European policy issues in a global trade analysis framework

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This report contains four papers on quantitative, model based, assessments of policy reforms in the European Union. The prospect of a new round of trade negotiations and the perspective of enlargement increase the need to deepen the reforms of the Union's agricultural policies, as set out in Agenda 2000. The outcomes of negotiation rounds such as WTO trade negotiations and the Kyoto environmental summit bear implications for European farmers, related supplying and processing industries and European consumers. The assessment of likely policy impact is bound to be complex and should be supported by quantitative modelling analysis that explicit the relations of European countries with third countries. The applications reported here all utilise the Global Trade Analysis Project (GTAP) model as a starting point and tailor the model and its database to the specific needs of the policy question.

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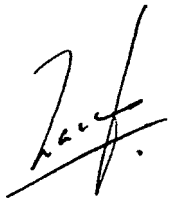
Preface

The prospect of a new round of trade negotiations and the perspective of enlargement increase the need to deepen the reforms of the Union's agricultural policies, as set out in Agenda 2000. The outcomes of negotiation rounds such as WTO trade negotiations and the Kyoto environmental summit bear implications for European farmers, related supplying and processing industries and European consumers. The assessment of likely policy impact is bound to be complex and should be supported by quantitative modelling analysis that explicit the relations of European countries with third countries.

On September 21, 2000, the Tinbergen Institute of Erasmus University Rotterdam and LEI, the Dutch Research Institute of Social Sciences for Food and Natural Resources, jointly hosted a workshop in Rotterdam, where applications of the Global Trade Analysis Project (GTAP) framework to European policy issues were discussed. The workshop was part of larger concerted action project which was financially support by the European Commisison under the FAIR-6 and INCO programmes. The GTAP-EU concerted action involves a large number of researchers from European countries and aims at assessing the usefulness of the GTAP framework for European policy issues. The concerted action, and this report, are specifically zooming in on enlargement of the European Union with Central and East European countries, WTO multilateral trade liberalisation negotiations, reforms of the Common Agricultural Policy and environmental issues.

The Managing Director,



Prof. Dr. L.C. Zachariasse

Summary

This report contains four papers which discuss applications of the GTAP model to some of the most pressing policy issues confronting the agricultural sector of the European Union. The applications are meant to be illustrative, in the sense that they highlight the possibilities of the GTAP framework to be adapted to policy questions. By the same token, the papers in this volume highlight also the needs for further research.

The first paper concerns the analysis of economic impacts of the enlargement of the European Union, with special emphasis on the role of direct payments to farmers.

The second paper concerns the modelling the impact of WTO negotiations on EU agriculture.

The third paper treats the interactions between the recent EU Agenda 2000 CAP reform, world prices and URAA GATT-WTO export constraints, and the
last paper treats transnational environmental issues by discussing the economic effects of an unilateral or harmonised tax on fertiliser and pesticide use in EU agriculture.

The GTAP database and its associated modelling efforts represent a major achievement for advancing quantitative analysis of international trade, resource and environmental issues. The demonstrative applications contained in this report show that the GTAP framework is easily adaptable to specific policy questions which center around the multi-country trade related issues. The applications also highlight the usefulness of a multi-sector general equilibrium approach for policy analysis, where indirect effects of policy changes in one sector of the economy trigger resource movements and reallocations within the entire economy. Such indirect effects propagate through markets for land and labour production factors as well as through markest for final products.

Although the GTAP framework is rather flexible, the applications in this volume clearly show that specific policy questions require additional efforts. All of the applications have engaged in the collection of additional data, which are either folded into the standard GTAP dataset to improve the representation of policy instruments, or are used to supplement the GTAP data for ex-post calculations. It is the area of database construction where we foresee the greatest benefits from future collaborations amongst researchers, both within the EU as well as between EU and non-EU researchers.

1. Introduction

On September 21, 2000, the Tinbergen Institute of Erasmus University Rotterdam and LEI, the Dutch Research Institute of Social Sciences for Food and Natural Resources, jointly hosted a workshop in Rotterdam, where applications of the Global Trade Analysis Project (GTAP) framework to European policy issues were discussed. The workshop was part of a larger concerted action project which involves a large number of researchers from European countries and aims at assessing the usefulness of the GTAP framework for European policy issues [1]. An earlier workshop, which was held in Copenhagen, and hosted by the Danish Institute of Agricultural and Fisheries Economics, resulted in a companion volume of workshop proceedings (Frandsen and Stæhr, 2000). The Copenhagen workshop aimed at an assessment of the usability of GTAP for important policy issues, with a focus on the theoretical elements as well as the empirical database. The current volume contains four papers, which discuss applications of the GTAP model to some of the most pressing policy issues confronting the agricultural sector of the European Union:

(I) Enlargement of the European Union.
(II) Impact of global trade issues such as the WTO trade liberalisation negotiations for the European Union.
(III) Impacts of Common Agricultural Policy reforms on member countries and third countries.
(IV) Analysis of environmental issues in a multi-region context.

The applications are meant to be illustrative, in the sense that they highlight the possibilities of the GTAP framework to be adapted to policy questions. By the same token, the papers in this volume also highlight the needs for further research.

What is GTAP?

GTAP was initiated in the early 1990s with the goal of supporting high level quantitative analysis of international trade, resource, and environmental issues in an economy wide context. The GTAP project is supported by leading international agencies in trade and development policy, as well as a number of national agencies with active research pro-

[1] This report has been financially supported by the European Commission under the FAIR-6 and INCO programmes (FAIR6 CT 98-4148) in the framework of the GTAP-EU concerted action. The content of this report is the sole responsibility of the authors and does not in any way represent the views of the European Commission or its services. For inquiries about the concerted action, please contact the co-ordinator: f.w.vantongeren@lei.wag-ur.nl.

grammes on these issues. The GTAP headquarters are at Purdue University under the directorship of Professor Thomas Hertel [1]. The project develops and maintains a global database, a multi-region multi-sector general equilibrium model and provides training courses [2]. All of these visible products are publicly available at modest cost.

There are basically two strands of quantitative modelling in policy analysis. One approach is to build issue-specific models, depending on the question at hand. These models will usually be capable of capturing many relevant aspects of one specific policy question, but are of less use in a different policy context. The other approach sets out to construct more general and flexible models, which do not necessarily attempt to capture all detail but are flexible enough to allow elaboration in face of specific policy questions. (for a deeper discussion of these methodological issues, see Van Tongeren, Van Meijl and Surry, 2001). Such a modelling framework is provided by the GTAP framework. The standard GTAP model is a multi-region, computable general equilibrium model, with perfect competition and constant returns to scale. Adaptations of the standard model have been developed by various GTAP users. Such elaborations, include increasing returns to scale and imperfect competition, international knowledge spillovers, dynamic equilibrium formulations and incorporation of non-continuous policy instruments such as formulated in GATT commitments.

Applications

The applications found in this report are adaptations of the standard GTAP model to specific European policy questions. The first paper by Frandsen and Jensen concerns the analysis of *economic impacts of the enlargement of the European Union*, with special emphasis on the role of direct payments to farmers. This paper addresses this issue from an economy-wide perspective, and develops three enlargement scenarios ranging from a situation where no direct subsidies are given to the new member countries to a scenario where the farmers in the new member states are given the same level of direct payments as under the existing CAP. A third scenario analyses the effects of reducing the direct payment to two thirds of the existing level in all current and new member countries.

The analyses illustrates that the Central and Eastern European Countries (CEECs) clearly have a solid potential for increasing their production of agricultural commodities. The extent to which direct payments are applied will affect the supply response in the CEECs. It is shown that the major force behind the significant crop supply response is due to large shifts in the use of agricultural land. An overall welfare economic analysis shows that enlarging the Union leads in all scenarios to only small economic welfare losses in 'old' member states in spite of relative large increases in 'old' member states net contributions. The analysis also illustrates that enlarging the EU with the existing CAP is an expensive option in budgetary

[1] For more information on the GTAP organisation see: http://www.gtap.org/.

[2] At the time of writing, version 4 is the latest version that is publicly released (publicly released in April of 1998); it has 45 Regions and 50 sectors and takes 1995 as its base year. Version 5 GTAP database is scheduled for public release in 2001. All applications reported in this report use version 4 data.

terms as the level of CAP related expenditures could increase by one third thereby exceeding the constraints laid down in the EU 'Financial Perspectives'.

The workshop discussions on the paper by Frandsen and Jensen clearly showed the benefits of using an economy-wide framework in the analysis of EU enlargement. While partial models, and direct impact calculations may be very well suited to make a first round assessment of the expected amounts of monetary transfers from 'old' to 'new' member states if some form of the CAP is applied in the CEECs, their use is limited when it comes to significant resource shifts between alternative uses. Such is certainly the case in CEECs, where agriculture forms a large share in the total economy. Accession to the European Union leads to changes in economic incentives, and reallocations within the enlarged EU can be expected to be guided by comparative advantage. A general equilibrium framework, such as GTAP, which takes explicitly the economy-wide resource constraints into account is the appropriate framework to study the medium- to long term impacts. While the GTAP framework has a clear contribution in highlighting such indirect effects, it should also be recognised that this is to some extent complementary to partial models of EU agriculture as regards the modelling of some of the details of the CAP, such as for example intervention stocks, the phasing of policy instruments, and the modelling of structural measures under the CAP.

The second paper by Joseph Francois concerns modelling the *impact of WTO negotiations on EU agriculture*. This application of the GTAP model uses a modified version of the GTAP model and dataset to examine the impact of a new set of multilateral agriculture negotiations, for EU agriculture, but also more broadly for the European Union and for its trading partners. Negotiations in agriculture and services under the aegis of the WTO are supposed to be undertaken anyway as part of the Uruguay Round Agreements. However, it is not clear if these negotiations will remain sectoral efforts, or if they might eventually be subsumed as part of a broader effort aimed at goods and services. The aim of this paper is to use the model to shed some light on possible implications of future multilateral agriculture liberalisation, both for the EU and other developed WTO Members, and also for developing countries. The paper starts by revisiting the Uruguay Round (UR), which will not be fully implemented until 2005. The paper zooms in on the scope for market access negotiations in the next multilateral trade round, and how they will be shaped by the results of the last one. This includes a discussion of tariff-rate quotas (TRQs) and related agricultural policy issues. Finally, the model is applied to examine the impact of multilateral liberalisation in agriculture on European agriculture and the EU economy more broadly defined.

Generally, for output levels, it does not matter much whether or not liberalisation takes place in the context of other negotiations. The output responses are roughly comparable, with rice, sugars, and natural fibres being the most sensitive in terms of output levels. Domestic prices display more significant differences between scenarios, with the direction of price changes depending for both oilseeds and vegetables on the scope of the scenario. Significantly, all negative pressures on EU agricultural prices are moderated in the context of broad liberalisation. With broad liberalisation, increased incomes exert enough pressure to pull prices up somewhat from the depressed levels that follow from agriculture-only liberalisation.

This suggests that price support schemes could be more easily maintained under a broad liberalisation, because of income-demand linkages. It is the developing countries in particular that have been vocal about their opposition to further trade-liberalisation efforts. For example, the poorest countries have expressed genuine concern that further agriculture negotiations will lead to an erosion in their real incomes. The analysis shows that the narrow liberalisation scenarios, lead to net welfare losses for poor regions in the world. These results are reversed, qualitatively, once we move to a broad round. Yes, we can expect losers from agricultural liberalisation, particularly in the world's poorest countries. However, this is more than compensated for if liberalisation is expanded to include manufactures and services.

The discussions following the paper concentrated on the thorny issue of modelling TRQs. In an aggregative global model like GTAP one inevitable loses some product detail, and this hampers the modelling of TRQs which are typically implemented at a very disaggregated commodity level. This is illustrated in the paper for the case of EU dairy quota, where quota may be binding for some types of cheese and not for others. Aggregation in this case is bound to lead to loss of insights. This is all the more the case if quota are allocated bilaterally. It was noted that the modelling of the other famous quota regime, the multi-fibre-agreement, does not suffer from such problems.

The discussions also highlighted the importance to incorporate existing preferential trade agreements correctly into the base data. A multilateral reduction of MFN tariffs is bound to erode existing preferences that for example the EU grants to the so called ACP countries. The erosion of current preferences is of concern to some developing countries and will influence their negotiation positions in the current WTO round.

The paper by Van Meijl and Van Tongeren treats the interactions between the recent *EU Agenda 2000 CAP reform, world prices and URAA GATT-WTO export constraints*. The Uruguay Round Agreement on Agriculture (URAA) in 1994 had a major impact on the EU's CAP policy, as domestic farm policies have become subject to international governance through the GATT. The set of rules established under the GATT limits the scope for domestic agricultural- and trade policies. The constraints on the value of export subsidy expenditures and on the volume of subsidised exports are expected to become most pressing. Binding constraints on export subsidies imply that insulation of EU markets from world markets is more difficult because some excess supply cannot be disposed on world markets at reduced prices. This paper discusses whether and to what extent the Agenda 2000 reform package of the CAP contributes to fulfilment of the EU's commitments on reduction of export subsidies made under the earlier URAA. They use a modified version of the GTAP model that includes the EU's price insulation mechanism from world markets. They introduce new equations and new variables to represent the EU's price insulation from world markets, and they include an explicit modelling of intervention (floor) prices. They also introduce set-aside rates in the EU's cereal sectors and a milk production quota system in the EU's dairy sector. Like the Frandsen and Jensen paper, they make some modifications to the database in order to achieve an improved representation of compensation payments. The paper shows that Agenda 2000 contributes to the alleviation of the export subsidy commitments, but not to alleviation of the export volume constraints.

Furthermore, a sensitivity analysis with respect to international grains markets shows that the export subsidy bindings are dependent on the situation on the world market. The results clearly point out that the development of international markets is important for the bindings of export subsidy constraints. The authors consider the endogeneity of world prices in the GTAP model to be a major advantage in this regard.

In the discussions it was pointed out that the results of this exercise are extremely sensitive to the base year employed. For example, the 1995 base year was characterised by exceptionally high world grain prices, which led to historically low values of EU export subsidies. Instead of using a fixed historical base year, it has been suggested to construct a 'representative' starting point for the simulations in order to iron out the specifics of a particular year.

