of payments across each of the axes (figure 2.7).

Figure 2.7 Rural development measures by axis, EU and national expenditures, 2007–13 financial period^a

Per cent



^a In the Irish plan spending on Axis 3 and Leader Axis is combined.

Data source: Calculations based on 85 rural strategy plans (national and regional) as at May 2008.

¹⁷ Council Decision of 20 February 2006 on European Community strategic guidelines for rural development (programming period 2007–2013).

2.4 Border protection

The European Union protects the agricultural sector with various import duties — ad valorem and specific tariffs, and tariff rate quotas.¹⁸ Tariff protection of agriculture, as well as food processing, is higher than that for the rest of manufacturing (table 2.2). In general, agricultural and processed food goods with the largest domestic production presence in the European Union receive the highest rates of protection. For example, cereals have an average most favoured nation (MFN) tariff rate of about 50 per cent. Agricultural goods generally not produced in the European Union tend to have lower levels of protection (see appendix table A.4).

Table 2.2 EU applied MFN tariff rates
Per cent, 2008

<i>Description^a</i>	<i>Simple average tariff</i>	<i>Range</i>
Agriculture and hunting ^b	9.9	0-139.6
Manufacture of food, beverages, tobacco	19.4	0-604.3
Manufacturing (excluding food processing)	3.8	0-89.8

^a ISIC (Rev. 2) definitions. ^b Import duties for durum wheat, high quality soft wheat, rye and sorghum were suspended between December 2007 and June 2009 (European Commission 2008b).

Source: WTO 2009.

The European Union grants preferential tariff rates on imports of agricultural products and processed food from some countries and regions. Duties on imports from many European countries outside the European Union, as well as from least developed countries, are particularly low (1–2 per cent). Outside of these areas, there has been limited liberalisation under preferential trade agreements.

The European Union's dispersion of protection is very high, with a large variation in rates of protection across trade partners, and across products due to tariff peaks on a few agricultural commodities such as sugar, meat and dairy (Bouet et al. 2008).

Of the import duties imposed on agricultural products and processed food, a little over half are ad valorem tariff rates. Another 30 per cent are specific tariffs.¹⁹ In

¹⁸ A tariff rate quota is a two-tier tariff regime. Imports within the quota enter at a lower (in-quota) tariff rate, and a higher (out-of-quota) tariff rate is used for imports above the concessionary access level.

¹⁹ Across the entire tariff schedule, around 10 per cent of tariffs are non-ad valorem rates which can be specific, compound or mixed rates. All of these are applied to agricultural products. All tariff rates greater than 100 per cent are also for agricultural products.

addition, in 2006 the European Union had 91 tariff quotas on agricultural products that were managed by the Commission through a licensing system (WTO 2007).

2.5 Assessing the cost of the CAP

Market support and trade barriers

Market support — mainly through price guarantees — and trade barrier measures are used to raise the income of farmers. They affect both domestic and world markets. The world market effects can be especially pronounced in the markets for goods for which the European Union is a relatively large consumer or producer or both. Market support and trade barrier measures distort EU and world markets and tend to transfer income from consumers to farmers. This usually results in a loss of welfare in the European Union, and in the rest of the world. This is illustrated with a partial equilibrium framework in figures 2.8 and 2.9.

In figure 2.8, in the absence of any distorting policy measure, the European Union is assumed to be an aggregate exporter of the good (left hand panel) and the rest of the world an importer (right hand panel) with the internationally traded price at P_t and the world traded quantity at X_t (middle panel).

In this policy scenario, the European Union implements a guaranteed price of P_g . With EU producers and consumers now facing this higher price, output increases to S_g , and consumption decreases to D_g . The excess supply ($S_g - D_g$) is exported to the rest of the world.

The new level of exports X_g is greater than the free trade quantity of X_t . Indeed, with the European Union guaranteeing farmers a price of P_g , and imposing this price on EU consumers, the export supply schedule becomes vertical at all prices below P_g . This new export supply curve intersects the import demand curve at the price P_t' . This causes the rest of the world to import more. To prevent domestic consumers from importing the good at a price below P_g , the European Union would need to impose a tariff of at least $(P_g - P_t')$ to sustain the price guarantee.

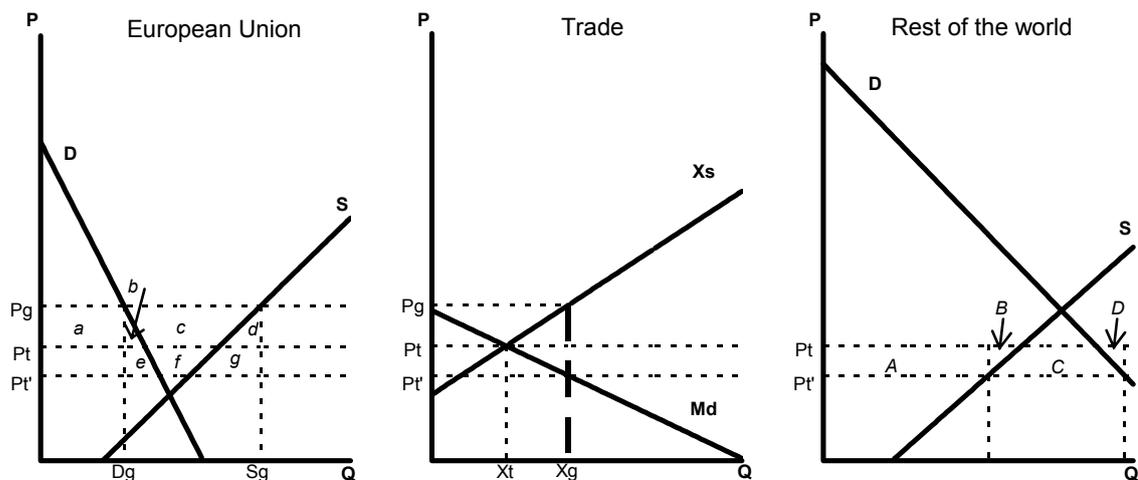
In the European Union, producer surplus increases due to the price guarantee by the area $(a+b+c)$. Consumers are made worse off by the area $(a+b)$ due to the higher price they pay and the smaller amount they consume. To dispose of surplus production on the world market at the world price, the government must fund the difference between P_g and P_t' for each additional unit exported. This 'export subsidy' is equivalent to the area $(b+c+d+e+f+g)$. Overall, the European Union is

therefore made worse off by the area $(b+d+e+f+g)$. Of this welfare loss, the area $(e+f+g)$ is due to a fall in the price of exports to the rest of the world.

In the rest of the world, welfare increases — producer welfare decreases by area $(A+B)$ but consumer welfare increases by area $(A+B+C)$ leaving a net welfare gain of area (C) .

Lower import prices generate a transfer of area $(B+C+D)$ to the rest of the world from the European Union — equivalent to area $(e+f+g)$. The rest of the world, however, only receives area C . There is a dead weight loss to the rest of the world equivalent to area $(B+D)$. The combined welfare effect on the European Union and the rest of the world is therefore a loss equivalent to the area $(b+d+B+D)$. This loss reflects the cost of switching production from more efficient producers in the rest of the world to European producers, and from switching consumption away from European consumers to the rest of the world.

Figure 2.8 Effects of a guaranteed price



The European Union also uses border protection to help shield domestic markets from import competition. In figure 2.9, under free trade, the European Union is an importer of the commodity, with the equilibrium price at P_t , domestic production at S_t and domestic consumption at D_t (left hand panel). The import demand schedule of the European Union is represented by M_d in the middle panel.

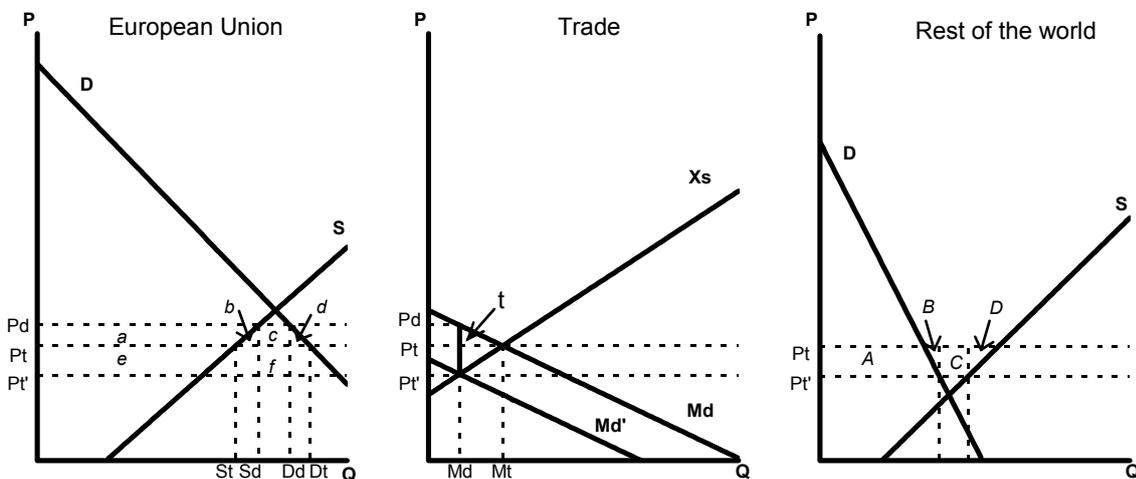
In this scenario, the European Union implements a specific tariff that increases the domestic price in the European Union to P_d . At this price, domestic producers increase their production (S_t to S_d) and consumers demand less (D_t to D_d).

The tariff causes the import demand schedule of the European Union to shift down from M_d to M_d' by the amount of the tariff (t in the middle panel). This causes the traded price to fall from P_t to P_t' , and the quantity traded to fall from M_t to M_d .

In the European Union, producer surplus increases by area (a) because farmers receive a higher price. Consumer welfare decreases by area (a+b+c+d). The government receives revenue from the import tariff equivalent to the area (c+f). The net welfare effect in the European Union is ambiguous, represented by area (f-(b+d)). Area (f) represents an increase in welfare from a lower price for EU imports, and the area (b+d) represents the deadweight loss created by the tariff.

In the rest of the world, the lower traded price causes producer surplus to decrease by area (A+B+C+D) and consumer welfare to increase by the area (A). The rest of the world therefore loses overall by area (B+C+D), which includes a loss from the decrease in the price it receives for its exports of area (C), equivalent to the European Union's gain from lower import prices, area (f). The combined welfare effect on the European Union and the rest of world is therefore a loss, corresponding to the area (b+d+B+D).²⁰

Figure 2.9 Effects of an import tariff



Market support and trade barrier measures can also induce a switch in the trade orientation of agricultural goods for the European Union. For example, under free trade, the European Union may be an importer of a particular agricultural good, represented by a world price below the equilibrium in the EU market. Imposing a

²⁰ The effects of other forms of border protection such as import quotas are similar to those of a tariff as described here.

large enough guaranteed price could increase the domestic price of the good sufficiently to induce a switch from importing to exporting the good.

Direct income payments

The OECD generally analyses decoupling as a continuum of degrees of decoupling because, in reality, no payment is ‘truly decoupled’ — a truly decoupled payment is one that would not alter the level or composition of output, or the adjustment to economic shocks, that would occur in the absence of any support (box 2.2). The degree to which payments are decoupled determines how much they distort the market outcome away from the efficient outcome. The OECD has a large body of analysis on the issue (see, for example, OECD 2001, 2005a and 2005b) which is drawn upon in this paper.

The distortions associated with any direct payment other than a truly decoupled payment can be summarised as follows.

- Cross-commodity effect — payments can affect the relative prices that farmers face and the relative profitability of producing one agricultural commodity over another (or using one input over another). These payments can affect the allocation of resources within agriculture, thereby altering the production mix.
- Aggregate supply response — payments encourage a movement of resources out of other industries, into agriculture, that would otherwise not occur. This leads to an expansion of overall agricultural output, and a contraction of output in other industries, such as manufacturing.²¹

The magnitude of these effects depends on the mobility of factors of production. In the case of cross-commodity effects, the mobility of factors within agriculture matters. See Gohin, Guyomard and Le Mouél (2000) and Frandsen, Gersfelt and Jensen (2002) for a discussion of how factor mobility affects the direction and magnitude of the cross-commodity effects of direct payments.