Discussants were also concerned about the fact that the modelling of the CAP differed in some respects between the Frandsen/Jensen paper and the Van Meijl/Van Tongeren paper. While it is certainly desirable to achieve a common basis of modelling the CAP, the authors pointed out that a completely uniform treatment of the policies may be to restrictive. It depends on the specific issue at hand which elaborations on the common basis are endeavoured. The advantage of the GTAP framework is precisely that it creates a common starting point in model formulation and in data collection. Specific elaborations and model specifications which are tailored to specific research and policy questions will always be necessary and useful. In this regard, the GTAP approach does not differ from the state of affairs in the wider academic community, where there appears to be no consensus on one uniform approach to analyse all the complexities of the CAP.

The last paper by Brockmeier, Efken, Herok and Van Tongeren treats transnational environmental issues by discussing the *economic effects of an unilateral or harmonised tax on fertiliser and pesticide use in EU agriculture*. Within the last two decades a major shift in public perception of fertilisers and pesticides used in agriculture has taken place. Whereas the 'green revolution' has put emphasis on higher yields and lower unit costs due to chemical use in agriculture, public debate in most industrialised countries nowadays focuses on environmental and health risks which might be related to the application of these two inputs. Consequently, some industrialised countries moved a step further and introduced institutional restriction on chemical use in agriculture. To this group of countries belong some member countries of the European Union (EU) as well. Does a national restriction on chemical use in agriculture make sense within a Customs Union or does this only produce some kind of leakage effect between member countries? Brockmeier et al. show how the multi-regional general equilibrium model GTAP can be adopted to make a first step towards the economic analysis of restricted chemical use in agriculture. Their focus is on a cost-effectiveness analysis of an environment-related tax, rather than on an assessment of environmental benefits. The simulation analysis shows that taxes on fertiliser and pesticides do not affect non-agricultural sectors in the EU economy or in third countries very much. However, the multi-regional analysis highlights the possibility of leakage effects when taxes fertiliser and pesticides are unilaterally applied within one country of a customs union. Since the standard GTAP database does not

contain information on fertiliser and pesticide use, nor on taxes levied on these substances, additional data collection has been necessary to conduct the analysis. The paper clearly points to the need for additional data collection to conduct environmentally related analyses.

As many other applied modelling works in this field, the Brockmeier et al. paper does not attempt to include environmental externalities in the production and utility functions. Consequently, this approach has to be silent on the question of welfare evaluation of environmental improvements related to the policy change. The focus is on the economic cost-effectiveness analysis of taxing policies targeted at environmental effects.

An important area of further research in this field is the representation of technologies. While the current specification of Brockmeier et al. provides for substitution possibilities between chemical inputs and labour inputs, it is certainly worthwhile to explore the modelling of substitution between polluting and non-polluting inputs. In addition, and in the context of the discussions around a 'greening' of agriculture, the possibilities to switch to alternative farming technologies might be relevant. Naturally, much additional data work and econometric work would be required.

Conclusions

The GTAP database and its associated modelling efforts represent a major achievement for advancing quantitative analysis of international trade, resource and environmental issues. The demonstrative applications contained in this report show that the GTAP framework is easily adaptable to specific policy questions which centre around the multi-country trade related issues. The applications also highlight the usefulness of a multi-sector general equilibrium approach for policy analysis, where indirect effects of policy changes in one sector of the economy trigger resource movements and reallocations within the entire economy. Such indirect effects propagate through markets for land and labour production factors as well as through markets for final products.

Although the GTAP framework is rather flexible, the applications in this volume clearly show that specific policy questions require additional efforts. All of the applications have engaged in the collection of additional data, which are either folded into the standard GTAP dataset to improve the representation of policy instruments, or - in the case of the Brockmeier et al. paper - are used to supplement the GTAP data for ex-post calculations. It is the area of database construction where we foresee the greatest benefits from future collaborations amongst researchers, both within the EU as between EU and non-EU researchers.

The GTAP experience shows that an 'open source' concept to the development and maintenance of large scale economic models is not only feasible, but also fosters the productivity of research activities. The 'cost' that is associated with the low entry barriers to this type of advanced global trade modelling is that individual researchers are free to develop their own applications according to their own insights and according to the problem at hand.

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2. Economic Impacts of the Enlargement of the European Union: Analysing the importance of direct payments

Søren E. Frandsen and Hans G. Jensen

2.1 Background [1]

The preparations for the enlargement of the European Union (EU) to include several of the Central and Eastern European Countries (CEECs) has led to a discussion of the future design of the Common Agricultural Policy (CAP). First, the debate has clearly shown that it is untenable in the longer term to have 'two separate agricultural policies' within the same Community. Second, it is evident that economic and budgetary implications of the impending enlargement depend not only on the level of border protection within the EU at the time of accession, but also on the extent to which the direct payments are extended to the new member countries.

The European Commission has recently clearly indicated that there is a need for discussing the future role of direct payments. First, the EU's 'financial perspectives' (i.e. the maximum funding available for EU activities) for the period 2000-06 were drawn up on the basis of the enlargement taking place without direct payments being made available to the new member states. Second, in acknowledgement of the expected budgetary strains the EU Commissioner for Agriculture Franz Fischler has suggested that direct payments be gradually phased in the new member states within the context of a transitional post-accession period. Furthermore, the Commissioner has suggested that the level of the direct payments be progressively reduced over a period of time in order to reduce the pressure on the EU budget, cf. Agra Europe (2000).

Against this political and budgetary backdrop one of the important questions being raised is therefore whether or not there is a need to radically change the existing financing system (who is going to pay for the enlargement?) or the agricultural direct payment system if such direct payments, as they exist today, are to be introduced in the Central and Eastern European Countries at the time of accession.

More specifically, the paper analyses the economic implications of extending the support and protective instruments of the current Common Agricultural Policy, including the direct payments, to the Central and Eastern Countries. The purpose of this paper is to address this issue from an economy-wide perspective and to illustrate how a specially tailored GTAP model and database can address such an important aspect of the economic implications of en-

[1] This paper was prepared for the Policy Workshop of the Concerted Action Fair Project (CT98-4148, financed by the EU Commission), held in Rotterdam, September 21-22, 2000. The Danish Ministry for Food, Agriculture and Fisheries has financed the development and adjustments of the economic model and the global database to enable us to analyse the effects of the enlargement.

larging the European Union. Nevertheless, it is important to stress that the present analysis in no way pretends to provide a complete analysis of all the important economic aspects related to the enlargement of the EU.

The paper starts with a brief overview of the important changes that have been made to the standard GTAP model and database followed by some important characteristics of the scenarios presented. The scenarios consist of two distinct parts. First, the construction of a baseline scenario for the period 1995 to 2010, and second, three enlargement scenarios under different assumptions with respect to how the Common Agricultural Policy is extended to the new member countries. The paper concludes by identifying the areas for further research and by providing some tentative conclusions.

2.2 Adjusting the standard model and database

Adjusting the standard model

The base GTAP model is a standard multi-regional, static computable general equilibrium (CGE) model. Regional production is produced according to a constant return to scale technology in a perfectly competitive environment, and the private demand system is represented by a non-homothetic demand system (a Constant Difference Elasticity function) [1]. The foreign trade structure is characterised by the Armington assumption implying imperfect substitutability between domestic and foreign goods, cf. Hertel (1998).

In order to analyse the impacts of extending the Common Agricultural Policy to the Central and Eastern European Countries it is important to capture the key institutional features of CAP (the instruments), including the reform achievements of the Uruguay Round and the more recent reform of the CAP (Agenda 2000). We have therefore explicitly modelled the following features of the CAP, cf. Bach, Frandsen and Jensen (2000):

- import and export policies, including the import tariff reductions and value and quantity based restrictions on export subsidies;
- direct payments to arable land and livestock, together with set-aside requirements and base area restrictions;
- budgetary limits on the total amount allocated to land and livestock according to the institutional rules of the Common Agricultural Policy;
- milk and sugar quotas;
- the European Union agricultural budget and the important effects of inter-regional transfers between member states.

[1] Hence, the present analysis abstracts from features such as imperfect competition and increasing return to scale, which may however be important in certain sectors.

Adjusting the data

The global database used for this analysis is version 4 of the GTAP database, cf. McDougall (1998). Hence this means that only 5 of the 15 members of the European Union are explicitly represented in the database (Denmark, Finland, Germany, Sweden United Kingdom and rest of EU) and seven of the Central and Eastern European Countries are aggregated into just one region in the database (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia). Version 5 of the database, to be released early 2001, will separate out all 15-member countries as well as several of the CEECs.

A number of minor adjustments have been made to the standard version 4 database to allow a more precise representation of the CAP instruments. First, the CAP subsidies have been allocated to the individual factors of production according to whether the subsidies are based on output decisions, use of land or capital intensity. Second, the common agricultural budget has been explicitly represented in the database (the 1995/1996 budget) at the member state level, including the contribution of the individual member states to the financing of the agricultural expenditures. Finally, a few of the behavioural parameters have been adjusted. This includes for example basing the own price elasticity for fish on recent econometric evidence as well as setting the Armington elasticities for livestock to zero. The latter has been done to avoid unrealistic increases in trade in these products.

2.3 Experimental design

Baseline scenario

Before analysing the enlargement of the EU, a baseline for the period 1995-2010 is constructed [1]. The baseline provides a benchmark against which alternative scenarios can be compared. It features projections of the world economy, cf. table 2.1 below, plus incorporation of policy changes, including a full implementation of the Uruguay Round Agreement in all countries and the effects of changes in the CAP as outlined in the Agenda 2000 reform, cf. box 2.1.

The baseline is shaped by relatively high rates of income growth in the Asian economies - particularly in China and a number of other developing countries (catching-up) - growth rates around 4-6% per year. For a number of developed countries, including the current EU member states, we assume growth rates of approximately 2-2½% per year. The global weighted average annual growth rate is 3%.

[1] The model is solved using GEMPACK (Harrison and Pearson, 1996).

Table 2.1 Exogenous assumptions, annual growth rates, 1995-2010

	GDP	Popula-tion	Total labour force	Labour Force		Total factor productivity			Capital a)
				unskilled	skilled	industry	services resources	primary agriculture	
AUS	2.7	1.0	1.0	-1.0	5.2	0.75	0.38	1.05	1.7
NZL	2.5	1.1	1.2	-0.8	5.2	0.75	0.38	1.05	1.2
JPN	1.9	0.1	0.0	-0.7	2.8	0.50	0.25	0.70	1.6
KOR	4.7	0.7	1.3	0.9	4.2	0.75	0.38	1.05	4.7
THA	3.6	0.7	0.9	0.7	4.6	0.75	0.38	1.05	2.7
CHN	7.8	0.7	0.8	0.6	3.4	1.75	0.88	2.45	6.7
TWN	5.6	0.7	0.8	0.6	4.2	1.50	0.75	2.10	4.5
ROA	4.7	1.6	2.2	2.0	4.5	1.00	0.50	1.40	4.0
CAN	2.8	0.8	0.8	-0.7	3.3	1.00	0.50	1.40	2.6
USA	2.6	0.8	0.9	-0.5	3.3	1.00	0.50	1.40	1.7
RLA	4.2	1.4	2.1	1.8	4.1	1.00	0.50	1.40	2.9
GBR	2.2	0.1	0.1	-1.2	2.6	1.00	0.50	1.40	2.0
DEU	2.3	0.1	0.1	-0.8	2.6	1.00	0.50	1.40	1.7
DNK	2.4	0.1	-0.4	-1.9	2.6	1.00	0.50	1.40	3.0
SWE	2.4	0.2	0.0	-1.6	2.6	1.00	0.50	1.40	2.1
FIN	3.0	0.2	-0.4	-1.6	2.6	1.00	0.50	1.40	3.8
REU	2.6	0.1	0.1	-0.8	2.6	1.00	0.50	1.40	1.6
EFT	2.4	0.4	0.4	-1.9	5.2	0.75	0.38	1.05	1.2
CEEC	4.5	-0.1	0.1	-2.1	5.4	1.25	0.63	1.75	6.3
FSU	0.9	0.1	0.5	-1.4	5.4	0.25	0.13	0.35	0.0
MEA	4.0	2.2	3.1	2.9	5.4	0.50	0.25	0.70	3.8
SSA	3.1	2.7	2.9	2.8	4.9	0.50	0.25	0.70	1.2
ROW	2.9	2.1	2.3	2.2	2.8	0.50	0.25	0.70	2.5

a) The endowment of capital is determined endogenously - determined by the exogenous variables shown and by the model and associated data

Source: OECD Economic Outlook, World Bank forecast, USDA's long term projections and own estimates.

For the Central and Eastern European Countries several important characteristics have been included in the baseline. First, the CEECs are assumed to partially catch up to the existing level of income in member states of the European Union as the annual GDP growth rate for this region is assumed to be 4.5% compared to around 2.5% for the European Union. Second, the baseline is shaped by higher rates of annual productivity growth in these reforming economies, e.g. it is assumed that total factor productivity in CEECs agriculture increases by 1.75% per year compared to 1.4% in the industrialised countries.

Box 2.1 Assumptions shaping the baseline 1995-2010

Projections
Shocks to GDP, factor endowments and population
Sector specific shocks to total factor productivity
Capital stocks endogenously determined

Uruguay Round Agreement
Tariff reductions according to Agreement
Export subsidy rates are adjusted in line with changes in tariff rates
If export subsidy commitment (either in value or quantity) is binding, the export subsidy rate is further reduced

Agenda 2000 Reform
Intervention prices reduced (export subsidy reductions)
Hectare and livestock premiums and milk quota adjusted according to reform
National Envelopes and new premiums introduced
All direct payments are deflated by 2% per year (the (maximum) budgetary outlays are fixed in nominal terms)
Set aside reflects the 10% requirement
Sugar quota unchanged
Blair House Agreement concerning oilseeds abolished

Central and Eastern European Countries
Protection levels adjusted according to the recent PSE indicators (protection is raised from its 1995 to 1998 levels).

Third, the recent changes in the agricultural policies of the CEECs have been incorporated in the baseline reflecting steps in the direction of significant increases in protection for a number of agricultural products. Given these exogenous assumptions, the data and the assumed behavioural parameters in the GTAP database, the model endogenously determines the implied annual growth rate in the stock of capital (the last column in the table). For the CEECs the implied annual growth rate of the capital stock is 6.3% whereas the corresponding growth rates in the EU member countries are between 2 and 4%. This growth rate implies that the capital-output ratio in the CEECs rises. The border protection and domestic support levels in the CEECs are shown in table 2.2 for the beginning (1995) and the end of the baseline period (2010). Import protection for wheat, other grains, oilseeds, and sugar and dairy products is assumed, as reported by the OECD (2000), to increase significantly in the CEECs during the period considered whereas the protection of other meat products (mainly pork and poultry meat) is assumed to decrease somewhat. In 2010 only sugar, other meat products and dairy products receive noteworthy export subsidies. The corresponding data for the EU-15 countries are shown in the appendix to this chapter. The table also reflects the assumption that the observed increases in protection in the Central and Eastern European Countries are incorporated mainly in the form of increased import protection. In the case of export subsidies we have abolished the taxation of exports in a few cases, and the use of export subsidies is not increased in the baseline considering the CEECs' Uruguay Round Commitments and the budgetary limitations facing a number of these countries.

Enlargement scenarios

The enlargement scenario considered in this paper entails the integration of the Central and Eastern European Countries into the European Union's Common Agricultural Policy in the year 2010 in a world shaped by the baseline scenario [1].

Enlargement of the European Union implies in principle that all tariffs and export subsidies as well as non-tariff barriers between the EU and the CEECs are abolished. At the same time all sectors in the CEECs are given the same level of protection against third countries as found in the EU at the time of accession. This leads to substantial increases in the CEECs agricultural protection rates against third country suppliers of cereals, sugar, bovine meat and dairy products. In the case of vegetables, fruit and nuts, oilseeds, other crops, beverage and tobacco and other processed food products, the pre-enlargement border protection rates in the CEECs are above the EU-15 levels. Therefore, integrating the CEECs into the CAP leads to reductions in border protection rates for these commodities, cf. table 2.2.

The enlargement scenario also extends the reformed (Agenda 2000) CAP to the new member countries including the common financing of the agricultural policy (import tariffs and GDP contributions) and transfers from the EU-15 to pay for export subsidies, output subsidies and hectare and livestock premiums in the new member countries.

[1] The macroeconomic closure used is a neo-classical closure where investments are endogenous and adjust to accommodate any changes in savings. This approach is adopted at the global level and investments are then allocated across regions to equalise the marginal rate of return in all regions. Although global investments and savings must be equal, this does not apply at the regional level, where the trade balance is endogenously determined as the difference between regional savings and regional investments. This is valid as regional savings enter the regional utility function. The numéraire used in the model is a price index as suggested by de Melo and Robinson (1989) and de Melo and Tarr (1992), namely the global primary factor price index.

Table 2.2 Protection and output subsidies, CEEC, % (levels) and % points (change)

	Import tariff equivalent			Export subsidies			Output subsidies		
	1995 levels	2010 levels	enlarg. change	1995 levels	2010 levels	enlarg. change	1995 levels	2010 levels	enlarg. change
Wheat	-17.9	12.3	0.0	-17.9	0.0	0.0	5.1	6.0	0.3
Other grains	-15.3	-0.6	45.1	-15.3	-0.6	23.2	4.9	5.8	-0.7
Vegetables, fruit, nuts	11.1	11.0	-5.8	0.0	0.0	-0.9	0.4	0.4	0.5
Oilseeds	3.8	7.0	-7.0	3.8	3.8	-3.8	6.0	6.6	2.3
Sugar cane and beet	29.1	61.0	15.5	29.1	29.1	47.7	4.0	4.6	-7.2
Other crops	8.9	9.9	-3.4	0.0	0.0	-0.4	0.4	0.4	-0.1
Bovine animals	2.3	-4.0	79.7	2.3	-4.0	72.8	6.1	7.0	-0.7
Other animal products	8.8	9.1	-8.6	33.8	9.1	9.5	5.2	6.0	3.0
Raw milk	-	-	-	-	-	-	5.9	5.9	3.0
Wool	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.9	25.1
Fish	7.3	4.6	1.2	0.0	0.0	-0.8	0.0	0.0	-0.6
Resource extraction	1.3	1.2	-1.2	0.0	0.0	-0.5	-2.6	-2.6	3.1
Bovine meat products	2.3	-4.0	79.5	2.3	-4.0	72.9	7.6	8.5	-7.9
Other meat products	33.8	9.1	9.5	33.8	9.1	9.6	7.5	8.4	-7.8
Vegetable oils and fats	3.8	3.8	-3.8	3.8	3.8	-3.8	1.9	1.9	-1.5
Dairy products	20.5	50.3	65.6	20.5	20.5	63.3	0.2	1.8	-0.8
Sugar	29.1	61.0	15.5	29.1	29.1	47.6	1.9	2.5	-1.7
Other processed foods	14.2	14.5	-4.9	0.0	0.0	0.2	1.5	1.5	-0.6
Beverages and tobacco	36.6	35.0	-11.7	0.0	0.0	-0.6	0.7	0.7	-24.7
Manufactures	8.0	7.0	-3.4	0.0	0.0	-0.5	-0.2	-0.2	-1.9
Services	0.0	0.0	0.0	0.0	0.0	-0.7	-0.3	-0.3	-2.1

Note: Columns (levels) indicate the level of the tax or subsidy in CEECs before accession and columns (change) are the change in taxes or subsidies in percent points associated with an enlargement
Source: GTAP version 4 database, OECD PSE tables and own calculations.

The expansion of the CAP to the CEECs also implies that sugar and milk quotas are established on the basis of production levels in the CEECs prior to the enlargement in 2010 and that base area and animal premium rights are limited to historic production levels in 1994/1995.

Box 2.2 The Design of the Enlargement Scenarios

Common for all three scenarios is that:

- the new member states are given the same level of border protection (import tariff and export subsidy rates) and output subsidy rates as in the EU at the time of accession (2010);
- production of milk and sugar in the CEECs are limited by quotas - established on the basis of production levels prior to enlargement (2010);
- all member countries contribute to the common financing of the EU agricultural budget;
- the common contribution rate across the member states is determined endogenously by the model given the estimated costs of the CAP (the rate balances the EU agricultural budget).

To illustrate the effects on the direct payments, three scenarios have been analysed. They all differ according to the extent to which direct payments are extended to the CEECs:

Scenario 1: No direct payments are given to the CEEC.
It is assumed that the new member states will not receive the Agenda 2000 direct payments – while the farmers in the 'old' member countries continue to receive such payments. This scenario corresponds to the content of the 'EU's Financial perspectives'.

Scenario 2: Same level of existing direct payments
It is assumed that farmers in 'both regions' will be treated equally - also in terms of eligibility for hectare and livestock premiums.

The maximum amount allocated to the new member states is determined as the EU per hectare or per head premiums and a defined base area or herd eligible for such payments in the CEECs. The base areas has been fixed to almost 27 million hectares assuming an average yield of 4.77 ton (EU average). The set-aside rate in the CEECs is equalised with the EU-15 rate. The following (maximum) number of premiums in the new member countries have been fixed to 1,205,900, 12,090,300 and 3,740,550 for suckler cows, mother ewes and male bovine animals, respectively.

If the area or number of animals exceed the total base area or maximum number of animals the direct payments are reduced proportionally in line with the overshoot of the total area or number of animals.

Scenario 3: 2/3 of the existing level of direct payment in all member states
Scenario 3 is based on the same assumptions as scenario 2 except that the (per unit) level of direct payments in the old EU-15 member states is reduced by 33%. The CEECs will receive a similar payment level (as in the old EU countries) when they are fully integrated in 2010. This scenario corresponds to the so-called principle of degressivity - i.e. that the direct payments in the old member countries would be progressively reduced over a period of time while the direct payments to the new member states would be progressively increased to the same level.

It is also important to stress, that the scenarios are based on the assumption - in line with the present rules under the Common Agricultural Policy - that the premium per hectare is reduced proportionally to the extent the total reform crop area exceeds the total defined base area. The total budgetary outlay is fixed (pre-defined as the EU per hectare premium multiplied by the defined base area eligible for the payments), however, the assumption used implies that there are no effective restrictions (in economic terms) at the individual farm level limiting the incentive to increase the reform crop area. This implies that there are no limita-

tions restricting the reallocation of land in the enlargement scenarios analysed affecting in particular the estimated crops supply response in the new member countries (area reallocated from non-eligible crops to eligible crops).

Further, as indicated above, the extent to which farmers in the new member states will receive the same land and livestock premiums as the farmers in the 'old' member states is an unresolved issues. Hence, the precise conditions for the enlargement of the Union are yet unknown, and the three enlargement scenarios analysed here are therefore used to illustrate the impact of different possible levels of the direct payments to the new member states, cf. box 2.2. Figure 2.1 summarises the experimental design.

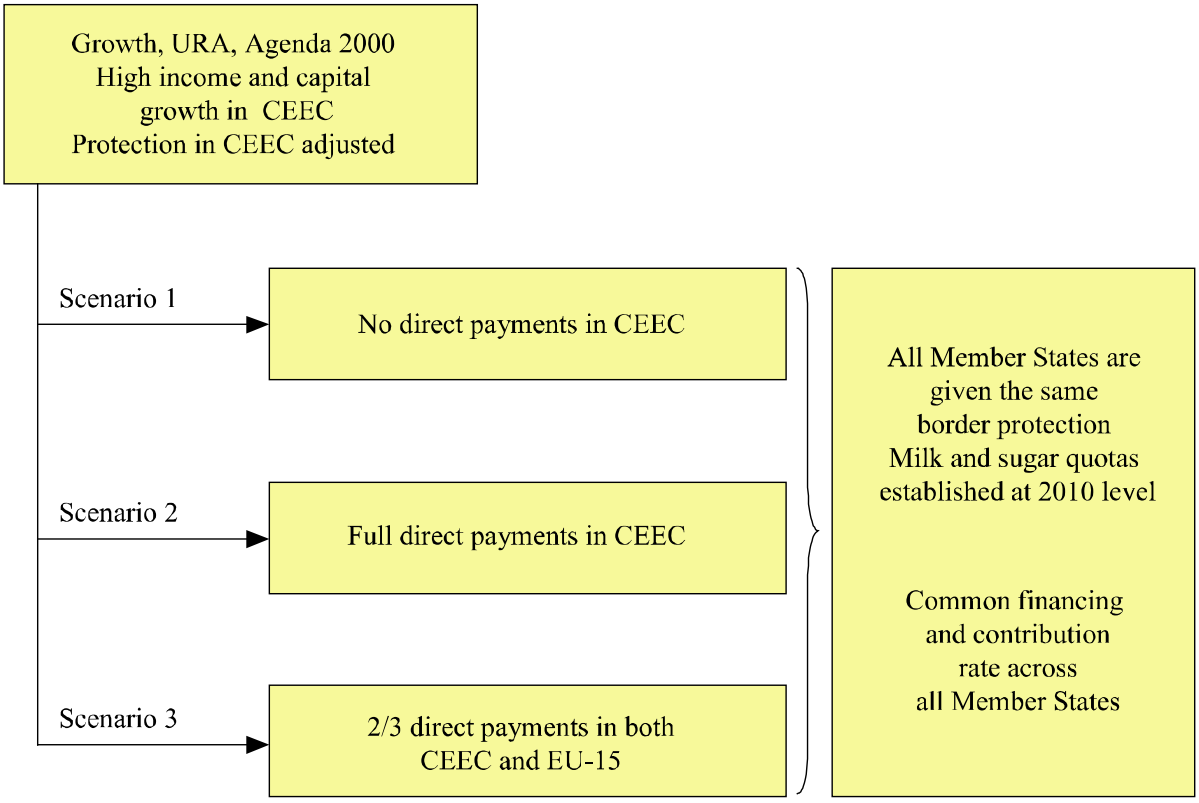

Figure 2.1 Experimental design

2.4 Results

Before examining the results of the enlargement scenarios it is useful to have an impression of the base line projection against which these experiments are performed.

Supply response

In the baseline both an expansionary and a substitution effect determine the changes in output. The expansionary effect represents the effects of growth in domestic and foreign demand shaped by income and population growth and the assumed income elasticities. The substitution effect reflects the changes in relative competitiveness shaped by changes in relative productivity, costs of production as well as the effects of any policy changes. The estimated annual changes in production in the EU and CEECs in the period 1995-2010 are shown in figure 2.2 for selected commodities [1].

Agricultural production in the European Union increases only marginally in the period considered - typically less than 1% per year. The production of wheat and other grains falls marginally due to lower export subsidy rates (complying with the Agenda 2000 reform and the Uruguay Round Agreement). The production of 'other meat products' (pork and poultry meat) increases by 1.3% per year - mainly a result of increased global food demand (in for example Asia and China) and increased competitiveness relative to the production of milk and bovine meat products.

The agricultural production in the CEECs increases somewhat more - typically 1 to 3% per year. This reflects the tendency to increased agricultural protection for some of the commodities and the assumed high rates of agricultural productivity growth. For example, the production of dairy products and sugar increase by more than 3% per year - a result of more than a doubling of the import tariff rates from 1995 to 1998 as reported by the OECD. The production of wheat and other grains is estimated to increase between 1.3 and 3.7% per year - also a result of a tendency to higher agricultural protection. For the non-agricultural commodities the production results reflect the high overall growth assumptions applied to the reforming countries - the production of manufactured goods and services increase by 4.2 and 3.0% per year, respectively.

Extending the Common Agricultural Policy to the new member states is expected to affect the agricultural supply response significantly given the applied assumptions. As indicated above in box 2.2, the three enlargement scenarios differs with respect to the extent the direct payments are extended to the CEECs - while at the same time all three scenarios are characterised by the same and typically higher level of the border protection (being equalised with the EU level of protection). In all three enlargement scenarios this implies that agricultural border protection increases significantly for a number of commodities, e.g. 'other grains', 'sugar', 'bovine meat products', and 'dairy products', cf. table 2.2. The estimated impact on production levels in the EU and CEECs is shown in table 2.3 for each of the three scenarios [2]. The results illustrate that the supply response in both the old and new member countries depend critically on the level of the direct payments given to the new member states.

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[1] Given the applied macroeconomic assumptions the real exchange rate in the CEEC appreciates by 6.8% in the baseline.

[2] Note that the results shown from *the baseline are yearly changes* whereas the reported results in *the enlargement scenarios are accumulated or total changes in the levels in 2010*.