In the case of the aggregate supply response, the mobility of factors across different sectors matters — for example between agriculture and manufacturing. Where they are very mobile, there will be stronger resource reallocation away from other industries into farming. Where an input is either less mobile or in fixed supply, such as agricultural land, any potential aggregate supply response will be dampened,

²¹ In a dynamic sense, coupled support can also influence farmers’ investment decisions, insofar as investment decisions are affected by current production decisions (Frandsen, Gersfelt and Jensen, 2002).

depending on the degree of substitutability of this input with other inputs (Frandsen, Gersfelt and Jensen 2002).

According to the OECD (2005b), payments based on variable input use are the most distortionary kind, followed by payments based on output. These sorts of payments are characteristic of the coupled, or commodity-specific payments of the CAP, which are specifically tied to producing certain commodities, or to using certain inputs into production.

Decoupling payments

Payments based on the area of land used in agricultural production are generally the least distorting, especially if payments are made based on historical references and if few or no conditions are imposed on the use of eligible land (OECD 2005b). In this case, if inputs are perfectly mobile across agricultural activities there will in theory be no cross-commodity effects (Frandsen, Gersfelt and Jensen 2002).

In the case of the move toward a greater degree of decoupling through the SPS of the CAP, however, cross-commodity effects can still take place. Firstly, agricultural inputs including machinery and buildings can be highly specialised and therefore relatively immobile in the short to medium term, resulting in potentially large cross-commodity effects. Secondly, even when payments are based on historical entitlements, if current conditions play a role in distributing payments, incentive effects can occur. Cross-compliance conditions attached to SPS payments are a good example; these conditions can affect production patterns (box 2.4).

Indeed, it is sufficient for payments to be contingent on the recipient being involved in farming for the measure to have some effect on production patterns. As the historical area based payments of the SPS require that recipients carry out (or not carry out) some agricultural activity on the land, there can still be an effect on production (OECD 2005b). Whether there is an effect depends on whether the conditions are binding — if they are not, production decisions will not be affected by the SPS, but and if they are, the farmers' actions will change in response to the payment.

Although lump sum income payments, with no requirements on production, may prevent cross-commodity effects, they can still induce an aggregate supply response. Lump-sum income payments can alter the incentive structure such that it becomes more profitable for some farmers to stay in the sector rather than to leave. That is, payments may induce an unprofitable farmer who would otherwise exit the industry to keep on producing, as the payments cover the losses from farming. It can also make it more costly to enter the industry, since payments could be

capitalised into land and make it more expensive for new entrants to purchase land (Van Tongeren 2008).

Furthermore, there may be incentives for farmers to maintain large production quantities as insurance against the possibility of losing established entitlements. This may occur if the government were to perceive, through a review process, that some future level of production is too small to warrant ongoing support (Roberts and Gunning-Trant 2007).

Existing policy landscape

The existing landscape of support is a crucial factor in determining the effects of any attempt to decouple support. Unless a new payment system results in the same level and composition of production and trade that would prevail if all existing coupled payments were removed, it cannot be considered to be fully effectively decoupled, and some distortions will be maintained (Roberts and Gunning-Trant 2007).

Box 2.4 **Economic effects of cross-compliance measures**

Cross-compliance measures make assistance payments conditional on farmers achieving certain environmental and animal welfare standards in production. These requirements aim to address social and environmental objectives, while also providing direct income support to farmers. Importantly, cross-compliance requirements in the European Union are already enshrined in existing legislation. Cross-compliance therefore aims to increase the effectiveness of enforcement of these established laws.

Cross-compliance measures can create incentives to change production patterns, or induce a change in production methods and commodity yields. The extent of these effects depends on the nature of the requirement, the cost of compliance and the cost structure of production across commodities. For example, animal welfare requirements affect livestock farmers but not crop farmers, and the limitation of the use of pesticides could affect crop farmers more than livestock farmers.

The cross-compliance regulations can increase unit costs for farmers. This shifts up the supply curve for farmers and, as a result, can lower output and increase prices. Evidence to date suggests that the majority of cross-compliance obligations have had little or no direct impact on farm production costs. The associated direct income payment, however, will tend to shift the supply curve back down. The net effect on production and prices is ambiguous; accurately measuring the cost of cross-compliance measures is therefore difficult and would require detailed, probably partial equilibrium, modelling.

There may be significant externalities ensuing from cross-compliance that would require consideration when evaluating the net impact of the measures on society, but which are inherently difficult to measure. For example, the impact of cross-compliance measures on the agricultural sector can depend on the willingness of society to pay for the cost of meeting enhanced environmental and animal welfare standards.

Sources: Alliance Environnement 2007, OECD 2005b and Van Tongeren 2008.

Furthermore, although direct payments may be ‘decoupled’, the overall system of support might not be if other distortionary support is in place (Roberts and Gunning-Trant 2007). Therefore, even if the SPS were considered to be a fully decoupled direct payments system, as long as it coexists with market support and trade barrier measures, market outcomes will be distorted.

Other effects of decoupling

Looking beyond its effects on production, decoupling can also improve the income transfer efficiency of payments — that is, more of the payment ends up as income to the farm household — and reduce the administrative and compliance costs associated with payments. However, when based on historical entitlements, decoupling can preserve a distributional pattern of support and thereby perpetuate

any inequities associated with support that was previously linked to production volumes — for example, larger farms can tend to be rewarded more than smaller farms (Van Tongeren 2008).

Measuring the effects of decoupling

The overall effect of decoupling on both agricultural output and its composition must be determined empirically. It is, however, difficult to estimate the effects of the SPS payments on EU agricultural output. This is because the system has only been in place since 2005, providing only a few years of data, and because the movement to the SPS has been incomplete, with commodity-specific, or coupled, payments remaining.

Since some countries, such as France, Spain, Portugal and the Netherlands, maintain a high degree of coupled payments, it is reasonable to expect, in the absence of data, that such payments induce cross-commodity effects. An aggregate supply response would also be expected as resources shift into agriculture away from industries where the marginal product of these resources may be higher.

Rural development programs

The eligible measures under the four rural development program axes are wide-ranging (see box 2.5). The complex mix of measures makes it difficult to identify the beneficiaries of these payments which, in turn, raises challenges for estimating the overall economic impacts of rural development payments.

Box 2.5 Selected rural development measures

Rural development measures that qualify for funding under Pillar II are diverse. The following is a sample of this diversity within the three main axes.

Axis 1: competitiveness

- Vocational training and information actions
- Setting up of young farmers
- Farm modernisation investment assistance
- Participation of farmers in food quality schemes

Axis 2: land management

- Animal welfare payments
- Less favoured areas payments
- Agri-environmental payments
- Organic farming consolidation payments
- Restoring forestry production potential

Axis 3: wider rural development

- Diversification into non-agricultural activities
- Village renewal and development
- Training and information
- Conservation and upgrading of rural heritage
- Encouraging tourism activities

Source: European Commission 2006.

Many of the measures tend to increase the cost of production for farmers (shift the supply curve up). If the government funds these measures by the exact amount of their cost, in the short term there would be no effect on output and prices. In the longer term, however, the measures themselves can induce a shift in supply. For example, measures such as training and the adoption of new technology can increase productivity and shift out the supply curve. There can also be effects on demand. Consumers may value some of the subsidised initiatives, such as more environmentally sound production processes, or improved animal welfare. If so, their willingness to pay for agricultural goods could increase (the demand curve shifts up). Once all of these factors are taken into consideration, the net effects on output and prices are ambiguous.

An additional consideration is whether the funded measures would have occurred anyway, in the absence of assistance. For example, if farmers have already budgeted for training and development, then providing a subsidy could simply encourage an expansion in agricultural output.

Apart from the direct costs and effects within the agricultural market, many rural development measures may create positive externality benefits to wider society. These could arise from improved environmental outcomes, animal welfare conditions and rural landscapes. These form part of the net welfare effect of rural development funding, but can be very difficult to quantify.

3 Modelling the elements of the CAP

The GTAP model of the world economy is used in this study to evaluate the effects of the CAP, both in the European Union and globally. This model has been widely applied to analyse trade policy issues, and can be used to produce counterfactual experiments. In this study the effects of the CAP are estimated by simulating its elimination.

An overview of the model (section 3.1) and database (section 3.2) is outlined in this chapter, followed by a discussion of the modelling strategy (section 3.3) and the simulations performed to evaluate the effects of the CAP as it existed in 2007 (section 3.4).

3.1 The GTAP model

GTAP model version 6.2 is used for this study.¹ The GTAP model is a comparative static model of the world economy. In the model, the world is divided into regions, in which consumers allocate income between private consumption, public consumption and savings.

Producers are divided into various sectors and are assumed to minimise costs subject to a constant returns to scale production technology. They combine intermediate inputs and a primary factor bundle in fixed proportions to produce their output. Skilled and unskilled labour, capital and land are combined using a constant elasticity of substitution (CES) function to form the primary factor bundle. Labour and capital are perfectly mobile between sectors within each economy. Agricultural land and land devoted to forestry can be transformed to a limited extent.

Each commodity imported by a country is assumed to be differentiated by the country of origin (according to the so-called Armington assumption). Commodity differentiation is expressed through a nested structure with a CES function between imported and domestically produced goods, and another CES function between

¹ The model is available at <https://www.gtap.agecon.purdue.edu/models/current.asp>. Documentation of the model is found in Hertel (1997).

imports from different origins. The elasticity of substitution between imported goods originating from different countries is twice the elasticity between domestic and aggregated imported commodities.

The supply of primary factors is fixed within each region, but is reallocated across activities within regions in response to changes in relative returns. The supply of land to agricultural production is controlled by a constant elasticity of transformation (CET) function. The fishing and mining sectors have a sector specific factor representing the value of the natural resources used in those sectors.

Goods and factor markets are assumed to be competitive and to clear in equilibrium. Returns to factors of production within each country are assumed to accrue as income to households in that country and, in turn, feed into consumption and savings. Households' average propensity to save is fixed in each country. Household savings in each country can be allocated to domestic and foreign investment. Aggregate world savings equals aggregate world investment, and rates of return on investments are equalized across all regions.²

At the macroeconomic level, government consumption and net (of depreciation) savings in each region are fixed nominal shares of regional income.³ Household consumption varies in response to changes in regional income and prices. It is assumed that net investment is reallocated across regions to equalise the expected rate of return on regional investments.

All price changes are relative to a world index of returns to factors. This price index is the numeraire.

3.2 The database

The database employed in this study is GTAP version 7 (Narayanan and Walmsley 2008). Key features of this version include:

- a 2004 base year
- 113 regional economies
- 57 industries.

² See Hertel (1997), for a discussion of the equations governing the international allocation of investment in GTAP.

³ In addition, a private consumption tax shifter is endogenised to keep the ratio of tax revenue to regional income constant. This is designed to keep the ratio of government expenditure to GDP constant, thus avoiding undesirable effects of swings in government expenditure on model results.

The database is composed of a set of detailed input–output tables linked by bilateral trade data. The trade data are combined with protection and transportation cost data to represent international trade linkages across regions.⁴

For the purposes of this study, the database is aggregated into 40 regional groups and 24 industries. As agricultural policy is the focus of this study, agricultural, forestry and fishing, and food processing industries are separately identified. Mining and manufacturing industries are aggregated into one group (‘manufacturing’) and all services sectors are aggregated into another group (‘services’).⁵

Within the 40 aggregated regional groups in the database, the EU15 member states are each represented individually, so that the CAP programs are modelled for each member. The NMS are aggregated in the database into a single region.⁶

For ease of presentation, results are further aggregated into nine regions — EU15, NMS, rest of Europe, Australia–New Zealand, East Asia, rest of Asia, North America, Latin America and Africa. Results are also aggregated into six industries — crops, livestock, forestry and fishing, food processing, manufacturing and services.⁷

The industry breakdown of output for each of the nine regions, and EU15 member states, is shown in table 3.1. Agriculture (the sum of crops and livestock) accounts for a small share of output in all regions when compared with manufacturing and services. It is particularly small in the EU15 (1.6 per cent) compared with Africa and rest of Asia (about 9 per cent), the NMS and rest of Europe (about 4.5 per cent) and, to a lesser degree, Australia–New Zealand (3 per cent). There is, nonetheless, some diversity in the size of agriculture within the EU15 — it comprises the largest share of output in Greece, Portugal and Spain.