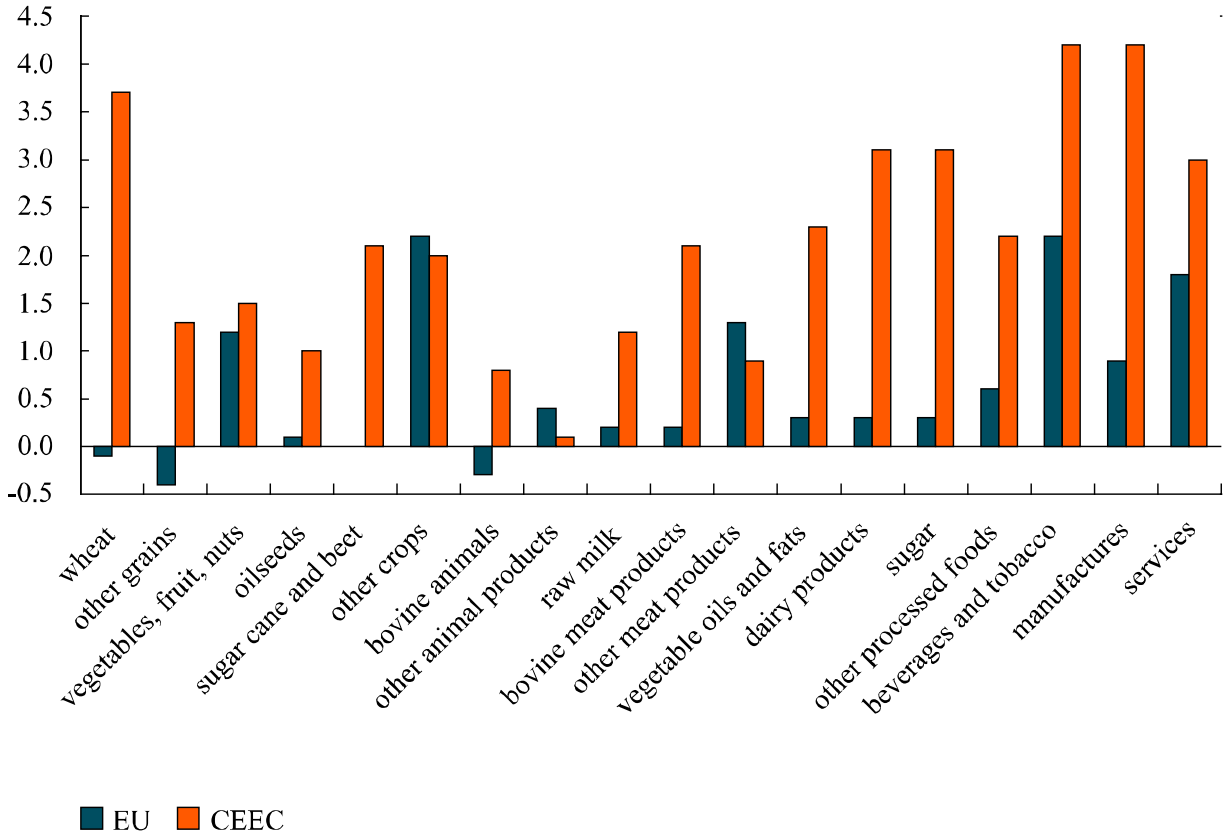

Figure 2.2 Annual changes in production, selected commodities, percent, 1995-2010

Table 2.3 Enlargement: Change in production, selected commodities, percentage

	Scenario 1		Scenario 2		Scenario 3	
	EU15	CEEC	EU15	CEEC	EU15	CEEC
Wheat	-0.4	-6.6	-1.9	12.3	-2.2	7.0
Other grains	-3.7	28.9	-7.2	63.2	-7.6	55.3
Vegetables, fruit, nuts	0.9	-4.4	2.8	-13.9	3.6	-11.7
Oilseeds	0.4	-12.5	-0.3	-0.4	-1.6	-4.3
Sugar cane and beet	0.0	0.0	0.0	0.0	0.0	0.0
Other crops	1.0	-13.4	1.4	-30.9	3.6	-29.9
Bovine animals	-4.3	93.9	-3.9	85.1	-7.4	91.1
Other animal products	-0.4	-0.9	-0.1	-4.3	0.1	-3.4
Raw milk	0.0	0.0	0.0	0.0	0.0	0.0
Bovine meat products	-6.9	142.7	-6.3	129.2	-9.4	138.9
Other meat products	0.0	-0.6	0.4	-5.6	0.4	-4.3
Vegetable oils and fats	0.0	-7.9	0.0	-3.4	-0.1	-4.8
Dairy products	0.2	32.2	0.1	30.4	0.3	30.8
Sugar	-0.3	5.0	-0.3	4.8	-0.3	4.8
Other processed foods	0.1	0.1	0.2	-1.4	0.2	-1.0
Beverages and tobacco	5.0	-59.2	5.2	-60.3	5.2	-60.0
Manufactures	-0.1	3.8	0.0	2.2	0.0	2.7
Services	0.0	-1.8	-0.1	-0.9	0.0	-1.1

In scenario 1, where no direct payments are provided to the farmers in the new member states, the production of wheat falls by almost 7% in the CEECs while the production of 'other grains' increases by almost 30%. This difference is due to the fact, that accession to the CAP will not change CEECs border protection for wheat whereas the CEECs import tariff rate for 'other grains' will increase significantly, i.e. by 45 percentage points. Of course, these results depend on the relative level of protection in the two regions prior to enlargement and thereby the assumed changes in protection in the period prior to enlargement (the baseline assumptions).

The production of bovine meat products in the CEECs more than doubles due to significantly higher protection rates for these products equivalent to an increase of 80-percentage points in the import tariff rate. The production of dairy products increases by a third in spite of the enforcement of milk quota at the farm level. This is explained by a significant shift in the consumption pattern in the CEECs - the on-farm consumption of milk is reduced significantly and the deliveries to dairies increase correspondingly.

In scenario 2 where premiums are set at the Agenda 2000 level and extended to the farmers in the new member countries, production of both crops increases significantly due to the now much higher return to land. Production of wheat and other grains in the CEECs increases by 12 and 63%, respectively. For the remaining commodities, the supply response

corresponds approximately to the supply response in scenario 1 - except for 'vegetables, fruit and nuts' and 'other crops' as the relative competitiveness of these crops falls significantly - they do not qualify for direct payments or at least only very limited support.

In scenario 3 the structural shift in production in the CEECs is slightly more moderate due to the lower level of direct payments extended to the new member states. By comparing the three scenarios, it is evident that the other land using sectors (which do not receive CAP payments) are also affected by the extent to which the direct payments are extended to the new member regions. Furthermore, the enlargement only marginally affects agricultural production in the EU-15 region. There are a few exceptions. Production of 'other grains', 'bovine animals' and 'bovine meat products' fall by 4-9% in the scenarios considered. The milk and sugar quotas in the EU-15 are binding in all scenarios and therefore the enlargement does not affect the production of these products, although the value of the quotas is marginally reduced due to slightly lower market prices in the EU.

Supply response in the individual EU-member countries

Enlarging the European Union affects the individual member countries differently depending on a number of factors such as the structure and level of production and trade. In table A1.2 of the Appendix, the impact on the level of production in the individual member countries is shown. The importance to the individual economies of the estimated percentage changes is difficult to compare across the individual member countries. In Denmark, for example, the production of bovine meat products is relatively small - Denmark specialises in milk production as opposed to raising cattle for meat production. More importantly in this case is the estimated increase in the production of other meat products (1.5 and 3.5% in scenario 2 and 3, respectively) given that Denmark is a relative large producer of pork. The results (not shown) also indicate that the individual country shares of overall EU agricultural production (the intra-industry competitiveness) changes somewhat due to the enlargement and that these changes depend on the level of direct payments given to the new member countries. In the case of other meat products, for example, Danish pig producers typically gain market shares in most of the 'old' member states as well as in the new member countries under the applied assumptions.

Allocation of land and yields

The size of the direct payments will - as expected - significantly affect the use of the agricultural land in the new member countries, cf. table 2.4. Between 1995 and 2010 the total area allocated to the reform crops is estimated to increase from 27 to 30 million hectares (according to the base line). In terms of structural change, land is being reallocated from 'vegetables, fruit and nuts' production and grassland and towards wheat production (protection of wheat has increased significantly since 1995 (OECD, 2000).

Table 2.4 Grown area and average yield per hectare in the CEECs region

	1995	2010	Scenario 1	Scenario 2	Scenario 3
Millions of hectares					
Wheat	8.53	11.47	10.33	12.86	12.14
Other grains	15.40	15.24	18.09	24.55	22.92
Oilseeds	2.34	2.22	1.88	2.23	2.12
Other crops	0.67	0.72	0.60	0.47	0.48
Set-aside	0.00	0.00	0.00	4.46	4.18
Total	26.93	29.65	30.90	44.56	41.83
Tons per hectare					
Wheat	3.36	4.34	4.50	4.34	4.38
Other grains	2.91	3.58	3.88	3.62	3.69
Oilseeds	1.65	2.02	2.08	2.00	2.03

Note: In 1998 the arable land in the CEECs was 52.2 million hectares
Source: Agricultural Situation and Prospects in the Central and Eastern European Countries and own calculations.

Enlarging the Union intensifies this effect when direct payments are extended to the farmers in the CEECs. The total area used for production of these reform crops increases by more than a third in scenario 2 and 3, which corresponds to 14 and 11 million hectares of land, respectively [1]. The lower part of table 2.4 shows the endogenously determined yields per hectare in the CEECs. The yields are estimated to increase significantly in the baseline - narrowing the spread to the EU-15 average from around 40% to around 20% (convergence), cf. table 2.4 and 2.5. Yields per hectare in the EU fall slightly in the baseline due to the Agenda 2000 reform and the implementation of the Uruguay Round Agreement, i.e. lower border protection and output prices but higher direct payments. The extent the direct payments are extended to the CEECs does only marginally affect the yields per hectare in the EU-15 region, cf. table 2.5, due to changing market prices.

[1] Note that the total budget for hectare premiums in the new member countries is fixed. This implies that an increase in the area beyond the defined base area leads to a proportionate reduction in the premium per hectare. As mentioned above the scenarios are based on the assumption that there are no - in economic terms - effective restrictions on the reallocation of land at the individual farm level and thereby at the national level.

Table 2.5 Grown area and average yield per hectare in the EU-15 region

	1995	2010	Scenario 1	Scenario 2	Scenario 3
Millions of hectares					
Wheat	16.45	17.25	17.26	17.20	16.74
Other grains	20.67	21.99	21.90	21.77	20.02
Oilseeds	4.70	3.76	3.77	3.75	3.67
Other crops	1.29	1.58	1.59	1.60	1.69
Set-aside	7.26	5.85	5.85	5.82	5.53
Total	50.37	50.42	50.38	50.13	47.66
Tons per hectare					
Wheat	5.30	4.97	4.95	4.90	5.01
Other grains	4.73	4.20	4.06	3.94	4.26
Oilseeds	2.18	2.78	2.78	2.77	2.80

Source: The Agricultural situation in The European Union, 1998 Report and own calculations.

It is also evident from table 2.4 that the supply response for grains in the CEECs reported earlier is - as expected - mainly a result of changes in the structural reallocation of land, as yield per hectare remain almost constant across the three scenarios.

Land prices

The impact on the price of agricultural land in the three enlargement scenarios is shown in table 2.6. As expected, land prices increase tremendously in the new member countries given the significantly higher level of border protection for many products and the introduction of direct payments. In scenario 1 land prices increases by almost 40% in the CEECs and supplementing this increased border protection by the introduction of hectare and livestock premiums leads to increases of 170 and 130% in scenario 2 and 3, respectively.

For the 'old' member countries, the enlargement even without extending the direct payments schemes to the CEECs region will affect the land prices negatively, although only marginally, cf. table 2.6. It is, however, evident that lowering the direct payments by a third will reduce land prices significantly in the EU-15 region. The simulations indicate that given such a scenario, land prices would fall by 20-30% in the EU member countries. The degree to which land prices are affected in the individual member countries reflects differences in the structure of production and hence the extent to which the individual agricultural markets are affected by the enlargement.

Table 2.6 Changes in land prices, percent

	Denmark	Finland	Germany	Sweden	United Kingdom	Rest of EU	CEEC
Scenario 1	-1.5	0.0	-0.2	-0.6	-0.1	-0.1	38.7
Scenario 2	-1.9	-0.2	-0.3	-0.6	-0.5	0.2	170.4
Scenario 3	-22.8	-23.0	-24.7	-29.1	-22.5	-22.3	129.8

International trade

Enlarging the European Union and extending the Common Agricultural Policy to the new member countries will increase competition in the European agricultural markets and thereby affect the trade between the EU-15 and the CEECs. The expected implications for trade between the two regions are illustrated in table 2.7 and 2.8. To illustrate the importance of the increased trade between the two regions, the results are presented in terms of shares of domestic consumption in the EU and the CEECs satisfied by CEECs and EU imports, respectively.

The first two columns of table 2.7 illustrate the pre-enlargement EU imports from the CEECs - measured as a share of total EU usage (for intermediate inputs and final consumption) of the individual commodities. For all the commodities shown, EU imports of good and services from the CEECs region in both years shown satisfies only a minor share of overall EU consumption. In the case of oilseeds CEECs - having the largest share of EU domestic consumption - import from that region only amount to slightly more than 2% of total EU consumption in both years. Nevertheless, the CEECs share of grains and manufactured goods are estimated to double from 1995 to 2010. This is due to significantly higher protection rates in the CEECs region in the case of grains and relatively high rates of production growth in the case of the labour intensive manufactured goods in the Central and Eastern European Countries. The last three columns in table 2.7 report how these 2010 import shares are affected by each of the three enlargement scenarios. In all three scenarios the CEECs increase their share of total EU consumption of especially grains, bovine meat products, dairy products and sugar. Relative to the pre-enlargement situation, the CEECs share of total EU consumption for these commodities increases significantly - an estimated increase of 5 to 15 times the estimated shares in 2010. In the case of other grains the CEECs share of total EU use increases from less than 1% of total use prior to the enlargement to 5 and almost 9% in scenario 1 and 2, respectively.

Table 2.7 CEECs' share of total EU-15 consumption, percentage

	1995	2010	Scenario 1	Scenario 2	Scenario 3
Wheat	0.7	1.4	2.4	3.4	3.1
Other grains	0.4	0.8	5.0	8.7	8,0
Vegetables, fruit, nuts	0.6	0.5	0.6	0.2	0.3
Oilseeds	2.4	2.2	1.7	2.4	2.1
Sugar cane and beet	0.0	0.0	0.0	0.0	0.0
Other crops	0.3	0.3	0.3	0.2	0.2
Bovine animals	2.0	2.1	1.4	1.4	1.3
Other animal products	0.2	0.3	0.3	0.3	0.3
Raw milk	0.0	0.0	0.0	0.0	0.0
Bovine meat products	0.3	0.5	8.7	8.0	8.7
Other meat products	0.7	0.2	0.3	0.1	0.2
Vegetable oils and fats	0.1	0.1	0.1	0.1	0.1
Dairy products	0.2	0.3	2.0	1.9	1.9
Sugar	0.4	0.6	1.7	1.7	1.7
Other processed foods	0.3	0.6	1.0	0.9	0.9
Beverages and tobacco	0.2	0.3	0.5	0.4	0.4
Manufactures	1.1	1.9	2.7	2.6	2.6
Services	0.1	0.1	0.1	0.1	0.1

In conclusion, extending the direct payment as well as the level of such payments provided to the farmers in the new member states is estimated to affect the EU-CEEC trade significantly. It is, however, also noteworthy that extending the EU border protection alone (scenario 1) to the new member countries also accounts for a relatively large share of the increased CEECs share of total EU consumption.

Analysing the opposite trade flow - exports from the EU-15 to the CEECs - also illustrate that enlarging the European Union and extending the instruments of the Common Agricultural Policy to the new member countries will lead to increased trade between the two regions. In some cases the enlargement leads to significantly larger trade shares between the two regions. The EU-15 shares of total CEECs use are estimated to increase for a number of commodities, especially for manufactured goods, beverages and tobacco, 'other crops' and 'vegetables, fruit and nuts', cf. table 2.8.

Table 2.8 EU-15 share of total consumption in the CEEC, percentage

	1995	2010	Scenario 1	Scenario 2	Scenario 3
Wheat	0.4	0.1	0.1	0.1	0.1
Other grains	0.6	0.1	0.1	0.0	0.0
Vegetables, fruit, nuts	3.8	4.4	7.1	11.3	10.4
Oilseeds	4.4	4.5	5.7	4.7	4.9
Sugar cane and beet	0.7	0.1	0.2	0.2	0.2
Other crops	15.0	23.4	38.2	41.4	42.1
Bovine animals	1.2	1.1	1.2	1.2	1.3
Other animal products	2.8	3.0	3.2	2.9	2.9
Raw milk	0.0	0.0	0.0	0.0	0.0
Bovine meat products	2.0	1.0	0.2	0.2	0.2
Other meat products	4.2	7.5	7.7	9.5	9.0
Vegetable oils and fats	10.8	7.9	9.5	8.6	8.9
Dairy products	4.1	0.7	1.2	1.2	1.2
Sugar	11.7	3.8	6.1	6.0	6.0
Other processed foods	7.5	4.6	7.2	7.6	7.5
Beverages and tobacco	4.7	3.2	51.8	53.3	52.8
Manufactures	24.0	15.9	22.1	22.4	22.3
Services	3.2	2.4	2.5	2.6	2.6

The EU budget and inter-regional transfers

As indicated in the introduction one of the important questions being raised is whether or not there is a need to radically change the existing financing system (who is going to pay for the enlargement?) or the agricultural direct payment system if such direct payments are to be introduced in the Central and Eastern European Countries.

Table 2.9 illustrates the budgetary effects in the baseline and in the three enlargement scenarios analysed. The budget for 1995 is for the EAGGF financial year 1995/1996 and shows that the net cost of the CAP in that year was EUR 42 billion. Given the assumptions applied in the model analysis this net cost increases to EUR 48 billion in 2010 (current prices) - a nominal increase of 14% in total. This increase falls within the guidelines provided in the EU 'Financial perspectives' for the period 2000-2006 [1].

To balance the EU agricultural budget the common rate of member state GDP contributions is reduced from 0.67% of GDP in 1995 to 0.47% in 2010. Note that this contribution rate

[1] In the Agriculture Newsletter of the European Commission, March 1999, the total expenditure of the future CAP in 2006 is reported to be EUR 41.7 billion (1999 prices). Using a deflator of 2% per year this corresponds to approximately 48 billion in that year. Extending the period using the similar assumptions, the total expenditure of the future CAP amounts to EUR 56 billion in the year 2010 (current prices).

is determined endogenously by the model given the estimated costs of the CAP. The reported fall in the contribution rate by definition reflects the 14% increase in net costs and an approximately 44% increase in the real GDP in the EU in the period considered. The net cost of the extending the CAP to the new members is by definition highly dependent on the extent to which the direct payments are included in the agreement. Without extending these payments, the net cost increases by EUR 5.5 billion or by 11% (scenario 1). This increase is explained entirely by increased output subsidies and export refunds. In scenario 2, the net cost increases by more than EUR 16 billion - a result directly related to the hectare and livestock premiums of a similar order of magnitude. The increase corresponds to a 34% increase in the net costs of the Common Agricultural Policy.

In scenario 3, in which the direct payments in the 'old' member countries are reduced by a third and the new member countries receive similar direct payments, the net cost of the CAP is estimated to add up to approximately EUR 52 billion. This corresponds to an increase of 8% relative to the estimated 2010 budgetary costs of EUR 48 billion. The significantly lower cost relative to scenario 2 is of course the assumed lower direct payment to the farmers in both the old and new member countries.

Table 2.9 Financial impact of extending the CAP to the CEECs (million EUR at current prices)

	1995	2010	Scenario 1	Scenario 2	Scenario 3
Total agricultural expenditure	43,152	49,372	54,726	65,505	53,166
of which					
Hectare premiums	15,992	15,994	15,983	24,448	16,299
Livestock premiums	4,150	10,266	10,266	12,487	8,324
Output subsidies	17,306	18,503	22,317	22,425	22,400
Export refunds	5,705	4,610	6,160	6,145	6,143
Levies	-940	-1,125	-1,032	-1,039	-1,058
Net cost of CAP:	42,213	48,248	53,694	64,466	52,108
- as % of GDP	0.67	0.47	0.50	0.61	0.49

Note: The 1995 figures are taken from the EAGGF financial year 1995/1996 and figures for 2010 are all deflated by an inflation rate of 2% per year as the (maximum) budgetary outlays are fixed in nominal terms.

The design of the scenarios seem to support the view that by reducing the Agenda 2000 premiums by a third the enlargement (with 'one common' agricultural policy) can be kept within the existing budgetary costs of the Common Agricultural Policy. That is, the common contribution rate is estimated to 0.49% of GDP (approximately similar to the estimated rate in 2010) or a total cost below the extrapolated costs of the future CAP of EUR 56 billion using a deflator of 2% per year.

Leaving the aggregate EU budget, table 2.10 illustrates the impact on net contributions of the individual member countries to the Common Agricultural Budget in the three scenarios. Net contributions are defined as the contribution (a percent of their GDP) less support received (output subsidies, hectare and livestock premiums) and import tariff revenue collected.

In 1995 and 2010 Germany, United Kingdom and Sweden were net contributors to the CAP budget whereas the 'Rest of EU', Denmark and Finland were net receivers of financial support from the CAP budget [1]. Enlarging the European Union leads to higher net contributions for all the old member states whereas the new member countries - not surprisingly are net receivers of transfers from the CAP budget. Germany, for example, is in scenario 3 required to transfer additional EUR 2.1 billion to the Common Agricultural Budget compared with a no-enlargement situation, corresponding to a total net transfer of EUR 9.1 billion in 2010. In the case of Denmark - being a net receiver of EU transfers - the net transfer will be reduced by 50 and 60% if the enlargement takes place as assumed in scenario 2 and 3, respectively.

Table 2.10 Net contributions to the CAP budget (million EUR at current prices)

			Change in net payments 2010		
	1995	2010	Scenario 1	Scenario 2	Scenario 3
Denmark	-446	-564	68	293	347
Finland	-101	-210	50	208	164
Germany	5,530	6,991	918	4,006	2,103
Sweden	516	425	94	372	263
United Kingdom	2,224	1,963	427	1,743	1,360
Rest of EU	-7,722	-8,605	1,944	7,251	6,572
CEEC	0	0	-3,500	-13,873	-10,808
Total	0	0	0	0	0

Welfare implications

More important than such budgetary implications are the overall welfare implications - although the political debate very often focuses exclusively on the effects on the 'visible budget'. The welfare effects include changes in allocative efficiency, terms of trade, inter-regional transfers and contributions from other factors (changes in endowments, technical change and

[1] Note that the 'Rest of EU' hides significant differences across the countries included in this aggregate.

the effect of non-homothetic preferences). The welfare effects quantified by using the money metric value of the Equivalent Variation are shown in table 2.11.

Table 2.11 Change in economic welfare, 1995, million EUR

	Denmark	Finland	Germany	Sweden	UK	Rest of EU	EU15	CEEC
Scenario 1								
Total welfare change	-126	-34	-1,034	-56	-57	-832	-2,139	3,331
-of which								
Efficiency	-17	8	460	50	80	1,076	1,657	-489
Terms of trade effects	-71	-6	-654	-47	164	-513	-1,128	1,434
Transfers	-50	-37	-683	-69	-317	-1,444	-2,601	2,563
Other effects	12	2	-157	10	16	50	-68	-177
Scenario 2								
Total welfare change	-323	-159	-3,590	-300	-1,070	-4,907	-10,350	9,499
-of which								
Efficiency	-49	0	484	19	80	1,033	1,567	-1,531
Terms of trade effects	-85	-20	-793	-67	114	-714	-1,564	1,860
Transfers	-218	-155	-2,979	-277	-1,295	-5,389	-10,313	10,078
Other effects	28	16	-303	24	31	163	-40	-907
Scenario 3								
Total welfare change	-361	-112	-1,794	-181	-593	-3,712	-6,753	7,782
-of which								
Efficiency	-31	15	627	50	244	1,918	2,823	-1,127
Terms of trade effects	-92	-11	-745	-50	149	-888	-1,637	1,817
Transfers	-258	-122	-1,563	-196	-1,011	-4,883	-8,031	7,867
Other effects	19	5	-114	15	25	141	92	-775

Note: Economic welfare is measured as the money value of the Equivalent Variation (1995-level). 'Other effects' include welfare changes due to changes in endowments, technical change, and effects of non-homothetic preferences.

In total, the CEECs are estimated to gain a welfare improvement of approximately EUR 3, 10 and 8 billion in each of the three scenarios. These increases correspond to a welfare gain of 1.2, 3.4 and 2.8%, respectively. Note, however, that the (relatively small) welfare effects reported in this paper is explained entirely by the impacts of extending the Common Agricultural Policy to the Central and Eastern European Countries as the objective of this study has been to study these aspects. Therefore, the welfare effects reported do not include the effects of an extension of the structural funds support or the possible important effects of dynamic efficiency gains from trade liberalisation's or the potential role foreign direct investments might have (i.e. enhanced capital accumulation and higher productivity growth).

The overall welfare loss for the EU-15 is estimated to be very small. The loss corresponds to approximately 0.03, 0.15 and 0.10% of total welfare in the three scenarios. This covers the economic impacts of both trade creation and trade diversion effects as well as the costs associated with transfers of income from EU-15 citizen to CEECs farmers through the CAP budget scheme. Decomposing the welfare losses experienced in the EU and the welfare gains experienced in the CEECs reveals that the story to be told is primarily one of redistribution from Western European tax payers to Eastern European farmers.

The efficiency gains achieved in the EU countries are relatively large when the direct payments are reduced by a third (scenario 3) whereas the contribution to the welfare change from the transfers is relatively large when the full CAP is extended to the new member countries (scenario 2). As expected, the contribution of terms of trade changes on welfare is almost unaffected by the extent to which the direct payments are provided to the farmers in the new member countries.

We find a similar pattern of welfare decomposition at the individual country level, although there are a few interesting differences. Differences in supply responses and changes in exports and imports as well as differences in tax structures in general explain these variations. In scenario 3, for example, the Danish welfare loss - being the largest relative loss - corresponds to a loss of 0.25% of national income whereas the remaining countries lose approximately 0.1% of their national income.

This somewhat higher loss of income is partly explained by an increase in the Danish export of dairy products to third countries. The larger export of dairy products from the CEECs region to the 'old' member countries does not (as seen for other agricultural commodities) lead to a lower level of production in the 'old' member countries (the quota value is clearly still positive). The increased surplus of dairy products is exported to third countries supported by export subsidies with a loss of efficiency as a consequence. This loss is relative large in the Danish case, Denmark being both a relative large producer of milk and a relative large net-exporter of these products.

2.5 Areas for future research

The results estimated in this analysis are no better than the data and parameters used and our efforts has identified areas that require further data work in the future. These include for example improvements of the base data to more adequately reflect actual allocation of land across the crops producing sectors in especially the Central and Eastern European Countries as well as improvements in the cost structures - especially the factor cost shares in the land using sectors. A few of the input-output tables also need to be adjusted with respect to the links between the primary agricultural sectors and the processing industries.

Representing the CAP correctly also requires an adequately representation of the EU sugar regime, including the sugar levies and A, B and C sugar quotas (and rents) in the database and the model. Also, the estimates of the milk quota rents in each of the 15 EU member

states need to be updated. Furthermore, an explicit representation of the tariff rate quotas (TRQs) in the database and the model would clearly enhance the usefulness of the database and the model for future policy studies as well as there is a need for econometric studies focusing on the determination of important behavioural parameters.

2.6 Conclusions and the need for further efforts

The analysis in this paper is a modest attempt to demonstrate that the GTAP general framework can be adjusted to address important policy relevant questions such as the economic impacts of an EU enlargement in general and the importance of the direct payments in particular. Naturally, the results estimated are no better than the data and parameters used and our work has identified areas for future data and model extensions.

There is no doubt that the standard GTAP model and database - like any other standard model - has to be adjusted and changed to be able to address more detailed policy issues such as the one addressed in this paper. The methods used correspond to some of our earlier work; cf. Bach (et al. 2000) and Frandsen (et al. 2000) supplemented by more detailed modelling at the individual country level. Particular effort has been put into the modelling of the financial issues related to the EU budget and the impact on the net transfers between the current and future member countries.

The analysis demonstrates, that the CEECs have a solid potential for increasing their production of agricultural commodities but also of labour-intensive manufactured goods. If the CEECs are integrated into the present CAP of the EU (with the Agenda 2000 reform fully implemented) it will significantly boost agricultural production in some sectors and lead to a reallocation of resources between the different crops.

The analysis shows that the level of direct payments will affect the supply response in the CEECs. It illustrates that the major force behind the significant supply response of some of the crops is due to very large shifts in the use of agricultural land whereas the yields are almost independent of the level of the direct payments extended to the new member states. Relatively high direct payments to selected crops (modelled as input subsidies to land) will distort the allocation of the production factors, including the use of land. Important for understanding this result is also the assumption that there are no - in economic terms - effective restrictions on the reallocation of land at the individual farm level.