⁴ Further details on the GTAP database are found on the GTAP website: <https://www.gtap.agecon.purdue.edu/databases/v7/default.asp>.

⁵ In the aggregation process, ‘natural resources’ of the fishing and mining sectors are combined.

⁶ The reference year in the database is 2004, and Romania and Bulgaria were not part of the European Union at that time. However, since we take the database to represent a 2007 CAP policy situation, Romania and Bulgaria have been included in the NMS aggregation.

⁷ Appendix tables A.5 and A.6 indicate the mapping from the 113 regions and 57 industries in the original GTAP 7 to the aggregated database containing 40 regions and 24 industries, and to the aggregation used for reporting results, which contains nine regions and six industries.

Table 3.1 Industry output share by region and EU15 member state
Per cent, 2004

<i>Country/Region</i>	<i>Crops</i>	<i>Live stock</i>	<i>Forestry & fishing</i>	<i>Food processing</i>	<i>Manuf</i>	<i>Services</i>	<i>Total</i>
Australia-NZ	1.4	1.4	0.5	5.4	22.1	69.2	100
East Asia	1.9	0.9	0.7	4.1	38.4	54.1	100
Rest of Asia	6.6	2.3	1.0	6.2	37.0	46.8	100
North America	0.7	0.5	0.2	3.3	23.5	71.9	100
Latin America	3.8	1.7	0.5	8.9	37.5	47.7	100
Africa	7.0	1.7	1.3	7.2	33.7	49.0	100
Rest of Europe	2.7	1.8	0.6	5.2	31.5	58.1	100
NMS	3.0	1.5	0.6	9.1	37.1	48.6	100
EU15	1.0	0.6	0.2	5.4	31.4	61.4	100
<i>Austria</i>	<i>0.5</i>	<i>0.6</i>	<i>0.4</i>	<i>4.2</i>	<i>33.9</i>	<i>60.4</i>	<i>100</i>
<i>Belgium</i>	<i>0.9</i>	<i>0.6</i>	<i>0.1</i>	<i>6.5</i>	<i>38.0</i>	<i>53.9</i>	<i>100</i>
<i>Denmark</i>	<i>0.8</i>	<i>1.3</i>	<i>0.4</i>	<i>6.4</i>	<i>27.8</i>	<i>63.3</i>	<i>100</i>
<i>Finland</i>	<i>0.6</i>	<i>0.6</i>	<i>1.3</i>	<i>4.6</i>	<i>34.3</i>	<i>58.6</i>	<i>100</i>
<i>France</i>	<i>1.0</i>	<i>0.7</i>	<i>0.3</i>	<i>5.8</i>	<i>29.6</i>	<i>62.6</i>	<i>100</i>
<i>Germany</i>	<i>0.7</i>	<i>0.5</i>	<i>0.1</i>	<i>4.8</i>	<i>36.7</i>	<i>57.2</i>	<i>100</i>
<i>Greece</i>	<i>3.2</i>	<i>1.1</i>	<i>0.5</i>	<i>8.8</i>	<i>21.5</i>	<i>64.9</i>	<i>100</i>
<i>Ireland</i>	<i>0.4</i>	<i>1.3</i>	<i>0.2</i>	<i>6.1</i>	<i>42.2</i>	<i>49.7</i>	<i>100</i>
<i>Italy</i>	<i>1.4</i>	<i>0.6</i>	<i>0.1</i>	<i>5.2</i>	<i>32.7</i>	<i>60.1</i>	<i>100</i>
<i>Luxembourg</i>	<i>0.2</i>	<i>1.8</i>	<i>0.1</i>	<i>4.0</i>	<i>22.7</i>	<i>71.2</i>	<i>100</i>
<i>Netherland</i>	<i>1.5</i>	<i>0.8</i>	<i>0.1</i>	<i>6.4</i>	<i>29.9</i>	<i>61.2</i>	<i>100</i>
<i>Portugal</i>	<i>1.7</i>	<i>0.9</i>	<i>0.8</i>	<i>7.5</i>	<i>27.3</i>	<i>61.9</i>	<i>100</i>
<i>Spain</i>	<i>1.9</i>	<i>0.8</i>	<i>0.4</i>	<i>6.4</i>	<i>29.5</i>	<i>61.0</i>	<i>100</i>
<i>Sweden</i>	<i>0.3</i>	<i>0.4</i>	<i>0.6</i>	<i>4.0</i>	<i>33.8</i>	<i>60.9</i>	<i>100</i>
<i>United Kingdom</i>	<i>0.4</i>	<i>0.3</i>	<i>0.1</i>	<i>5.1</i>	<i>25.2</i>	<i>68.9</i>	<i>100</i>

Source: GTAP 7 database.

Agricultural support

To account for increased decoupling of agricultural support around the world, the method for building the GTAP version 7 database differs from that used for earlier versions.

In particular, rates of domestic support (based on data from the OECD producer support estimate (PSE)) were not calculated on a sector-specific basis, as has been the case in the past. Instead, for the European Union, rates of subsidisation were *equalised* across all crop sectors. This strategy aims to reflect the idea that direct income support is increasingly paid independently of the type and volume of commodity produced. Box 3.1 summarises the steps taken to allocate assistance

across the available subsidy types in the database — output, intermediate input, labour and capital.⁸

Box 3.1 Calculating domestic support in the European Union

Total support estimates for the EU member states in aggregate were taken from the OECD 2004 PSE database. The total was adjusted so that provisional estimates for crop payments were updated with actual payments reported by the EAGGF Guarantee section financial report 2004-05. The market price support component of the PSE was excluded from the calculations to avoid double counting with the tariffs in the GTAP database.

To disaggregate the subsidies received in each EU member state, each OECD payment was cross-referenced with the corresponding entry in the EAGGF financial report, where payments are specified by country. National payments were disaggregated using additional information about national support in each member country provided by the OECD.

Payments within each commodity group were then allocated across output, input, land and capital subsidies using the concordance in the following table.

Classification used in allocating PSE components^a

<i>GTAP domestic support category</i>	<i>Description of PSE component</i>
Output subsidy	Output-based subsidies Miscellaneous subsidies
Intermediate input subsidy	Subsidies based on input use: variable inputs and on-farm services
Land subsidy	Subsidies based on area planted Subsidies based on historical entitlements Subsidies based on input constraints: variable inputs and set of inputs Subsidies based on input constraints: fixed inputs (crop sectors)
Capital subsidy	Subsidies based on overall farming income Subsidies based on animal numbers Subsidies based on input use: on-farm investment Subsidies based on input constraints: fixed inputs (livestock sectors)

^a The OECD no longer uses this PSE component classification — a new system was implemented in 2007 (OECD 2008).

Under this classification, crop related payments are mostly allocated as payments to land, and payments for animal production are allocated under capital-based payments.

Domestic support rates for land and capital for crops as a group (containing eight GTAP crop sectors) were then calculated and used to distribute domestic support payments for each sector based on their value-added share.

Source: Narayanan and Walmsley (2008).

⁸ There are no subsidies to agricultural labour allocated in the database in the European Union.

The distribution of payments across output, input, land and capital subsidies by commodity is presented in table 3.2. Only a small share is allocated as either an output or intermediate input subsidy.⁹ The exceptions are output subsidies to the oil seeds sector (due to large payments to olive oil production) and crops nec (due to large payments to tobacco production), and input payments to the other animal products sector (due to payments for pest and disease control).¹⁰ The largest share of payments in the crop sectors is allocated as land-based payments, and the largest share in the livestock sectors is allocated as capital-based payments.

Table 3.2 EU15 domestic support payments by commodity and type^a
Per cent

<i>Commodity</i>	<i>Output</i>	<i>Input</i>	<i>Land</i>	<i>Capital</i>	<i>Total</i>
Crops					
Paddy rice	0	0	89.1	10.9	100
Wheat	0	0.2	91.8	8.0	100
Cereal, grains nec	0	0.4	90.9	8.8	100
Vegetables, fruit, nuts	2.2	0.5	88.6	8.8	100
Oil seeds	69.5	0	27.0	3.4	100
Sugar cane, sugar beet	0	0	91.5	8.5	100
Plant based fibres	0	0	89.1	10.9	100
Crops nec	10.5	0	81.4	8.1	100
Livestock					
Bovine cattle, sheep, goats, horses	0	7.3	3.3	89.4	100
Animal products nec	0	12.1	24.5	63.4	100
Raw milk	0	9.0	18.7	72.3	100
Wool, silk-worm cocoons	0	26.1	40.6	33.3	100
Total	7.8	3.2	52.3	36.7	100

^a This table does not include net taxes — ‘zero’ cells in this table represent net taxes.

Source: GTAP 7 database.

It is worth noting some important aspects of the allocation process.

- Land and capital subsidies to the livestock sectors (including cattle, sheep, goats and raw milk) were not equalised. The database *only* represents decoupling for the crop sectors. This is consistent with payments to livestock remaining more coupled than those to crops (chapter 2).

⁹ The GTAP database contains negative net subsidies (that is, net taxes) for some output and intermediate input subsidies.

¹⁰ The shares presented in the table mask large differences in absolute values. For example, the share of intermediate input payments in the wool sector is high, but the overall level of payments is very small and therefore the shares can be misleading. This is also the case for payments to the rice, sugar cane and beet, and plant fibres sectors.

-
- OECD payments data used in the allocation process exclude market price support, but include some rural development expenditure. Therefore, the database amounts are not strictly confined to CAP direct income payments.
 - No output or intermediate input subsidies were equalised, including for the crop sector. This is consistent with some commodity-specific support remaining, discussed in chapter 2.
 - Although decoupling means ‘equal payment per unit of land or capital’, irrespective of the activity undertaken, the effect of the subsidy on an activity is determined by the intensity with which it uses land and capital.

Although efforts have been made to represent a greater degree of decoupling in the database, the subsidy rates are still different across commodities and, therefore, distortionary cross-commodity effects can still be expected. This is consistent with the fact that, on average, 20 per cent of direct payments in the European Union remain coupled to production.

3.3 Modelling strategy

The database enhancements noted above build on the considerable volume of past developments using earlier versions of the database aimed at better modelling different elements of the CAP. Some examples include El Mekki et al. 2000, Francois 2001, Van Meijl and Van Tongeren 2001, Bach et al. 2000 and Francois et al. 2000. Many of the developments implemented by GTAP users in earlier versions of the database have been adopted in the latest version. For example, the equalisation of land subsidies across commodities to represent decoupling in version 7 was adopted in Frandsen et al. (2002) and Brockmeier and Pelikan (2006).

Previous studies have also changed elements of the GTAP model itself to capture better some of the unique characteristics of agricultural production and the CAP. For example, Balkhausen et al. (2007) use a nested land allocation structure so that land substitutability is differentiated between different crop sectors. Bach et al. (2000) and Brockmeier and Pelikan (2006) include an EU budget constraint to model the net transfer of income between countries in the European Union.

Others have used an agriculture-specific version of the GTAP model to, among other things, separate out farm households from aggregated household demand (Hertel and Keeney 2005), or a combination of agriculture-specific partial equilibrium models with the GTAP model, to capture the effects of specific characteristics of agricultural policy in a general equilibrium framework (see, for example, European Commission 2007 and Huang et al. 2004).

In this paper, the standard GTAP model is used. Rather than making adjustments to the model itself, the modelling simulations have been designed to represent the likely magnitude of the effects of specific elements of the CAP on standard variables in the model. In this way, the specificities of the CAP can be accounted for without making significant changes to the model itself.

Setting up the simulations

The objective of this study is to produce up-to-date estimates of the global effects of the CAP, using a representation of the CAP as it existed in 2007. The effects of the CAP are estimated by simulating its elimination. This creates a counterfactual which represents the global economy without the influence of the CAP, against which impacts on welfare, production and trade flows can be assessed, globally and within economies.

Four modelling scenarios are undertaken (they are discussed in more detail below):

1. direct payments
2. export subsidies
3. border protection
4. the total CAP.

The design of the simulations takes into account the complexity of the CAP described in chapter 2, and data availability. Although the programs within the CAP are part of an integrated policy and cannot be disassociated from each other, the main programs have been modelled separately in order to interpret the role and contribution of each of them.

Quantitative modelling is limited to what can be measured using the available data. Rural development payments (Pillar II) were not modelled for the following reasons.

- Although some rural development spending is included in the GTAP database, it is not separately identified. Rather, it is included in the agricultural support data allocated across GTAP subsidies and equalised across crop commodities (as outlined above) and, as such, is treated in the same way as direct payments. Without altering the structure of the database or introducing additional behaviour into the model to represent spending on rural development, this makes Pillar II difficult to model.
- Even with detailed and accurate data on rural development spending, the likely effects of these payments are complex and uncertain, as discussed in chapter 2.

In cases where the effects are clear, they may still be difficult to evaluate because of a lack of information about the value of the benefits of the externality, such as improved environmental and animal welfare outcomes.¹¹

In addition, cross-compliance requirements of direct payments are not modelled as they are difficult to represent in the model, especially in light of the fact that they are designed to enhance the enforcement of legislation that already exists. As Pillar I funding is being linked to cross-compliance measures that involve externalities which are difficult to evaluate (for example, adherence to environmental and animal welfare standards), it is difficult to assess the entire contribution of Pillar I to welfare in the European Union, or to the world as a whole.

3.4 Simulations

The four simulation scenarios are set out below.

Simulation 1: Direct income payments

Given the importance of direct income payments in the CAP budget and their evolution, both in size and nature, it was judged important to model this taking into account the most recent data available. Therefore, direct payments were modelled by adapting policy scenarios to the relevant information available for 2007 (as described in chapter 2).

The magnitude of the policy scenario for direct payments was determined by the average rate of assistance (rather than an absolute dollar amount) observed in 2007 for each member country across all agricultural commodities, measured as the share of payments in gross agricultural output (chapter 2). The scenario, therefore, is the impact of eliminating the rate of assistance observed in 2007. For example, as shown in chapter 2, the rate of support for France was 12.5 per cent. An amount of payments equivalent to 12.5 per cent of output is therefore removed.

In scaling the simulated rate of support to 2007 levels, the profile of payments across types of subsidies — input, output, land and capital — in the database is retained.¹² This is shown in table 3.3. Notably, about 80 per cent of the payments

¹¹ A recent GTAP conference paper by Van Meijl et al. (2009) makes a first attempt at explicitly modelling Pillar II payments.

¹² The negative net subsidies (that is, net taxes) that are recorded for some output and intermediate input subsidies are not shocked.

are treated as land and capital subsidies. The remainder are treated as industry subsidies and subsidies on intermediate inputs.¹³

The profile of payments across agricultural commodities in the database is also retained, with the exception of the fruit and vegetables sector, which is not shocked. The fruit and vegetables sector has received little support in the form of direct payments in the past, and is unlikely to have received large direct payment subsidies in 2007.¹⁴

As direct payments are comparatively small in the NMS (with the emphasis being more on rural development spending in these countries), the direct payments scenario is only applied to EU15 members.¹⁵

Nearly 80 per cent of direct payments are distributed to farmers in France, Germany, Spain, Italy and the United Kingdom (table 3.3). Although small relative to the size of the EU15 economies — direct payments represent only 0.33 per cent of EU15 GDP — direct payments can be large relative to the output of some agricultural sectors. In France for example, direct payments represent 12.5 per cent of the value of gross agricultural output.

¹³ The level of payments in the database reflects the implementation method of the SPS — historic or regional — chosen by each EU member state. The influence itself of the method of payment (historic or regional) is not modelled.

¹⁴ As noted in chapter 2, this situation is changing under a 2008 CAP reform of the fruit and vegetable sector, where land used for the production of fruit and vegetables will become eligible for payments under the SPS, replacing existing support mainly in the form of operational funds to producer organisations.

¹⁵ This situation will change once the phasing in of direct payments to the NMS is completed by 2013 (2016 for Bulgaria and Romania).

Table 3.3 Proportions of total CAP direct payments by subsidy type
Per cent

<i>Country</i>	<i>Output</i>	<i>Input</i>	<i>Land</i>	<i>Capital</i>	<i>Total</i>
Austria	0.0	0.0	1.0	0.7	1.7
Belgium	0.0	0.0	0.3	1.0	1.3
Denmark	0.0	0.0	1.8	0.6	2.5
Finland	0.0	0.0	0.7	0.6	1.3
France	0.0	3.1	8.8	8.5	20.3
Germany	0.1	0.0	11.0	7.5	18.7
Greece	3.7	0.0	2.0	2.8	8.5
Ireland	0.0	0.2	0.4	2.4	3.0
Italy	2.7	0.0	5.1	5.2	13.0
Luxembourg	0.0	0.1	0.1	0.4	0.5
Netherlands	0.0	0.0	0.6	0.7	1.4
Portugal	0.1	0.2	0.7	0.9	1.8
Spain	3.2	0.4	2.5	4.5	10.6
Sweden	0.0	0.1	1.1	0.7	2.0
United Kingdom	0.0	1.4	5.5	6.6	13.5
Total	9.8	5.4	41.6	43.2	100.0

Source: Simulation shocks based on 2007 data and GTAP 7 database subsidy structure.

Simulation 2: Export subsidies

The European Union provides subsidies for exports of some agricultural products, and indirectly supports agriculture with export subsidies for many processed food products. In the database, these subsidy rates are applied equally to EU exports to all destination countries (although the total value of subsidy paid differs by member state depending on their structure of trade). The rates of subsidy are based on data obtained in the financial report of the EAGGF (Narayanan 2009). There are no export subsidies on intra-EU trade.

Simulation 2 involves reducing the rate of subsidy on exports to zero for agricultural and food processing goods in all EU countries as they appear in the GTAP database, with a reference year of 2004. In doing so, it is assumed that the rates of subsidy have not changed between 2004 and 2007. In practice, export subsidies move in line with changes in the gap between world and domestic prices of agricultural goods, and this gap narrowed between 2004 and 2007. However, movements over that period are not necessarily representative of the average trend. For example, in 2008-09 export subsidies increased due to lower world prices. The assumption of no change is therefore considered to be a reasonable approximation of the average level.

Table 3.4 presents the export subsidy rates in the database. It shows that processed food receives the largest subsidies in terms of values and rates. Sugar and dairy products are the most subsidised exports; their subsidy rates are estimated at around 6 and 26 per cent of the value of exports respectively.

Table 3.4 EU export subsidy rates by commodity
Per cent of export value

<i>GTAP Commodity</i>	<i>Subsidy rate</i>
Cereal grains nec	2.11
Vegetables, fruit, nuts	0.13
Bovine meat products	2.30
Meat products nec	0.65
Dairy products	5.64
Processed rice	3.64
Sugar	25.97
Food products nec	0.52
Beverages and tobacco products	0.03

Source: Calculated from the GTAP 7 database.

Simulation 3: Border protection

Protection from imports is an integral part of the CAP package that affects the allocation of resources and trade in the global economy. Incorporating border protection measures has been a focus of GTAP since its inception. These policy instruments have been included in the GTAP database as ad valorem equivalents (AVEs) at the detailed product level, with the data sourced from the Market Access Maps (MAcMap) database and aggregated to the GTAP commodity level by using import weights (Narayanan and Walmsley 2008).

AVEs are a way of converting specific tariffs and tariff rate quotas (TRQs) into equivalent ad valorem rates, so that different trade barrier instruments can be compared directly. Specific tariffs are converted to AVEs by dividing the duty by the unit value of the good. TRQs are more problematic, as they cannot be accurately summarised as an AVE (Bouet et al. 2008). In MAcMAP, TRQs are converted using a methodology which reflects the marginal level of protection as well as the quota rents involved. The level of protection of marginal imports is calculated as:

- the inside quota tariff rate if the quota is non-binding
- the outside tariff rate if the quota is binding but the outside quota tariff rate is not prohibitive

-
- the average of the inside and outside quota tariff rates if the quota is binding and the outside quota tariff rate is prohibitive.

The quota rent is calculated according to a formula that links the quota, the unit value, the trade value, the marginal level of protection, and the inside quota tariff rate.

A shortcoming of using AVEs in a CGE model is that the effects of prohibitive tariffs on some tariff lines are underestimated, as the corresponding import flows will be zero (or close to zero) and therefore not captured in the database (or have a very small weight). Prohibitive outside quota tariff rates may not be properly accounted for either. This, for example, could be a problem for EU imports of beef, sheep meat and dairy products from Australia and New Zealand which have a prohibitively high out of quota tariff rate.

Simulation 3 involves reducing the ad valorem tariff equivalents on imports of agricultural and food processing goods observed in the database for all EU countries to zero. In doing so, it is assumed in this study that rates have not changed between 2004 and 2007 — a reasonable assumption since border protection policies in the European Union have not changed much over this period.¹⁶

The trade weighted average AVE rates imposed by the European Union on imported agricultural and food processing goods by region of origin are shown in table 3.5 (no tariffs are applied on intra-EU trade). Border protection measures are concentrated on imports of crop products and, in particular, processed foods, which indirectly protects the related agricultural sectors. There is a strong pattern of tariff escalation, where tariff rates increase with the degree to which products are processed.

The average rate of tariffs faced by an exporting region is determined by the mix of its exports to the European Union. This results in a high variation in the average rates faced by different exporters. The trade weighted average tariff on agricultural products imported from Latin America exceeds 21 per cent, while products imported from African countries face an average tariff of less than 10 per cent. The aggregation here masks variation by importing partner and individual commodity. See appendix tables A.7 and A.8 for greater detail on tariff rates in the GTAP database.

¹⁶ The main exception is the implementation of the Economic Partnership Agreement between Europe and some African, Caribbean and Pacific (ACP) countries, but its impact is limited.

Simulation 4: Total CAP program

Simulation 4 involves applying all three scenarios above simultaneously, in order to assess the overall impact of the CAP.

Table 3.5 Trade weighted average ad valorem equivalent tariff rates on EU imports

Per cent

<i>Exporting regions</i>	<i>Crops</i>	<i>Livestock</i>	<i>Food processing</i>	<i>Average</i>
Australia-NZ	4.36	0.37	16.62	11.89
East Asia	16.52	0.64	17.02	15.94
Rest of Asia	4.73	0.93	19.38	10.86
North America	9.55	1.82	16.17	11.93
Latin America	19.43	8.32	23.96	21.37
Africa	2.10	0.05	19.86	9.34
Rest of Europe	6.00	0.42	13.31	10.69
Total	10.94	1.75	18.76	14.62

Source: Calculated from GTAP 7 database.

4 Global effects of the CAP

The effects of the CAP on the European Union and other regions are presented in this chapter, through a discussion of the CGE modelling results for the four simulations outlined in chapter 3 — direct payments, export subsidies, tariffs and the total CAP (see box 4.1 for a characterisation of CGE results). In section 4.1 the framework used to analyse results is outlined. Results are then discussed firstly in terms of the effects of the CAP on sectoral outputs in the European Union (section 4.2) and secondly outside of the European Union (section 4.3), to identify the various allocative effects of the CAP. The welfare and efficiency effects of the CAP are then summarised in section 4.4.

4.1 Presentation of results

The results in this study are interpreted as the contributions and costs that the CAP generates. Therefore, the signs on the results obtained from the simulations that model the removal of the CAP are reversed. Furthermore, where US dollar amounts are reported, they represent projections for a 2007 year based on the values of GDP in 2007 obtained from the World Bank.¹

As outlined in chapter 3, results for each of the four simulations are aggregated into nine regions — with the EU15 and NMS identified separately — and six industries: crops, livestock, forestry and fishing, food processing, other manufacturing, and services.

Although the CAP is an integrated system, the effects of various parts of the CAP can be very different, and on the whole, complex to interpret. For this reason, results are often separated into the contributions of direct payments (simulation 1), export subsidies (simulation 2) and import tariffs (simulation 3), as well as the aggregate effect of the CAP (simulation 4).

¹ The GDP and GNE value change results reported in this chapter are calculated using the percentage change results from the simulations and the GDP data for 2007 from the World Bank. This means that the sum of the regional changes in value will not sum to the change in the world value as the relative share of each region in world GDP is different in 2007 compared to the database values for 2004. An average conversion rate for 2007 of 0.73 Euros to 1 US dollar can be used to convert US dollar results into Euros.

Box 4.1 **General equilibrium mechanisms at work**

In chapter 2, the economic effects of individual elements of the CAP are discussed within a partial equilibrium (PE) framework (section 2.5). This analysis is useful to explore what the directional impacts of the CAP policies are likely to be on agricultural markets. The general equilibrium (GE) framework used in this paper differs from the analysis in chapter 2 in several important ways that are useful to keep in mind when considering the results presented in this chapter.