Enlarging the EU to include the CEECs in the present CAP is an expensive option in budgetary terms. It is found that if direct payments are extended in their full amounts to the new members the level of CAP related expenditures could increase by one third. The analysis also shows that if direct payments are reduced by one-third prior to enlargement, the impact on the EU budget will approximately correspond to a situation in which the direct payments were not extended to the CEECs, but the 'old' EU members retain their access to the current payments (a two tier CAP). In other words, the CAP expenditure level could be hold within the

present maximum rate of funding for the EU's CAP activities, if reforms are in place prior to enlargement.

In spite of these relatively high budgetary costs the current EU countries are estimated to lose no more than approximately 0.1% of their national income. Overall economic welfare improves significantly in the Central and Eastern European Countries following accession. The gains for these countries amount to an annual welfare increase of 1 to 3% depending on the extent to which the direct payments are provided to the farmers in the new member states.

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Appendix 2

Table A.1 Protection and output subsidies, EU15, percentage (levels)

	Import tariff equivalent		Export subsidies		Output subsidies	
	1995 levels	2010 levels	1995 levels	2010 levels	1995 levels	2010 levels
Wheat	12.4	12.4	12.4	0.0	6.2	6.2
Other grains	44.2	44.2	44.2	22.6	5.0	5.0
Vegetables, fruit, nuts	5.6	5.5	5.5	-0.9	1.0	1.0
Oilseeds	0.0	0.0	0.0	0.0	8.9	8.9
Sugar cane and beet	76.6	76.6	76.6	76.6	-2.7	-2.7
Other crops	9.0	8.9	8.9	-0.2	0.4	0.3
Bovine animals	111.2	75.6	75.6	68.9	6.3	6.3
Other animal products	0.8	0.9	0.9	18.7	9.0	9.0
Raw milk	0.0	0.0	0.0	0.0	8.9	8.9
Wool	0.0	0.0	0.0	0.0	24.9	26.0
Fish	4.9	2.7	2.7	-0.7	-0.6	-0.6
Resource extraction	0.0	0.0	0.0	-0.5	0.6	0.5
Bovine meat products	111.2	75.6	75.6	68.9	0.6	0.6
Other meat products	18.7	18.7	18.7	18.7	0.7	0.6
Vegetable oils and fats	0.0	0.0	0.0	0.0	0.4	0.4
Dairy products	116.3	116.1	116.1	83.9	1.0	1.0
Sugar	76.6	76.6	76.6	76.6	0.8	0.8
Other processed foods	9.8	9.8	9.8	0.6	1.0	1.0
Beverages and tobacco	20.4	20.7	20.7	-0.8	-24.2	-24.0
Manufactures	4.1	3.8	3.8	-0.4	-2.1	-2.1
Services	0.0	0.0	0.0	-0.7	-2.3	-2.3

Table A.2 Enlargement: Production changes within the European Union, selected commodities, percentage

	Denmark			Finland			Germany			Sweden			United Kingdom			Rest of EU		
Scenario:	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Wheat	1.1	-0.1	-2.1	-0.3	-0.6	-1.6	-0.4	-2.1	-2.3	0.7	-0.4	-0.4	0.1	-0.8	-3.1	-0.8	-2.3	-2.0
Other grains	-6.2	-11.0	-13.2	-1.4	-2.7	-3.1	-5.6	-10.9	-9.5	-2.5	-4.7	-4.0	-1.1	-4.2	-5.5	-3.5	-6.6	-7.2
Vegetables, fruit, nuts	0.5	1.2	3.0	0.0	0.3	0.8	0.7	2.1	3.0	0.5	0.8	2.1	0.3	0.6	1.6	1.0	3.4	4.1
Oilseeds	1.5	0.9	-0.9	0.3	0.0	-1.4	0.7	-0.1	-1.6	0.9	0.1	0.3	1.3	1.1	0.4	0.2	-0.6	-1.9
Sugar cane and 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	0.0	0.0	0.0	0.0	0.0
Other crops	0.6	1.2	6.7	1.2	1.4	1.8	2.6	3.5	6.0	1.9	2.3	4.6	0.8	1.2	3.3	0.9	1.2	3.3
Bovine animals	-11.3	-10.5	-16.7	-0.4	-0.3	-0.5	-3.7	-3.4	-3.7	-10.5	-9.5	-10.5	-1.0	-0.9	-1.7	-5.2	-4.7	-10.1
Other animal products	0.1	1.2	2.7	-0.2	-0.2	-0.3	-0.5	-0.4	-0.3	-1.8	-1.3	-1.6	-0.7	-0.6	-1.1	-0.1	0.3	0.5
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	0.0
Bovine meat products	-13.8	-12.6	-19.8	-0.8	-0.8	-0.8	-8.7	-7.9	-7.7	-13.6	-12.5	-13.7	-4.1	-3.7	-3.8	-5.9	-5.3	-11.1
Other meat products	0.2	1.6	3.5	-0.1	-0.1	-0.3	0.2	0.4	0.2	0.3	1.3	0.8	-0.1	0.0	-1.7	-0.1	0.4	0.6
Vegetable oils and fats	0.2	0.6	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.3	0.3	0.1	0.0	-0.2	0.1	0.1	-0.2
Dairy products	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.1	0.0	0.3	0.3	0.7
Sugar	-	-0.3	-0.3	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.7	-0.7	-0.6	-0.6	-0.6	-0.6	-0.5	-0.5	-0.5
Other processed foods	28	-0.2	-0.4	-0.1	0.0	0.0	0.3	0.5	0.6	0.3	0.5	0.5	0.2	0.2	0.1	0.0	0.2	0.1
Beverages and tobacco	-	1.9	1.7	10.6	11.1	11.2	1.3	1.4	1.4	7.7	8.1	8.1	17.8	18.9	18.4	4.9	5.1	5.2
Manufactures	0.1	0.3	0.2	-0.5	-0.3	-0.4	0.1	0.3	0.1	-0.1	0.0	0.0	-0.6	-0.5	-0.5	-0.1	0.0	0.0
Services	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	-0.1	0.0

3. Modelling the impact of WTO negotiations on EU agriculture: an application of the GTAP model

Joseph Francois

3.1 Introduction

This paper uses a modified version of the GTAP model and dataset to examine the impact of a new set of multilateral agriculture negotiations, for EU agriculture, but also more broadly for the European Union and for its trading partners. Negotiations in agriculture and services under the aegis of the WTO are supposed to be undertaken anyway as part of the Uruguay Round Agreements. However, it is not clear if these negotiations will remain sectoral efforts, or if they might eventually be subsumed as part of a broader effort aimed at goods and services.

The aim of this paper is to use the model to shed some light on possible implications of future multilateral agriculture liberalisation, both for the EU and other developed WTO Members, and also for developing countries. It is the developing countries in particular that have been vocal about their opposition to further trade-liberalisation efforts. For example, the poorest countries have expressed genuine concern that further agriculture negotiations will lead to an erosion in their real incomes. (At the end of the Uruguay Round, this became a major last minute obstacle). It merits examination of the extent to which negotiations in other sectors might be used to compensate for these losses.

The paper is organised as follows. Before embarking on an assessment of the impact of a new multilateral round of trade negotiations, it makes sense to first revisit the last one. The Uruguay Round (UR) will not be fully implemented until 2005. While many industrial tariff commitments are now in place, implementation of one of the more problematic parts of the UR agreements, the Agreement on Textiles and Clothing (ATC) has largely been deferred until the very end of this period. In addition, in a number of developing countries, the commitments made on tariff bindings (the bound most-favoured nation or MFN rate) are so loose that there may be little scope for actual tariff reductions through negotiated reduction in bound rates in future rounds. This next two sections are concerned with the scope for market access negotiations in the next multilateral trade round, and how they will be shaped by the results of the last one. This includes a discussion of tariff-rate quotas (TRQs) and related agricultural policy issues. This is followed by an overview of the database and model structure in section 3.4. Finally, we apply the model in section 3.5 to examine the impact of multilateral liberalisation in agriculture on European agriculture and the EU economy more broadly defined.

3.2 A hitchhiker's guide to the post-UR agriculture policy landscape

Dirty Tariffication and TRQs

Under the Uruguay Round, market accessibility was to be made more transparent by converting a plethora of non-tariff import barriers to tariffs. This process is referred to as 'tariffication'. Under tariffication, new and existing tariffs were to be bound and reduced on average by 36% over a 6-year implementation period. Unfortunately, the process of tariffication was complicated by loose interpretation of the relevant guidelines. As a result, OECD countries exhibited a tendency to grossly overstate actual levels of protection, to ensure that they could avoid any real liberalisation in those sectors. This process was called dirty tariffication. As a result of dirty tariffication (and combined with the possibility of uneven tariff cuts), the extent of liberalisation is especially limited in highly protected 'sensitive' products. As a result the most protected commodities, such as sugar and dairy products, were liberalised the least.

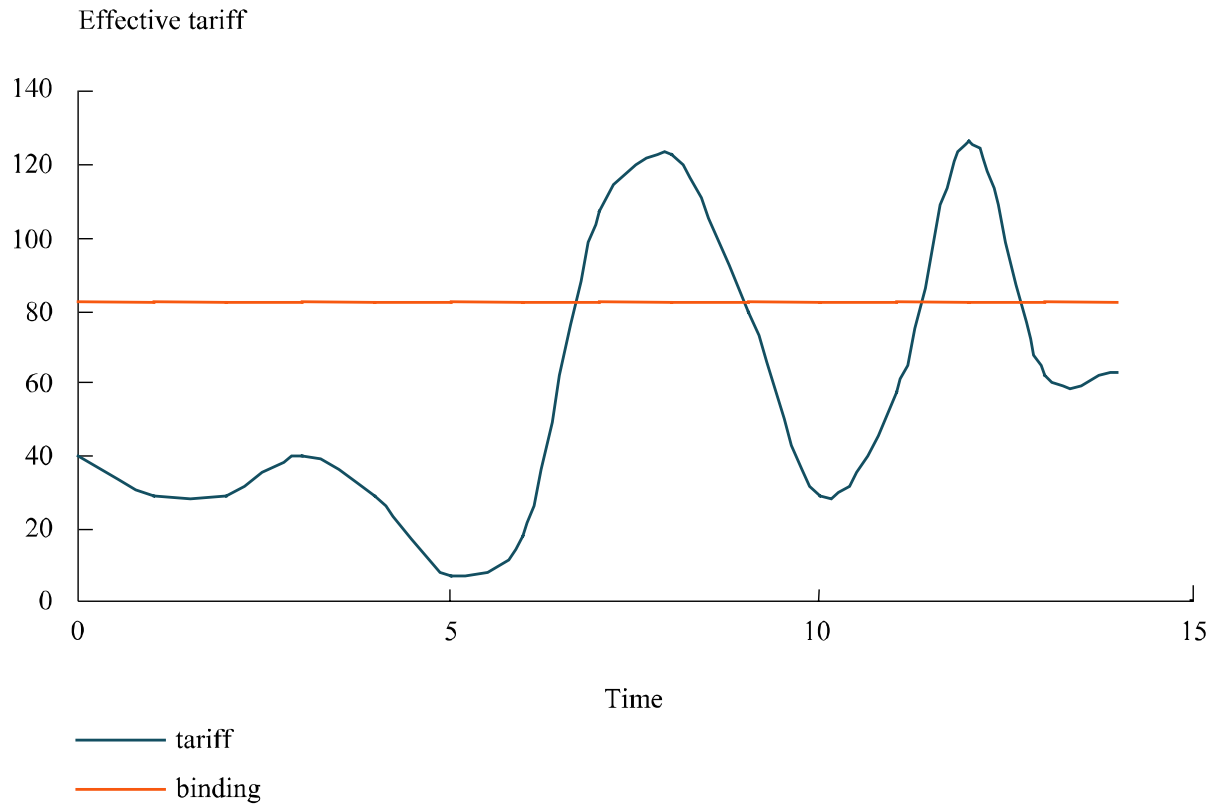

Figure 3.1 EU protection for wheat, 1979 through 1993

To illustrate this point, figure 3.1 offers a comparison of average European Union protection over the 1979-1993 period (through the end of the Uruguay Round), and the bound rate actually set by the European Union. The European Union's final bound rate is an estimated effective rate of around 82%, while the average applied rate for the previous 15 years had been 56%. To ensure that dirty tariffication during the UR did not actually lead to 'trade liberalisation' wherein we actually realised less trade instead of more, the URAA embedded the tariff components of market access commitments into a parallel set of commitments on current access and minimum access. Current access commitments, made in quantity terms, were portrayed to those outside agriculture negotiating circles (i.e. the public) as ensuring that there would not be an erosion in effective market access as a result of the URAA. At the same time, some liberalisation was to be guaranteed through minimum access commitments, set at 5% of 1986-88 consumption levels. The combination of the two leads directly to quantitative commitments (and quantitative restrictions) on market access. These are managed through tariff-rate quotas.

Tariff-rate quotas are, in effect, a two-tiered tariff system. Up to the quota level, a relatively low tariff is charged. Above this level, a high (and often prohibitive) tariff is charged. Depending on the level of these tariffs and the level of trade, substantial rents can be tied to in-quota imports. The quota levels themselves are determined by current and minimum access commitments.

In theory, while current access commitments could be allocated on a bilateral basis, minimum access commitments should have been allocated on an MFN (i.e. non-discriminatory or most-favoured nation) basis. In practice, there is typically no distinction between the two regimes in national tariff schedules. Up to the total access (current and minimum) quota levels, we tend to find a within-quota tariff in national tariff schedules, with imports above this access level, or outside the quota, typically assessed a higher tariff. In cases where the out of quota rate is prohibitive but the quota is largely filled, we in effect have a strict quota system for food imports.

The sharing of the relevant quota rents is determined by how the quotas are allocated, and by the in-quota tariff rates. Where the out-of-quota rates are not prohibitive, the two-tiered tariff structure still creates quota rents and all of the political economy considerations associated with rent seeking (and well known from our experience with the Multi-Fibre Arrangement). In yet other cases, the in-quota tariff rate is so high that exports are below the quota levels (i.e. market access has eroded since the end of the UR), and the in-quota tariff rate is the binding constraint. In contrast to the regime for textiles and clothing, wherein trade restrictions were largely a North-South issue, in agriculture TRQs have been employed by both developed and developing countries. Hence, the implied quota rent transfers are potentially a drain on incomes in both developed and developing food importers.

An important reason why quotas are unfilled in this new regime is the way quotas are allocated. While access commitments were supposed to be MFN based, silent deals were sometimes struck wherein quota allocations were awarded to key suppliers during bilateral negotiations. As a result, in practice these quotas often are purely bilateral. In addition, the

bilateral nature of these quotas has been reinforced by liberal interpretation of the rules. For example, in the case of the EU, there has been an explicit assertion that expanded access for Central and East Europeans under the Associate Agreements will be counted against overall access commitments. On net, we now have a system where protection of politically sensitive agricultural products is often bilateral, and involves quota rents. For other products, we have seen a move toward a price-based system, though one sometimes characterised by very high tariff bindings.