- Although the PE analysis measures the first round impacts of changes to a policy instrument on one particular industry, the GE model also measures the flow-on impacts not only to the affected industry but also to other industries in the same economy and across the world.
- The PE analysis in this paper assumes that the goods produced domestically and those sold by other countries on the world market are perfect substitutes (homogeneous). This means that a country is assumed to either import or export a product, but not both. The GTAP GE model assumes that goods produced in each country are imperfect substitutes for each other (differentiated). Therefore, two-way trade is common — countries import and export the same goods.

A GE model measures the effects of policy instruments on each sector as well as on the economy as a whole for each region in the model. In this study, the effect of the CAP on the world is unlikely to be large as agriculture makes up only a small proportion of world output, and EU agriculture is a small percentage of world agricultural output.

On the other hand, sectoral effects within the European Union are likely to be large as the CAP represents a significant percentage of output for some agricultural sectors in the European Union. As direct payments have a less distortionary effect than trade protection measures, the majority of the cost of this part of the CAP is likely to be felt within the European Union. However, border measures are likely to result in significant costs (and some benefits) to countries with which the European Union trades heavily, or which compete with the European Union in world commodity markets.

The analytical separation of the components of the CAP does not mean that they can be dissociated in a policy sense. The individual components are part of an integrated policy that cannot exist without all three components.² However, the decomposition provides an indication of the contribution of each element of the CAP to the total effect and helps to interpret the different effects of each component as outlined in chapter 2.

² Although occasionally, world market conditions mean that some parts of the policy can be suspended, such as the tariffs on grains in 2008.

The sum of the simulations for each component do not exactly add up to the total effect because of linearisation error. The source of this linearisation error is aggregation, and arises from aggregation across countries and commodities.

Industry output

The components of CAP support affect the prices of inputs and factors used in the production of assisted agricultural products, including by:

- changing the relative prices received by producers for the supported products
- reducing the cost of using inputs in the supported activities
- increasing the returns to factors employed in the supported activities.

In the model, primary factors of production within each regional economy are fixed and are reallocated between sectors in response to the changes in relative returns. A measure of this reallocation is the change in sectoral outputs. The changes in sectoral outputs feed into the changes in welfare and GDP in each regional economy and for the world as a whole.

GDP and welfare

As primary factors are assumed to be in fixed supply in each regional economy, real GDP can be used as a measure of the efficiency with which resources are used. Changes in real GDP can therefore be interpreted as gains or losses in efficiency due to allocative changes.

In this paper, the change in real gross national expenditure (GNE, also referred to as gross domestic absorption) is used as an approximate measure of the effect of CAP support on a country's welfare (box 4.2).

Box 4.2 Measuring welfare

Changes in a population's wellbeing are approximated by changes in economic welfare, which is often measured as changes in consumption opportunities. Measures of this include:

- the change in real national disposable income, a measure of income accruing to residents, which can be calculated as the output of the economy (GDP) less net transfers that accrue to foreigners who might own factors used in the production of this output
- the change in gross national expenditure (GNE), a measure of expenditure, or of the demand for goods and services.

In the version of GTAP used for this study, changes in foreign ownership of factors are not accounted for. Therefore, changes in real national disposable income are equivalent to changes in GDP. Changes in real GNE are used as the indicator of changes in wellbeing. With this choice, changes in wellbeing can be decomposed into changes in income associated with changes in efficiency (through changes in GDP when the resources of an economy are held fixed) and changes in the trade surplus, as shown hereafter.

GNE is defined as the sum of private and public consumption (C and G) and investment (I): $GNE = C + G + I$.

As the balance of the current account ($X - M$, where X is exports and M is imports) and the capital account ($S - I$, where S is savings) must be equal, investment can be represented as: $I = S - (X - M)$.

Therefore, GNE can be expressed in the following way:

$$GNE = C + G + S - (X - M) = GDP - (X - M).$$

The difference between the change in real GNE and real GDP is, therefore, accounted for by real changes in the trade balance — that is, export and import quantities. Changes in exports and imports can, in turn, be influenced by two factors: the change in a country's terms of trade — that is, the price of a country's exports relative to its imports — and changes in the flow of foreign investment.

Changes in GNE can therefore be interpreted as changes in income that come from improvements in allocative efficiency (GDP), changes in the terms of trade, and changes in foreign investment. It then follows that the difference between GDP and GNE can be accounted for by income changes that are associated with changes in the terms of trade and changes in foreign investment. When changes in foreign investment are small, as they are for most regions in this paper, the main contributors to changes in welfare are changes in allocative efficiency and terms of trade effects. Therefore, in this study, the explanation of policy induced welfare changes is confined to changes in allocative efficiency and the terms of trade effects.

4.2 Sectoral effects within the European Union

The CAP increases the size (in terms of total output) of agriculture by about 8 per cent in the EU15, and by less in the NMS. It also increases food processing by nearly 6 per cent in the European Union as a whole (table 4.1). The resources required for this expansion come from the parts of the economy that are not supported by the CAP. Manufacturing and services in the EU15, for example, shrink by more than 1 and 0.1 per cent respectively. Resources also come from forestry, which competes with CAP supported industries for agricultural land and is more than 3 per cent smaller in the EU15 than if the CAP did not exist.³

Direct payments, export subsidies and border protection contribute in different ways to these results.

Table 4.1 **Effects on sectoral outputs within the European Union**

Per cent

<i>CAP component / Region</i>	<i>Crops</i>	<i>Livestock</i>	<i>Forestry & fishing</i>	<i>Food process.</i>	<i>Manuf.</i>	<i>Services</i>
Direct payments						
NMS	-0.49	-1.98	0.95	-0.29	0.26	0.01
EU15	1.92	2.52	-0.95	0.76	-0.29	-0.05
Export subsidies						
NMS	0.02	0.06	-0.03	0.23	-0.05	..
EU15	0.03	0.16	-0.01	0.25	-0.04	..
Border protection						
NMS	2.48	2.41	-0.77	5.56	-1.29	-0.20
EU15	6.23	4.93	-0.77	4.92	-1.02	-0.10
Total CAP						
NMS	1.97	0.64	0.09	5.61	-1.11	-0.19
EU15	8.09	7.64	-1.65	6.02	-1.35	-0.15

.. between -0.005 and 0.005.

Source: Simulation results.

Direct payments

Direct payments create a wedge between the cost of producing a supported commodity and the price paid by consumers. The initial effects of this wedge are to decrease the price paid by consumers without reducing the price received by

³ To the extent that direct payments might require farmers to plant some forest (for example, to satisfy some environmental cross-compliance criterion), this effect may be overstated.

farmers, and to increase the size of the sectors that benefit from this form of support in the EU15.

Direct payments cause the agricultural sectors in the EU15 to expand by around 2 per cent.⁴ Food processors in the EU15 are the main users of some of the products that are made cheaper by direct payments. The reduction in the cost of some of the inputs into food processing contributes to an expansion of the industry in the EU15 and a reduction in the world price.

Sectors that do not benefit from direct payments are smaller than they would be otherwise as they supply the resources required for the expansion of agriculture and food processing. This is the case for all non-supported activities, including resource-based sectors, manufacturing and services in the EU15. In 2007, the resources transferred to the agricultural and food processing sectors in the EU15 represented some \$US 8.8 billion.

The cropping and livestock sectors in the NMS are smaller than otherwise because the expansion of EU15 agricultural output reduces the price of agricultural products in world markets. Agriculture in the NMS responds by contracting.⁵ A relative shortage of local produce and a reduction in the world price of processed foods leads to a contraction of the food processing sector in the NMS. These contractions free up resources, which in turn allow other sectors to expand in the NMS economies.

Export subsidies

Export subsidies lower the cost of exporting goods overseas and therefore expand production in subsidised industries. As export subsidies are highest for processed foods, the results are largest for this sector — output in the food processing sector is around 0.3 per cent larger than it would be without export subsidies. This flows through to increased demand for related inputs from the agricultural sector, leading to a larger than otherwise crop and livestock sector in the European Union. Manufacturing, on the other hand, is slightly smaller than it would otherwise be.

⁴ To the extent that this is a simplification and that some direct payments are made in the NMS and not modelled, these results may be somewhat overstated. However, although some direct payments are made in the NMS (refer to chapter 2) their rate is much lower (less than half) than in most of the EU15 members.

⁵ To the extent that direct payments to the NMS are increasing, this effect would be smaller and may be reversed by the end of the phasing-in period of direct payments (between 2013 and 2016).

Border protection

The initial effect of border protection is to increase the cost of imports and expand the industries that produce goods that compete with imports. This expansion occurs at the expense of other sectors in the economy, including any rural activities that do not benefit from the protection.

Of total CAP support, border protection contributes by far the most to increasing the size of agriculture and food processing in the European Union. It has different effects on the agricultural sectors of the NMS and the EU15 because of the different structures of production and imports in different parts of the European Union. Protection rates are weighted toward protecting commodities that are produced more intensively in the EU15.⁶ Border protection accounts for more than 50 per cent of the effects of the CAP in the EU15, and is also the main contribution of the CAP to maintaining a larger agricultural sector in the NMS.

Border protection contributes to increasing the size of cropping, livestock and food processing activities in the order of 2.5 to 6 per cent across the European Union. In the European Union as a whole, manufacturing declines by about 1 per cent and services by about 0.1 per cent as a result. In 2007, this represented a transfer of value added to agriculture and food processing in the order \$US 49.7 billion.

Effects on fruit and vegetables and forestry

Two rural sectors do not benefit from direct payments in the model: fruit and vegetable production, and forestry.⁷ As part of the CAP, however, the fruit and vegetable sector benefits from some border protection. Disaggregated results (table 4.2) show that border protection increases the size of the EU fruit and vegetable sector by about 5 per cent.⁸ Both sectors compete for land with other agricultural activities. Therefore, when direct payments cause agriculture in the EU15 to expand, the size of the EU15 fruit and vegetable sector is reduced by more

⁶ Whether this is because protection was developed in this way or whether protection has influenced the structure of agriculture is not explained by the model. However, the model results which show that resources flow toward protected activities are consistent with the latter hypothesis that over time, border protection has distorted the agricultural sector in the EU15.

⁷ This may change somewhat in the future since, as noted in chapter 2, land used for fruit and vegetable production is being gradually transitioned into the SPS system, following a 2008 CAP reform. The amount to be transferred is expected to be around 800 million Euros.

⁸ This is an average effect for the fruit and vegetable sector. To the extent that some products are less protected than others (for example, the tariff rate on competing imports is lower), output from producers competing with these imports would decline as a result of the CAP to the benefit of more highly protected products that are included in the aggregate fruit and vegetable sector.

than 1 per cent. Similarly, the size of the corresponding sector in the NMS increases by 0.5 per cent (\$US 65.3 million).

In total, the CAP contributes to reducing the size of the forestry sector in the European Union by more than 3 per cent, or around \$US 870 million.

Table 4.2 Effects on EU rural sectors that do not benefit from direct payments
Per cent

	<i>Fruit and vegetable</i>	<i>Forestry</i>
Direct payments		
NMS	0.49	1.12
EU15	-1.21	-1.70
Border protection		
NMS	4.64	-0.96
EU15	6.66	-1.72
Total CAP		
NMS	4.95	0.04
EU15	5.62	-3.35

Source: Simulation results.

4.3 Sectoral effects outside the European Union

The effects of the CAP outside the European Union are summarised in table 4.3. Some of these effects can be dramatic, with border protection reducing the size of herds in South America by about 12 per cent, and in Australia by about 3.5 per cent. The relatively high border protection and reduced market access affecting some processed foods result in decreases in the size of the processed food sector in most regions by 4 to 5 per cent.

Overall, the impact of the CAP outside the European Union is to reallocate some sizable amount of resources away from agriculture and food processing, toward other sectors of the economy. This reallocation of resources amounts to about \$US 52.7 billion, and reflects a decrease in world prices for agriculture and food processing, and increases in prices for other commodities (table 4.4)

Direct payments

With direct payments contributing to reducing the world prices of several commodities, the reaction in most regions is to reduce the activity in the cropping

and livestock sectors. The largest effect is on cropping and livestock activity in Australia and New Zealand (-0.6 per cent or \$US 188.9 million). Resources are reallocated mainly to the manufacturing sector, which expands in all regions.

Table 4.3 Effects on sectoral outputs outside the European Union
Per cent

<i>CAP component /Region</i>	<i>Crops</i>	<i>Live-stock</i>	<i>Forestry & fishing</i>	<i>Food process.</i>	<i>Manuf.</i>	<i>Services</i>
Direct payments						
Australia-NZ	-0.31	-1.07	0.21	-0.47	0.22	-0.01
East Asia	-0.11	-0.06	..	-0.11	0.04	..
Rest of Asia	-0.15	-0.46	0.05	-0.07	0.08	0.01
North America	-0.50	-0.34	0.14	-0.07	0.07	-0.01
Latin America	-0.73	-0.44	0.09	-0.15	0.19	0.01
Africa	-0.63	-0.48	0.25	-0.30	0.20	0.04
Rest of Europe	-0.33	-0.35	0.29	-0.41	0.10	0.01
Export subsidies						
Australia-NZ	0.05	-0.60	0.15	-0.48	0.12	..
East Asia	-0.01	-0.04	-0.01	-0.06	..	..
Rest of Asia	-0.01	-0.11	..	-0.24	0.02	0.01
North America	-0.03	-0.13	0.01	-0.09	0.01	..
Latin America	-0.04	-0.16	0.01	-0.18	0.04	..
Africa	-0.02	-0.14	0.02	-0.35	0.05	0.01
Rest of Europe	-0.09	-0.12	0.03	-0.43	0.05	0.01
Border protection						
Australia-NZ	-0.19	-3.61	0.77	-3.53	0.97	0.01
East Asia	-0.83	-0.27	-0.07	-0.92	0.16	0.02
Rest of Asia	-0.08	-0.50	-0.06	-4.45	1.15	0.14
North America	-1.73	-1.03	0.29	-0.88	0.19	0.01
Latin America	-2.25	-11.88	0.53	-4.14	2.39	0.06
Africa	-0.18	-2.14	-0.05	-5.21	0.74	-0.03
Rest of Europe	-1.49	-1.46	0.38	-4.98	0.84	0.06
Total CAP						
Australia-NZ	-0.49	-4.89	1.01	-4.30	1.28	0.01
East Asia	-0.96	-0.39	-0.07	-1.10	0.20	0.02
Rest of Asia	-0.23	-1.07	-0.02	-5.01	1.32	0.15
North America	-2.30	-1.50	0.45	-1.07	0.28	..
Latin America	-2.78	-12.70	0.60	-4.51	2.64	0.06
Africa	-0.81	-2.93	0.18	-6.13	1.02	0.02
Rest of Europe	-1.95	-1.94	0.68	-5.90	1.00	0.08

.. between -0.005 and 0.005.

Source: Simulation results.

Table 4.4 Effect of the CAP on world prices

Per cent

Crops	-2.08
Livestock	-3.91
Forestry & fishing	0.16
Food processing	-0.83
Manufacturing	0.10
Services	0.18

Source: Simulation results.

Border protection

Although the European Union applies unique tariff rates at the tariff line level, average barriers for aggregated commodity groups are affected by their composition. This gives rise to differences in the average tariff rates faced by exporters to the European Union (as outlined in chapter 3 and appendix tables A.7 and A.8). Given the pattern of its exports to the European Union, Latin America faces the highest barriers of all regions for the crop, livestock and food processing sectors. Thus border protection from the European Union results in the largest reallocation of resources in Latin America where the outputs of the cropping, livestock and food processing sectors are reduced, and output of the manufacturing and services sectors increases by \$US 24.2 billion.

The high ad valorem tariff equivalents in the food processing sector (well in excess of 10 per cent on average) lead to decreases in output in this sector in many regions of the order of 5 per cent. The total decrease in activity in this sector outside the European Union is about \$US 24.6 billion. The effects of escalation in border protection are well illustrated with the results for Australia and New Zealand. Although the border protection faced by livestock exporters is relatively low, the high protection applied to the meat and dairy sectors has a flow-on impact upstream, reducing the output of the food processing and livestock sectors in Australia and New Zealand by more than 3.5 per cent. Furthermore, it is important to note that, to the extent that trade barriers are underestimated due to prohibitive tariffs (including prohibitive out of quota tariffs) not being fully captured in the database, these results are probably underestimates.

Export subsidies

The European Union subsidises exports of processed foods and, to a lesser extent, some agricultural products.⁹ Export subsidies expand the European Union's markets and benefit importers of EU products by lowering the price of EU exports. The effects of export subsidies on the European Union's trading partners are a function of the amount of subsidy that they receive (table 4.5). A large share of subsidies accrue to consumers in regions that import large amounts of agricultural and, in particular, food products from the European Union, such as parts of Asia, Africa, Latin America and non-EU Europe. On the other hand, North America, Australia and NZ import much less agricultural and food products from the European Union and consumers in these regions benefit little from EU export subsidies.

Table 4.5 EU export subsidies by destination region
US\$ million, per cent of value of exports

<i>Importing region</i>	<i>Crops</i>		<i>Food processing</i>	
	Value	Rate	Value	Rate
Australia-NZ	0.03	0.04	10.64	0.74
East Asia	0.97	0.13	123.93	1.10
Rest of Asia	1.92	0.23	237.79	3.61
North America	1.68	0.15	99.02	0.66
Latin America	0.32	0.10	53.03	1.56
Africa	1.15	0.06	186.26	2.68
Rest of Europe	6.74	0.17	246.65	1.68
Total	12.81	0.15	957.32	1.60

Source: Simulation results.

Because export subsidies reduce the cost of procuring EU exports of agricultural and food products, the demand for these goods expands. Importers therefore substitute away from products from other regions and domestic production is reduced.¹⁰ This accounts for the decline in agricultural and food production in

⁹ A possible alternative to export subsidies is to store or destroy surplus production. Storage and destruction of production are thought to be more expensive alternatives than selling a product on the world market. Although some storage occurs in the European Union, the cost of this option is not modelled.

¹⁰ Export subsidies are contingent on the level of price support and on world prices; they bridge the gap between the two. For a given price support, the export subsidy increases as the world price decreases, for example, in response to an unexpected increase in production outside the European Union. As it increases, the export subsidy depresses world prices further, as the EU production arrives on the already oversupplied world market. The effect shown here is only that of the export subsidy, isolated from that of any initial, unrelated decrease in world agricultural prices.

non-EU regions and the corresponding rise in the outputs of other industries as resources are shifted out of agriculture and food processing and reemployed in manufacturing and services. Livestock activities in Australia and New Zealand are particularly exposed to the reduction in world prices of bovine meat and dairy products. The small effects observed for the African crops sector relative to what may be expected is related to the high prices that prevailed during the period and therefore the relatively low subsidies modelled. This effect could be larger when world prices are low.

4.4 Welfare and allocative efficiency effects of the CAP

The following analysis of the global GDP and welfare effects of the CAP is couched in terms of the contribution of the different parts of the CAP as it is modelled. Export subsidy results are not presented, as the GDP and welfare effects of export subsidies in the modelling are very small (equal to zero at two decimal points in almost all cases).

Direct payments

Table 4.6 shows that the main welfare impact of direct payments is on the European Union itself — a loss in welfare measured in terms of GNE equivalent to \$US 1 billion per annum. This result can be decomposed into changes in allocative efficiency (GDP) and the EU15's terms of trade (refer to box 4.2). Most of the loss is attributable to a loss in allocative efficiency (US\$7.5 billion in terms of 2007 GDP) associated with diverting resources away from non-supported sectors. This efficiency loss is partly compensated by a gain in the EU15's terms of trade as the prices of EU15 exports rise relative to the price of their imports.

The rest of the world also suffers a net loss from the direct payments. For example, direct payments reduce GNE in Australia–New Zealand by 0.04 per cent, equivalent to \$US 387 million. In the Americas, the reduction in GNE amounts to \$US 3.5 billion. The welfare losses can be largely attributed to a terms of trade deterioration.

The welfare cost to the world of the EU's direct payments is equivalent to US\$ 6.6 billion per annum, which is about 0.01 per cent of global GNE. This is the net effect of the various resource reallocations that occur within the economies across the world, and represents an opportunity cost in terms of consumption possibilities.

Table 4.6 Effects of direct payments on real GNE and GDP

Per cent, US\$ million in 2007 prices

<i>Region</i>	<i>Gross National Expenditure</i>		<i>Gross Domestic Product</i>	
	Per cent	Value	Per cent	Value
Australia-NZ	-0.04	-387	..	-6
East Asia	-0.01	-1213	..	135
Rest of Asia	..	18	..	76
North America	-0.02	-2775	..	190
Latin America	-0.02	-726	0.01	200
Africa	..	-16	0.01	74
Rest of Europe	..	-66	0.01	366
NMS	-0.02	-217	0.02	286
EU15	-0.01	-1042	-0.05	-7538
World	-0.01	-6598	-0.01	-6598

.. between -0.005 and 0.005.

Source: Simulation results.

Border protection

The European Union suffers the traditional efficiency losses that are associated with border protection, in the order of \$US 46 billion, as these measures encourage a larger agricultural sector (and reduced activity in other sectors) in the European Union than is optimal (table 4.7). These losses are partly compensated by a transfer of income from the rest of the world through an improvement of the European Union's terms of trade, to the tune of almost \$US 15 billion. A standard result of an economy that restricts its imports is to induce a reduction in the world price of its imports and an increase in the price of exports (refer to chapter 2).

Table 4.7 Effects of border protection on real GNE and GDP

Per cent, US\$ million in 2007 prices

<i>Region</i>	<i>Gross National Expenditure</i>		<i>Gross Domestic Product</i>	
	Per cent	Value	Per cent	Value
Australia-NZ	-0.14	-1347	..	-34
East Asia	0.04	3375	0.01	650
Rest of Asia	-0.11	-2691	0.03	706
North America	-0.01	-1885	0.01	941
Latin America	-0.23	-7870	0.05	1644
Africa	-0.07	-834	..	-46
Rest of Europe	-0.07	-2314	0.06	1980
NMS	-0.30	-3687	-0.45	-5295
EU15	-0.17	-26 159	-0.26	-40 808
World	-0.08	-40 748	-0.08	-40 748

.. between -0.005 and 0.005

Source: Simulation results.

North America and the rest of the world experience an increase in GDP due to increased imports of manufactured goods by the European Union. This increase is due to the retention of resources in agriculture in the European Union leading to a reduction in production in other sectors. In many cases, however, the increases in GDP are counteracted by worsening terms of trade.

Almost all regions experience a welfare loss from the EU protection from agricultural imports. Latin America as a group suffers the biggest losses because its exports to the European Union face the highest protection. The main source of this loss is a deterioration in the region's terms of trade as the border protection reduces the price they receive for their exports. Similarly, losses in Australia and New Zealand are mainly attributable to a deterioration in the average price of their exports induced by the EU protection. Importers of food experience some benefit from the lower world food prices caused by increased agricultural protection in the European Union.

Overall effects of the CAP

The overall effects of the CAP are made up of the effects of each of the components modelled, as outlined above. The largest contributor to the aggregate effects of the CAP is the border protection component, which accounts for more than 80 per cent of the losses in welfare and GDP sustained by the EU economy as a whole (table 4.8).

The estimated allocative efficiency cost to the European Union of all the elements of the CAP exceeds \$US 52 billion. This figure does not account for any administrative and resource costs of managing the CAP (see chapter 5). A terms of trade gain offsets some of the allocative efficiency loss, but the European Union still experiences a net welfare loss.

In most regions outside the European Union welfare declines, usually due to the terms of trade gain in the European Union. A terms of trade gain for the European Union means a terms of trade loss for the rest of the world. For the world as a whole, the CAP causes gross output (and welfare) to decline by 0.08 per cent or \$US 45 billion.

Table 4.8 Effects of the CAP on economic welfare and activity

Per cent, US\$ million in 2007 prices

<i>Region</i>	<i>Gross National Expenditure</i>		<i>Gross Domestic Product</i>	
	Per cent	Value	Per cent	Value
Australia-NZ	-0.19	-1850	..	-38
East Asia	0.03	2468	0.01	891
Rest of Asia	-0.10	-2552	0.03	908
North America	-0.03	-4891	0.01	1293
Latin America	-0.26	-8730	0.06	1955
Africa	-0.05	-560	0.01	158
Rest of Europe	-0.06	-1816	0.09	2794
NMS	-0.32	-3943	-0.44	-5116
EU15	-0.16	-25 541	-0.30	-47 063
World	-0.08	-45 205	-0.08	-45 205

.. between -0.005 and 0.005.