Export competition

In the case of export promotion (i.e. export supports), the changes in the rules were less strong, though the direct trade effects may be more significant. Export subsidies were to be reduced both in terms of expenditure and of volume. The allowed expenditure was to fall by 36%, and the volume by 21%. Although the definition of export subsidies contained in the URAA is fairly rigorous, the definitions of commodities are not. Countries declared commodity aggregates instead of individual tariff lines, which allowed them more flexibility with regard to export supports. For example, the EU included some 40 products as coarse grain.

Although the export subsidy commitments have been cited as one of the most important achievements of the round, it should be noted that trade in many products will continue to be heavily distorted at the end of the implementation period.

Domestic support

In theory, transfers to producers through domestic support programs were also limited and had to be reduced by 20%. The domestic support level is measured by an Aggregate Measurement of Support (AMS) defined within the URAA. In practice, the definition of the AMS means that the constraint on any particular commodity is slight. In addition, it was agreed that measures with a minimal impact on trade could be used freely. These 'green box' measures include government services such as research, disease control, infrastructure, and food security. They also include payments made directly to farmers that do not stimulate production, such as certain forms of direct income support, assistance to help farmers restructure agriculture, and direct payments under environmental and regional assistance programmes. Finally, the USA and the EU also agreed during the negotiations on a 'blue box' category of policies, which, although production neutral, are coupled with supply reduction instruments.

Though countries committed to cut their market price support in the URAA, they have actually engaged in a game of shifting the support (at least partly) into the forms that are allowed in 'green' and 'blue' categories. A good example of this is CAP reforms where measures affecting market prices have been transformed into animal and land premiums that are fixed to given number of animals or fixed amount of land. Another is the recent pattern of annual 'emergency assistance' payments, in the range of USD 9 billion per year, made to U.S. farmers as income support.

European TRQs

The European Union, like many of its trading partners, has implemented TRQs (or reserved the right to implement them) for a wide range of products. Data on TRQ quota levels, allocations, and in and out of quota tariff rates is important to any assessment of future negotiated liberalisation in products affected by TRQs. For this reason, the U.S. Agriculture Department, the European Commission, the Food and Agricultural Organisation, the OECD Secretariat, and UNCTAD have launched a joint database initiative called the Agricultural Market Access Database (AMAD). The goal is to make detailed data on agricultural trade and policy available over the Internet. The database currently contains information on TRQ regimes in 30 countries.

Table 3.1 EU Dairy TRQs

TRQID	Description	Bound Quantity (tons)	Actual Quantity (tons)	Actual Import value	Unfilled Quota	Quota Fill Rate	Value shares
EEC71	Skimmed Milk Powders	68,000	50,682	90,332	17,318	0.75	0.10
EEC72	Butter	76,667	71,894	211,912	4,773	0.94	0.25
EEC73, 74	Emmentaler, Gruyere, Sbrinz	23,600	45,973	373,983	-22,373	1.95	0.43
EEC75	Cheddar	15,000	15,562	50,620	-562	1.04	0.06
EEC76	Cheese for processing	20,000	5,075	20,642	14,925	0.25	0.02
EEC77	Pizza Cheese	5,300	345	1,291	4,955	0.07	0.00
EEC78	Other Cheese	19,500	16,224	68,312	3,276	0.83	0.08
	Unbound Dairy	NA	48,363	46,450	NA	NA	0.05

As illustration, figure 3.2 summarises data from AMAD for dairy imports from the European Union. Over 95% of dairy imports, by value, are covered by scheduled quantity commitments. Of these, the full butter quota has been allocated exclusively to New Zealand, while a share of the Cheddar Cheese quota has been allocated to New Zealand, Australia, and Canada.

From the data in figure 3.2, it is clear that different items within the dairy regime are affected differently by TRQs. For butter and cheddar cheese, 31% of all imports by value, the system operates as a strict quota regime, with quota rents accruing and the out of quota tariff being prohibitive. For skimmed milk powders, cheese for processing, other cheese, and pizza cheese, the in-quota tariff is so high that import quota levels (based on current access commitments, or Uruguay Round base imports) are not met, so that there has been an erosion of market access since the Uruguay Round base period. These products account for 21% of imports by value. If we throw in the unbound products, then roughly 26% of dairy imports are

under a strict tariff regime. The remainder, 43%, involves Emmentaler, Gruyere, Sbrinz cheese and related products. These products fall into yet another category, where imports are well above quota levels, implying that the out of quota tariff is the binding constraint (and that quota rents also accrue on roughly half of imports). Further detail on the TRQ regime for dairy is illustrated in figure 3.2. This figure highlights the pattern of filled, unfilled, and overfilled import quotas.

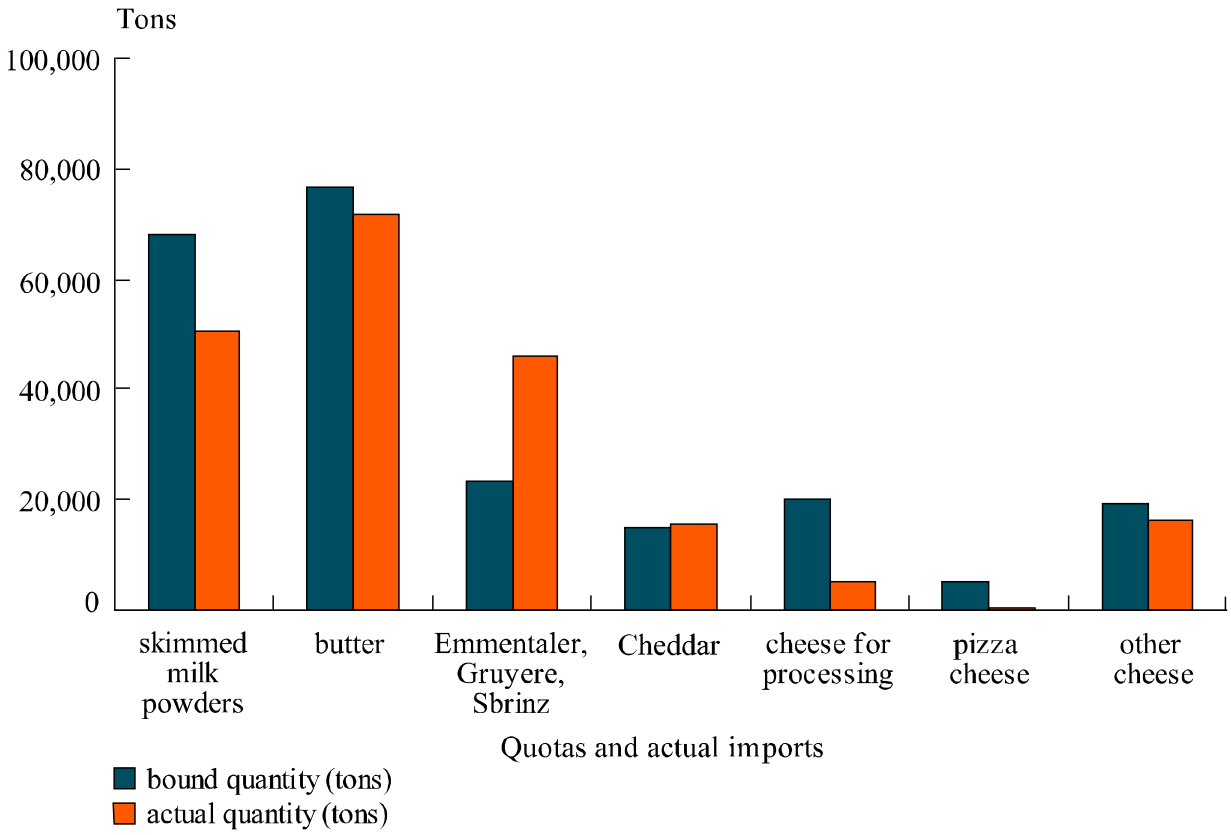

Figure 3.2 Dairy Quotas for the EU (1995 imports in quantity terms)

3.3 The market access landscape beyond agriculture

Industrial tariffs

An important feature of the policy landscape left by the UR agreements is tariff bindings on industrial goods. It is useful to remember that tariff negotiations in the WTO are not actually about applied tariff rates, but rather tariff 'bindings'. Tariff bindings are commitments not to raise tariffs above a certain level (see Francois and Martin, 2000). In the case of OECD indus-

trial tariffs, there is a close correspondence between applied and bound rates. This is not the case for developing countries. In particular, for developing countries (and also for Australia) the industrial tariff landscape features bound rates often well above applied rates. For the poorest developing countries, tariffs are often completely unbound.

Under the UR, the share of developing country imports of industrial products subject to tariff bindings rose from 13 to 61% (Blackhurst et al. 1996). This rise was mainly due to commitments by Latin American countries to apply ceiling bindings on 100% of tariff lines, and commitments made by Asian developing economies. Some of the Latin American bindings pre-date the end of the UR. Chile was the only developing country that offered to bind 100% of its tariff lines in the context of the Tokyo Round, while Costa Rica, El Salvador, Mexico and Venezuela bound 100% of tariff lines upon accession to GATT during the period 1986-1991. Among Asian developing economies, Indonesia bound more than 90% of tariff lines during the UR. India, the Republic of Korea, Malaysia, Philippines, Singapore and Thailand bound between 60 and 89%. Sri Lanka and Zimbabwe bound less than 15%. Where developing economies had bound all or a significant portion of tariffs prior to the end of the Uruguay Round (Chile, Costa Rica, El Salvador, Mexico and Venezuela), the Uruguay Round tariff commitments often reflected a decline in ceiling rates (rather than applied rates). For these reasons, implementation of Uruguay Round tariff commitments by developing countries has involved virtually no declines in current applied tariffs. This means that, to the extent reductions have occurred since the end of the UR, they have been undertaken for reasons unrelated to WTO commitments.

What is important for future industrial tariff negotiations is the current level of ceiling bindings vis-à-vis applied rates and the limited scope of bindings coverage. Taken together, the combination of bound and applied rates means that developing countries will, collectively, be able to reduce bound rates (or introduce them for the first time) while having to make only modest (and in many cases no) changes to applied rates. For example, for most developing countries in the table, a 20% reduction in average bound rates could be accomplished without any actual reduction in average applied rates. Hence, for industrial tariffs, the relevant scenarios for the next round are likely to involve little or no reduction in many developing country applied tariffs. This will be true whether or not developing countries take an active part in future industrial tariff negotiations. As in previous rounds, there is a good chance that only OECD countries will actually reduce industrial tariffs as part of any upcoming industrial tariff negotiations.

While they did not affect current applied rates, ceiling bindings were considered important enough that countries which agreed to bind previously unbound tariffs during the UR were given 'negotiating credit' for the decision even if the tariff was bound at a level well above the currently applied level. For countries (like India) that have implemented further reforms since, the issue will come up again in future tariff negotiations. Regardless of how they are treated (and though they are an integral part of the tariff negotiations) reductions in ceiling bindings clearly are more akin to rules and procedures - in terms of their contribution to the predictability of future market access - than to direct increases in market access.

For the industrial countries, average tariffs are now 3% of less. However, there are important exceptions. These include motor vehicles in the EU, and textiles and clothing in the EU and United States and Japan. This is illustrated in figure 3.3.

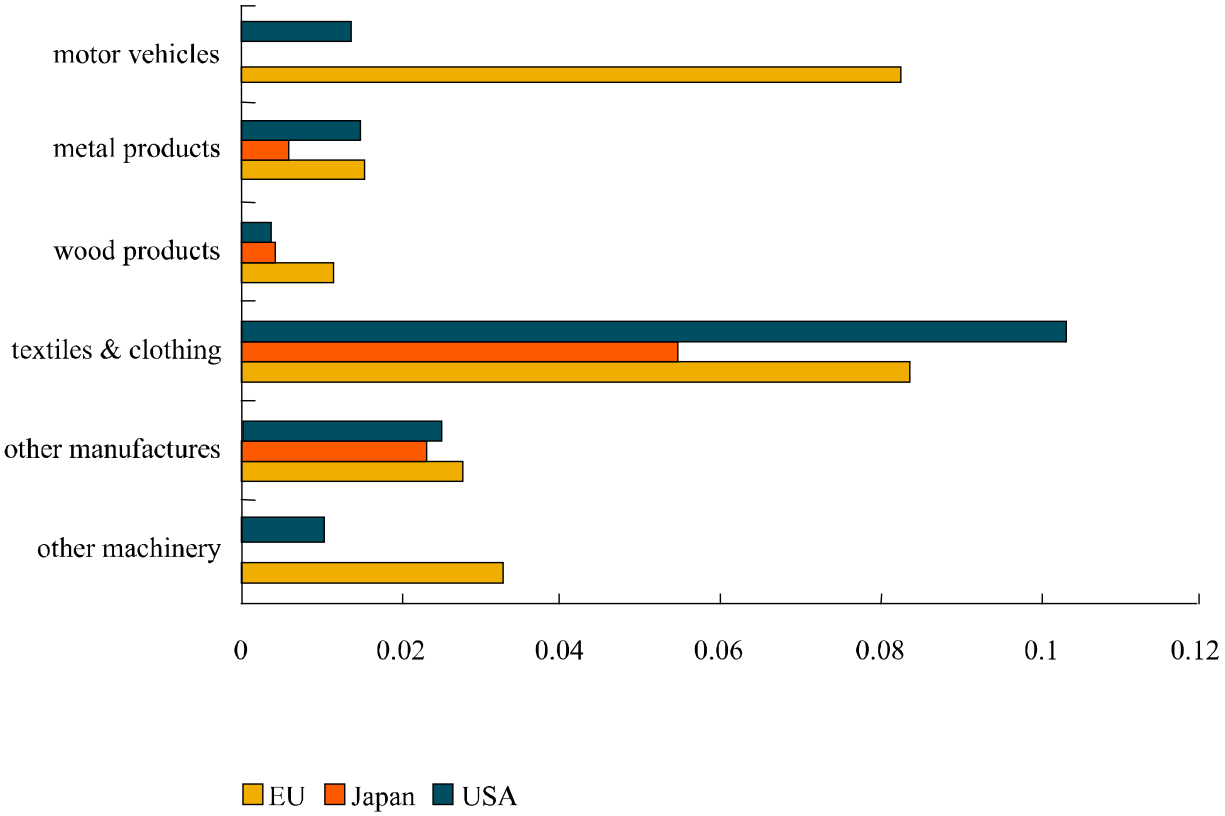

Figure 3.3 Tri-country tariff rates

Services

Finally, we turn to the issue of market access in the service sectors. From the outset, service negotiations have been 'qualitative'. They have not targeted numeric measures, but rather commitments in the cross-border movement of consumers and providers and the establishment of foreign providers. As a result, efforts to quantify market access in service sectors (a basic requirement if we want to then quantify liberalisation) have been problematic at best. The standard approach (an example is Hoekman, 1995) has been to produce inventory measures.