Source: Simulation results.

5 Conclusion

An agricultural assistance program such as the CAP encourages an expansion of the agricultural and food processing sectors in the European Union. This occurs through a reallocation of fixed primary factor resources within the economy from non-supported sectors (manufacturing and services), to supported activities where the costs to purchasers decline (in the case of direct payments and export subsidies) or where competition from imported alternatives is restricted (in the case of border protection).

Support for the agricultural and food processing sectors in the European Union reduces world prices for agricultural and food commodities. This encourages a movement of resources in other economies away from agriculture and food processing, towards other sectors such as manufacturing and services, which offer higher returns.

These reallocation effects can lead to an overall loss in welfare across the world, including in the European Union itself. The costs include inefficiencies caused by resource reallocation, reflected in a loss in GDP, as well as decreases in an economy's purchasing power, as reflected in a decrease in the terms of trade.

The results of the modelling conducted in this study confirm, and quantify, the picture outlined above. The results show that the CAP leads to:

- an increase in the output of the agricultural and food processing sectors of around 8 and 6 per cent respectively in the European Union
- a decrease in the output of the manufacturing and services sectors in the European Union equivalent to around \$US 65 billion
- decreases in world prices for agricultural goods (of between 2 and 4 per cent) and food processing goods (of around 1 per cent), and increases in world prices for manufactured goods and services
- a reallocation of resources away from agriculture and food processing toward other sectors of the economy in all non-EU regions — some of the largest decreases occur in the livestock sectors in Latin America (12.7 per cent) and Australia–New Zealand (4.9 per cent), and in the food processing sectors in most regions

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- forgone production, as measured by a decrease in GDP, in the European Union of about 0.3 per cent, or \$US 52 billion
 - a net welfare cost in almost all of the European Union's trading partners, in most cases due to the terms of trade gains experienced by the European Union, which translate into a terms of trade loss for all the other regions
 - net global welfare costs of about \$US 45 billion that mostly accrue to the European Union itself (\$US 30 billion), with the largest contributor to this welfare loss being the border protection component of the CAP.

Other general equilibrium (GE) analyses of European assistance to agriculture usually examine the effects of liberalising some or all components of the CAP and are generally consistent with the results presented above (see, for example, Frandsen, Gersfelt and Jensen, 2002).

Some caveats

The modelling results are sensitive to parameter choices, specific model features, and the structure of the database. They are also incomplete, reflecting the limited ability of CGE modelling to capture all costs and benefits associated with the CAP. These factors would need to be accounted for in a more comprehensive analysis of the effects of the CAP.

Model and database

Using a database with a 2004 base year to model a 2007 policy situation relies on the simplifying assumption that the structure of production and trade has not changed across countries over that time. This may be a reasonable assumption for many countries. The period between 2004 and 2007 saw some changes in the structure of the European Union: twelve NMS joined the European Union, and direct payments were gradually decoupled over this period. These changes are likely to have induced changes in production and trade patterns which are not accounted for in the database and could affect results.

Aggregating the database into commodity groups can lead to an underestimation of some of the sectoral results. Although in this study all agricultural sectors were left disaggregated, all other industries were aggregated into two — manufacturing and services. This reduces the scope for inter-sectoral resource reallocation in the model, and may understate the allocative efficiency costs associated with the CAP.

Much work has been done in version 7 of the GTAP database to represent better the decoupling of direct income payments. Although the decoupling in the database is incomplete, with only crop sectors accounted for in the process, this is presently not of concern as many commodity-specific payments remain. However, as the European Union moves increasingly towards the SPS across all agricultural sectors, away from more traditional assistance measures, this will need to be reflected in the database and future modelling.

Results are sensitive to the parameter estimates used as they affect, among other things, the supply response associated with various forms of assistance. Future work might investigate the appropriateness of the standard parameters that were used in this study, and may produce estimates of the elasticity of output with respect to assistance. However, econometric estimation of this relationship is difficult due to a lack of data.

Other factors

There are several other considerations that have not been taken into account in the modelling conducted in this study, both because some effects are inherently difficult to model, and because the complexity of the model increases with the number of effects incorporated. Accounting for the following considerations would be an important addition to a comprehensive policy assessment of the effects of the CAP.

- The costs of administering the CAP, including the costs of managing the diverse elements of the CAP — that is, the costs of managing the tariff, the quota systems, or the direct payments.¹ Their exclusion means that the costs of the CAP are underestimated.
- The effects on productivity of having the CAP in place. The CAP assistance afforded farmers can lead to inefficiencies associated with technical change (in addition to allocative inefficiencies). For example, the lack of competitive forces in the presence of subsidisation can remove the incentive to improve management practices, implement best practice farming techniques, and adopt new technology. Including this technical change (productivity) effect in the modelling would increase the estimated costs of the CAP.
- The effects of cross-compliance and rural development measures. The direct effects of these were not modelled, nor were the possible externalities associated with them. Positive externalities could include the value of improved

¹ For example, the costs of administering the tariff schedule can include costs to business from having to comply with import regulations, import licensing and quarantine restrictions, and costs to government of administration.

environmental outcomes, animal welfare conditions and rural landscapes. These would be countered by possible negative externalities associated with a higher level of agricultural output under the CAP than would otherwise prevail (such as environmental damage from fertiliser or pesticide use). Neither positive nor negative externalities of the CAP have been captured in this assessment.

- The CAP is in constant evolution. This means that any study at a point in time is either an attempt at an ex post assessment of the effects of the CAP (as is this study) or an ex ante evaluation of the possible effects of changes. The former is likely to have more information available, and usually entails numerous compromises to isolate the effects of policies from all that has taken place. The latter is often based on less information, making it more difficult to review and less susceptible to thorough criticism.
- A successful transition to a more market oriented CAP program means that the costs of CAP assistance may decline over time. This raises the challenge of developing methods for modelling less traditional forms of industry assistance that have a less predictable relationship with economic outcomes.

Notwithstanding the limitations of the modelling, the results suggest that the CAP is generating a significant welfare loss, particularly to the European Union itself.

A Supporting tables

Table A.1 2008 CAP Health Check main issues and Council outcomes

<i>Issue</i>	<i>Council outcome</i>
Set-aside	Abolish the requirement to leave 10% of arable lands fallow
Milk quotas	Increase quotas by 1% annually from 2009 to 2013 (milk quotas will be phased out by April 2015)
Decoupling	<ul style="list-style-type: none"> • Arable crops, olives and hops to be fully decoupled from 2010 • Seeds, beef and veal payments (except the suckler cow premium) to be decoupled by 2012
SPS model	Additional flexibility granted to member states distributing decoupled support under the historic model with funds to be distributed on a regional basis
SAPS	Extend the SAPS to 2013 (initially SAPS needed to be converted to the SPS by 2010-11)
Cross-compliance	<ul style="list-style-type: none"> • Simplify the requirements by withdrawing some irrelevant and redundant rules • Implement new requirements on landscape features and water management
Article 68	<ul style="list-style-type: none"> • Member states may use up to 10 per cent of their financial ceiling to grant measures to address disadvantages for farmers in certain regions specialising in dairy, beef, goat and sheep meat, and rice farming • Risk management measures broadened to include crop, animal and plant insurance and mutual funds for animal diseases and environmental incidents
Modulation	<ul style="list-style-type: none"> • Overall increase in modulation by 5 per cent distributed over four steps beginning in 2009, to reach 10 per cent by 2012 • Progressive modulation of 4 per cent for direct payments above 300,000 Euros
Intervention mechanisms	<ul style="list-style-type: none"> • Abolish intervention for pigmeat • Set at zero the intervention quantity for barley and sorghum • Introduce tendering for common wheat, butter and skim milk powder once threshold has been reached
Payment limitations	Apply either a minimum payment (100 Euros) or a minimum size of eligible area per holding (1 hectare) with the exception of Portugal, Hungary and Slovenia for which the minimum size remains at 0.3 hectares
Specific scheme	<ul style="list-style-type: none"> • Protein crops, rice and nuts will be decoupled by 1 January 2012 • Abolish the energy crop premium in 2010
Rural development	<ul style="list-style-type: none"> • Reinforce programmes in the fields of climate change, renewable energy, water management and biodiversity (funded with additional modulation) • Dairy and accompanying measures added as a new challenge

Source: European Commission 2009b.

Table A.2 Expenditures on market intervention measures by EU member state and sector

Million Euros, 2006 and 2007^a

	2007 <i>all sectors</i>	2006 <i>all sectors</i>	Cereals	Sugar	Textile plants	Fruit & veg.	Wine	Milk & dairy	Others
Austria	43.7	106.8	14.2	53.0	0.0	5.0	6.7	5.9	22.0
Belgium	225.8	404.9	6.6	214.4	3.8	43.8	0.0	101.3	35.0
Bulgaria	0.9	-	-	-	-	-	-	-	-
Cyprus	10.9	10.2	0.0	0.0	0.0	5.1	3.6	1.1	0.4
Czech Rep.	23.2	47.3	27.5	16.3	0.5	1.2	1.2	14.3	3.3
Denmark	107.3	164.2	15.1	59.8	0.0	2.9	0.0	62.3	24.1
Estonia	3.3	233.5	0.9	0.0	0.0	0.0	0.0	4.3	0.1
Finland	38.4	69.3	13.6	9.8	0.0	0.6	0.0	38.9	6.4
France	1 111.3	1 235.7	110.0	201.1	14.8	151.2	369.8	179.6	209.2
Germany	158.9	521.4	152.0	107.5	0.2	27.7	24.4	141.3	68.3
Greece	212.7	928.1	0.8	66.2	693.1	111.5	28.6	-0.9	28.8
Hungary	3.4	2.9	130.3	38.9	0.0	10.3	32.7	5.3	16.0
Ireland	44.5	145.1	0.2	6.4	0.0	2.2	0.0	82.0	54.3
Italy	997.3	1 191.9	7.7	184.5	0.1	474.5	425.0	-41.8	141.9
Latvia	2.4	65.5	1.0	0.1	0.1	0.0	0.0	1.2	0.5
Lithuania	33.7	0.6	5.2	27.0	0.4	0.0	0.0	19.4	13.5
Luxembourg	0.8	0.6	0.0	0.0	0.0	0.0	0.4	0.0	0.2
Malta	0.9	183.6	-0.2	0.0	0.0	0.4	0.1	0.0	0.3
Netherlands	308.4	482.8	38.3	42.9	1.7	72.4	0.0	268.9	58.6
Poland	135.0	64.3	27.4	80.7	0.0	10.6	0.0	8.2	56.6
Portugal	144.5	159.3	-7.4	14.5	0.0	51.4	64.5	0.6	35.7
Romania	8.4	-	-	-	-	-	-	-	-
Slovakia	24.4	10.0	9.1	33.7	0.0	1.1	0.5	2.6	0.3
Slovenia	6.3	4.7	-0.1	2.1	0.0	0.4	2.6	2.7	2.3
Spain	1 013.9	1 403.3	-2.4	66.5	220.1	358.3	526.4	5.5	228.9
Sweden	33.2	89.6	10.8	32.3	0.0	4.0	0.0	36.2	6.3
UK	121.1	536.1	2.2	263.0	0.1	37.1	0.5	70.7	162.5
EU27	4 814.7	8 061.7	562.8	1 520.7	934.9	1 371.7	1 487.0	1 009.6	1 175.5

^a Disaggregated product data from 2006.

Source: European Commission, 2008c.

Table A.3 Share of commodity-specific payments by EU member state and sector

Per cent, 2008

	<i>Coupling max^a</i>	Belgium	Denmark	Germany	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Slovenia	Finland	Sweden
Livestock														
Sheep and goats	50		50			50	50			50	50			50
Slaughter (calves)	100	100 ^b				100	100		100	100	100			
Beef option 1 ^c suckler cow premium ^d	100	100				100	100			100	100			
slaughter (adults)	40					40	40			40	40			
Beef option 2 slaughter (adults)	100								100					
special male premium ^e	75		75									75	75	75
Crops														
Arable crops	25					25	25							
Hops	25			25			25			25				25
Olive groves	40					6								
Seeds														
All species	100				100	100	100	100			100			
Certain species	100	100				100	100		100					100

^a In the French overseas departments, Azores and Madeira (Portugal) and the Canary Islands (Spain), 100 per cent of direct payments remain coupled. ^b Only the Northern region (Flanders + Brussels). ^c Member states can choose one of the two options presented in this table for retaining coupled payments to beef. ^d A 'suckler cow' is belongs to a herd intended for the rearing of calves for meat production. ^e The 'special male premium' is for the holding of male cows before either slaughter or export.

Source: European Commission, 2008e.

Table A.4 EU applied MFN tariffs on selected products

By classification system, 2008

<i>Code</i>	<i>Description</i>	<i>Number of lines</i>	<i>Average tariff (%)</i>	<i>Range (%)</i>	<i>Standard Deviation (%)</i>
HS2 ^a					
09	Coffee, tea, mate and spices	43	3.0	0-12.5	4.2
10	Cereals	55	49.4	0-138.2	34.5
17	Sugar and sugar confectionary	42	35.7	0.1-604.3	95.0
24	Tobacco	30	28.6	10-74.9	17.4
51	Wool	70	4.0	0-8.0	3.1
52	Cotton	149	6.4	0-8.0	2.3
ISIC ^b					
1	Agriculture, hunting, forestry & fishing	565	9.3	0-139.6	13.8
11	Agriculture & hunting	422	9.9	0-139.6	15.5
12	Forestry & logging	36	0.3	0-3.2	0.9
3	Manufacturing	9 009	6.7	0-604.3	14.8
	Manufacturing excluding food processing	7 247	3.8	0-89.9	4.0
31	Manufacture of food, beverage & tobacco	1 762	19.4	0-604.3	30.4
311	Food products	1 433	20.5	0-485.6	27.7
3111	Meat products	290	25.4	0-204.2	29.2
3112	Dairy products	150	32.4	0-189.7	33.2
3113	Fruit & vegetable canning	383	21.5	0-485.6	32.2
3115	Manufacture of oil & fats	128	10.2	0-161.9	21.8
3118	Sugar products	11	32.9	0-94.7	37.0
3132	Manufacture of wines	108	16.2	0-218.3	33.1
314	Tobacco manufacturing	9	41.8	10-74.9	25.5

^a Harmonized System (HS) of classification Revision 2. ^b International Standard Industrial Classification (ISIC),

Source: WTO 2009.

Table A.5 Country/region mapping

<i>GTAP country/region</i>	<i>Database aggregation</i>	<i>Results aggregation</i>
Australia	Australia	Australia-New Zealand
New Zealand	New Zealand	
China	China	East Asia
Hong Kong	Hong Kong	
Japan	Japan	
Korea	Korea	
Indonesia	Indonesia	
Malaysia	Malaysia	
Philippines	Philippines	
Singapore	Singapore	
Thailand	Thailand	
Taiwan	Taiwan	
Bangladesh	Bangladesh	Rest of Asia
India	India	
Rest of Oceania	Rest of Asia	
Rest of East Asia		
Cambodia		
Lao People's Democratic Republic		
Myanmar		
Viet Nam		
Rest of Southeast Asia		
Pakistan		
Sri Lanka		
Rest of South Asia		
Iran Islamic Republic of		
Rest of Western Asia		
Canada	Canada	North America
United States of America	United States of America	
Mexico	Mexico	Latin America
Brazil	Brazil	
Rest of North America	Rest of Americas	
Argentina		
Bolivia		
Chile		
Colombia		
Ecuador		
Panama		
Paraguay		
Peru		
Uruguay		
Venezuela		
Rest of South America		
Costa Rica		
Guatemala		
Nicaragua		
Rest of Central America		

Caribbean		
South Africa	South Africa	Africa
Egypt	Rest of Africa	
Morocco		
Tunisia		
Rest of North Africa		
Nigeria		
Senegal		
Rest of Western Africa		
Central Africa		
South Central Africa		
Ethiopia		
Madagascar		
Malawi		
Mauritius		
Mozambique		
Tanzania		
Uganda		
Zambia		
Zimbabwe		
Rest of Eastern Africa		
Botswana		
Rest of South African Customs		
Russian Federation	Russia	Rest of Europe
Switzerland	Rest of Europe	
Norway		
Rest of EFTA		
Albania		
Belarus		
Croatia		
Ukraine		
Rest of Eastern Europe		
Rest of Europe		
Kazakhstan		
Kyrgyzstan		
Rest of Former Soviet Union		
Armenia		
Azerbaijan		
Georgia		
Turkey		
Cyprus	NMS	NMS
Czech Republic		
Estonia		
Hungary		
Latvia		
Lithuania		
Malta		
Poland		
Slovakia		

Slovenia		
Bulgaria		
Romania		
Austria	Austria	EU15
Belgium	Belgium	
Denmark	Denmark	
Finland	Finland	
France	France	
Germany	Germany	
Greece	Greece	
Ireland	Ireland	
Italy	Italy	
Luxembourg	Luxembourg	
Netherlands	Netherlands	
Portugal	Portugal	
Spain	Spain	
Sweden	Sweden	
United Kingdom	United Kingdom	

Table A.6 Industry mapping

<i>GTAP industry</i>	<i>Database aggregation</i>	<i>Results aggregation</i>	
Paddy rice	Paddy rice	Crops	
Wheat	Wheat		
Cereal grains nec	Cereal grains nec		
Vegetables, fruit, nuts	Vegetables, fruit, nuts		
Oil seeds	Oil seeds		
Sugar cane, sugar beet	Sugar cane, sugar beet		
Plant-based fibres	Plant-based fibres		
Crops nec	Crops nec		
Bovine cattle, sheep and goats, horses	Bovine cattle, sheep and goats, horses	Livestock	
Animal products nec	Animal products nec		
Raw milk	Raw milk		
Wool, silk-worm cocoons	Wool, silk-worm cocoons		
Forestry	Forestry	Forestry and fishing	
Fishing	Fishing		
Bovine cattle, sheep and goat meat products	Bovine cattle, sheep and goat meat products	Food processing	
Other meat products	Other meat products		
Vegetable oils and fats	Vegetable oils and fats		
Dairy products	Dairy products		
Processed rice	Processed rice		
Sugar	Sugar		
Food products nec	Food products nec		
Beverages and tobacco products	Beverages and tobacco products		
Coal	Manufacturing		Manufacturing
Oil			
Gas			
Minerals nec			
Textiles			
Wearing apparel			
Leather products			
Wood products			
Paper products, publishing			
Petroleum, coal products			
Chemical, rubber, plastic products			
Mineral products nec			
Ferrous metals			
Metals nec			
Metal products			
Motor vehicles and parts			
Transport equipment nec			
Electronic equipment			
Machinery and equipment nec			
Manufactures nec			
Electricity	Services	Services	

Gas manufacture, distribution
Water
Construction
Trade
Transport nec
Water transport
Air transport
Communication
Financial services nec
Insurance
Business services nec
Recreational and other
services
Public admin. and defence,
education, health
Ownership of dwellings

Table A.7 EU trade-weighted average import tariff rates by member country and commodity^a

	Per cent																
	AUT	BEL	DNK	FIN	FRA	DEU	GRC	IRL	ITA	LUX	NLD	PRT	ESP	SWE	GBR	NMS	EU15
Paddy rice	57.5	58.7	38.8	24.2	64.1	54.8	55.1	101.4	62.7	6.2	60.7	72.2	76.1	52.4	58.2	15.9	60.4
Wheat	2.6	14.3	1.9	11.5	4.3	1.6	22.1	24.5	14.6	0.0	10.4	23.0	27.2	2.8	23.3	22.8	17.3
Cereals nec	4.2	17.8	27.6	6.8	4.8	24.7	33.1	28.4	27.0	1.1	22.3	27.4	26.0	14.5	26.1	35.8	23.3
Vegetables, fruit, nuts	30.7	26.4	13.3	29.4	6.0	20.8	12.6	22.2	24.8	0.8	7.2	30.0	4.7	25.1	7.7	23.3	15.4
Oil seeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	0.0
Sugar cane, sugar beet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.6	0.0	3.9	0.5
Plant-based fibres	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crops nec	3.0	4.9	18.7	0.7	4.2	3.5	5.3	144.7	1.4	9.2	13.3	38.6	5.3	1.9	6.6	6.3	7.7
Cattle, sheep & goats	0.5	2.8	0.7	0.7	1.3	1.3	0.4	0.3	1.1	2.2	2.3	0.3	0.4	1.2	0.1	0.5	0.5
Animal products nec	2.0	1.7	0.8	0.7	1.3	4.6	0.6	3.7	0.7	0.8	1.4	1.0	3.0	0.5	4.7	2.1	2.6
Raw milk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wool, silk-worm cocoons	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattle, sheep & goat meat	76.0	17.5	77.5	71.3	32.2	54.9	62.4	121.0	108.4	22.3	105.7	106.9	115.5	98.0	48.3	69.6	63.5
Other meat	12.8	9.2	7.1	17.3	24.4	24.8	44.7	22.7	29.9	1.5	28.8	11.6	31.5	18.0	29.9	39.9	26.1
Veg. oils & fats	2.4	3.3	1.5	6.2	0.7	3.0	2.5	2.2	24.4	2.7	1.4	5.8	8.9	5.8	1.6	2.9	8.0
Dairy products	41.6	33.4	75.8	37.2	46.8	29.1	38.3	46.4	31.4	19.1	36.2	39.3	42.8	34.4	39.7	24.6	39.0
Processed rice	80.4	100.9	95.1	88.4	109.2	103.5	97.3	85.7	97.1	2.6	100.8	79.2	113.8	107.7	99.8	70.5	102.1
Sugar	164.5	47.1	32.4	155.9	87.4	102.2	184.7	20.2	120.4	9.9	31.3	172.8	37.4	50.1	143.1	76.6	130.9
Food nec	12.4	7.8	5.1	12.4	5.3	10.5	6.2	16.5	6.5	3.8	11.4	9.5	5.0	9.5	7.3	11.6	7.9
Bev & tobacco	15.5	10.4	9.9	13.2	9.2	7.9	3.1	6.0	7.2	6.4	15.3	5.7	5.1	12.4	6.8	32.6	8.1

^a The calculation excludes intra-EU trade.

Source: GTAP version 7 database.

Table A.8 EU trade-weighted average tariff rates by source region and commodity

Per cent

	<i>Australia- New Zealand</i>	<i>East Asia</i>	<i>Rest of Asia</i>	<i>North America</i>	<i>Latin America</i>	<i>Africa</i>	<i>Rest of Europe</i>
Paddy rice	51.0	67.6	58.9	54.7	71.4	17.4	64.7
Wheat	6.0	0.1	5.6	17.5	22.2	0.0	29.0
Cereals nec	26.1	27.9	45.8	13.3	24.7	2.4	43.4
Vegetables, fruit, nuts	4.5	27.1	2.4	2.6	36.0	4.1	2.3
Oil seeds	0.0	1.3	0.1	0.0	0.0	0.0	0.2
Sugar cane, sugar beet	0.0	0.0	1.1	0.0	0.0	0.0	4.4
Plant-based fibres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crops nec	4.5	3.9	1.6	33.9	13.4	0.1	2.5
Cattle, sheep, goats, Animal products nec	1.4	2.7	0.2	0.3	1.7	0.4	1.1
Raw milk	1.4	0.6	1.4	2.6	9.4	0.0	0.4
Wool, silk-worm cocoon	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cattle, sheep & goat meat	18.0	4.7	148.3	26.3	101.5	71.0	24.8
Other meat	6.1	20.5	12.5	33.9	34.6	4.3	16.0
Vegetable oils & fats	18.5	6.8	7.9	6.1	0.2	53.3	8.5
Dairy products	55.5	31.3	30.2	36.2	26.7	28.0	32.2
Processed rice	58.0	121.1	83.4	83.0	74.9	38.9	39.9
Sugar	10.8	50.6	109.5	13.4	181.1	101.5	142.0
Food nec	12.2	14.4	6.0	16.1	6.7	1.7	5.8
Beverages & tobacco	7.9	13.5	8.0	10.0	7.0	8.7	17.3

Source: GTAP version 7 database.

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