As an alternative perspective, figure 3.4 presents estimates of 'tariff equivalents' for services trade. These are based on a simple gravity model, estimated from detailed U.S. trade data for services trade in 1997 (the basic approach is described in Francois 2000 -- annex C). The estimates are for two categories, (i) business, business, and other intermediate services,

and (ii) construction. The estimates are admittedly crude. The pattern that emerges is consistent with that for industrial tariffs. It appears that barriers to services trade are higher (often much higher) in developing countries than in the OECD. Hence, as in the case of industrial tariffs, the effects of further GATS negotiations will hinge critically on developing country participation or non-participation, and the extent to which they commit to actual liberalisation rather than stand-stills (the qualitative equivalent of ceiling bindings).

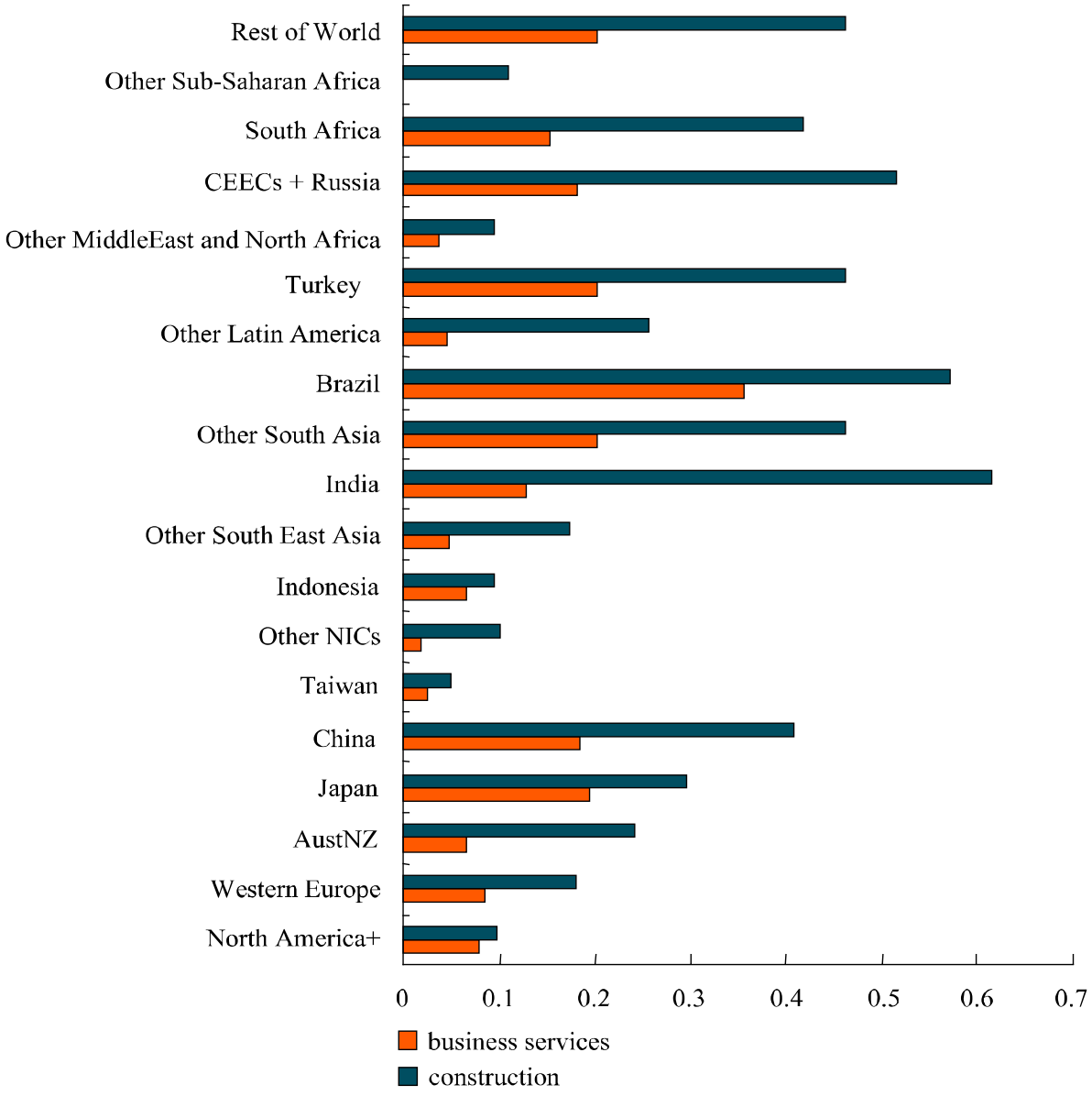

Figure 3.4 Tariff equivalents for services

3.4 The Model and Data

This section provides a brief overview of the global computable general equilibrium (CGE) model used in this study. The model is based on the GTAP model (see Hertel, 1996).

It is characterised by an input-output structure (based on regional and national input-output tables) that explicitly links industries in a value added chain from primary goods, over continuously higher stages of intermediate processing, to the final assembling of goods and services for consumption.

Inter-sectoral linkages are direct, like the input of steel in the production of transport equipment, and indirect, via intermediate use in other sectors. The model captures these linkages by modelling firms' use of factors and intermediate inputs.

Sectors	Regions
primary	European Union
Rice	Japan
Cereals	ASEAN
Vegetables	India
Oilseeds	United States
Cane and Beet Sugars	Brazil
Natural Fibers	Central and South America
Other Agriculture	Sub-Saharan Africa
Fishing	Rest of Africa
Energy and Minerals	CEA
	Russia
secondary	ROW
Processed Foods	
Textiles and Clothing	
Other Manufactures	
Wood	
Metals and Metals Products	
Motor Vehicles and Parts	
Other Machinery	
tertiary	
Trade, Transport, and Communications Services	
Finance, Professional, and Business Services	
Other Services	

Figure 3.5 Model Sector Scheme

The most important aspects of the model can be summarised as follows: (i) it covers all world trade and production; (ii) it allows for imperfect competition (oligopoly); (iii) it includes intermediate linkages between sectors; (iv) and it allows for trade to affect capital stocks through investment effects. The last point means we model medium to long-run investment ef-

fects. The inclusion of imperfect competition implies agglomeration effects like those emphasised in the recent economic geography literature. Some of these model features, in particular (ii) and (iv), represent departures from the core GTAP model (see Francois et al. 1996, Francois, 1998, Francois, 2000, Baldwin and Francois, 1999).

Imperfect competition as modelled, but is not directly important for agriculture, but is for interaction between agricultural liberalisation and liberalisation in other sectors, and for relationships between agriculture and processed foods. We include it here to keep the model as close as possible to actual industrial structure.

The effects of the CAP are captured through its impact on relative prices and output levels in the base data. A detailed treatment of the CAP has not been implemented for this application.

Social accounting data are drawn directly from the Global Trade Analysis Project (GTAP) version 4 dataset (GTAP 1999). The GTAP version 4 dataset is benchmarked to 1995, and includes detailed national input-output, trade, and final demand structures. The basic social accounting and trade data are supplemented with trade policy data, including additional data on tariffs and non-tariff barriers. Data on post-Uruguay Round tariffs are taken from recent estimates reported by Francois and Strutt (1999).

These are taken primarily from the WTO's integrated database, with supplemental information from the World Bank's recent assessment of detailed pre- and post-Uruguay Round tariff schedules. All of this tariff information has been concorded to GTAP model sectors. Services trade barriers are based on Francois (2000). The social accounting data have been aggregated to 19 sectors and 12 regions. The sectors and regions for the 19x9 aggregation of the data are detailed in figure 3.5.

While the basic GTAP dataset is benchmarked to 1995, and reflects applied tariffs actually in place in 1995, we of course want to work with a representation of a post- Uruguay Round world. To accomplish this, before conducting any policy experiments we first run a 'pre-experiment' in which we implement the rest of the Uruguay Round. As such, the dataset we work with for actual experiments is a representation of a notional world economy (with values in 1995 dollars) wherein we have full Uruguay Round implementation.

3.5 Experiments and Results

Experiments

We turn now to a description of the experiments. The experiments are described in figure 3.6. These involve 20 and 50% cuts in trade barriers. There are 2 sets of these experiments. One involves only agricultural liberalisation (agriculture in isolation). The other involves a broad liberalisation scenario (as described in Francois, 2000), where our notional agricultural liberalisation takes place in the context of a broad multilateral round. We focus on a number of issues: the impact of multilateral liberalisation on European agricultural production and trade;

the overall impact on the European economy; and the implications for European trading partners. This last issue targets concerns about net food importers. Concerns about food importers are a potential block to multilateral agricultural liberalisation. However, they may be less of a problem if compensation for terms-of-trade losses in agriculture can be offered through other trade liberalisations.

Note that we do not examine TRQs explicitly. The reason is that, in the context of aggregate sectors, detailed TRQ workings are lost. Like the textile and clothing quotas, we might at first glance expect to be able to work with an 'aggregate' treatment of TRQs within broad agricultural product categories. However, there is a critical difference.

In the case of textiles and clothing, there is only one relevant instrument (a quota). We can therefore hold a straight face while modelling aggregate quotas.

Experiments	Issues
20% agriculture-only liberalisation (a 20% reduction in tax equivalent of all border measures)	The impact on European agricultural Sectors
50% agriculture-only liberalisation (a 50% reduction in tax equivalent of all border measures)	The overall impact on the European economy
20% liberalisation across agriculture, industry, and services.	The overall impact on EU trading partners
50% liberalisation across agriculture, industry, and services.	

Figure 3.6 Experiments and issues

In agriculture, this is not the case. For example, the case of dairy products in section 2 illustrates how, within broad product categories, the detailed nature of individual TRQ regimes can be lost within aggregates. In this case, this also means that quantitative analysis that seeks to treat TRQs seriously must also deal with detailed (6- or 8-digit) tariff categories for the relevant products, as we are working with different regimes for different products. The alternative is to continue working in the tradition of stylised protection measures for aggregate categories. Progress is underway to map the GTAP database to more detailed information on TRQs. Even then, we should link TRQs through satellite models of individual products (like cheddar cheese and dried skim milk) to really track TRQ-related constraints. This is simply beyond the scope of this paper.

3.6 Estimated Effects

We next turn to a description of our simulation results. These are summarised in figures 3.7, 3.8 and 3.9 and tables 3.2 and 3.3. Except as noted, all changes are in % differences in the counterfactural.

Agricultural performance

We focus first on agricultural performance. These results are summarised in figures 3.7, 3.8 and 3.9. Note that we have changes reported for output, exports, and prices (in 1995 dollars).

Generally, for output levels, it does not matter much whether or not liberalisation takes place in the context of other negotiations. The output responses are roughly comparable, with rice, sugars, and natural fibers being the most sensitive in terms of output levels. There is a slight modification of output effects under broad liberalisation. For example, under the 20% scenario, we have a -3.4% change in natural fiber production when only agriculture is liberalised, but only a -2.2% change in the context of broader liberalisation.

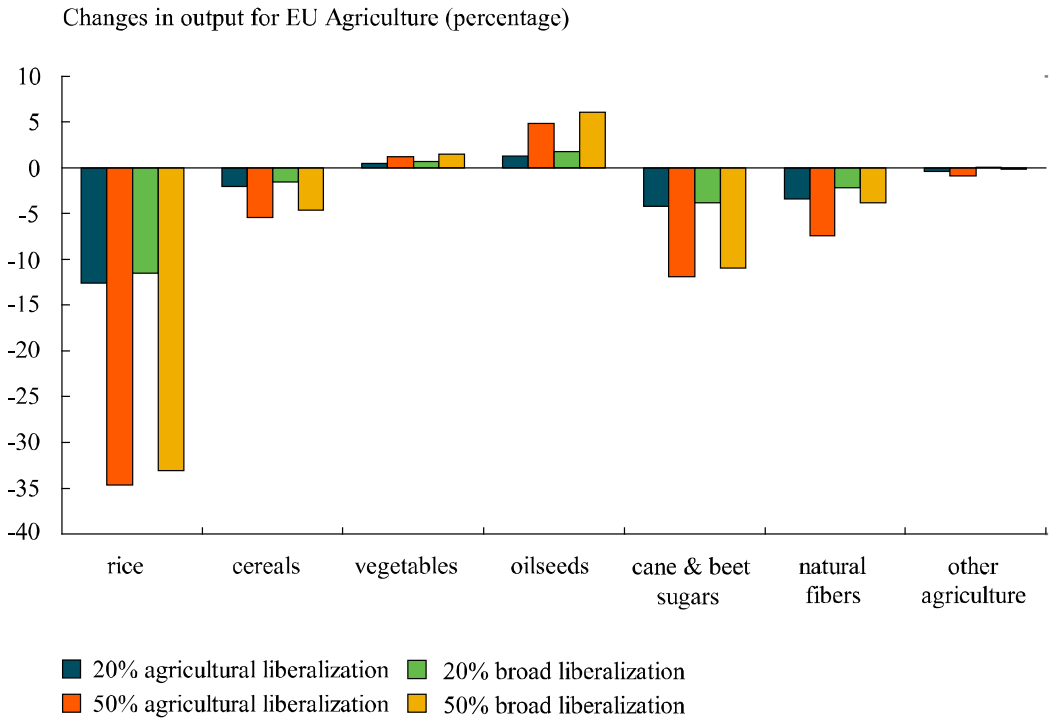

Figure 3.7 Changes in output for EU agriculture (%)

Turning next to exports, the results are more mixed. Some sectors, like oilseeds, are squeezed at home, forcing them to increase exports. For other sectors, like cereals, the fall in exports maps to a corresponding fall in output. The only changes that flip sign between narrow and broad scenarios are in natural fibers. Under the broad scenario, the domestic textile and clothing industry is squeezed by tariff reductions. At the same time, there is expanded production abroad. This draws exports from the EU, so that natural fiber exports rise under the broad liberalisation scenarios (0.6 and 6.4%).

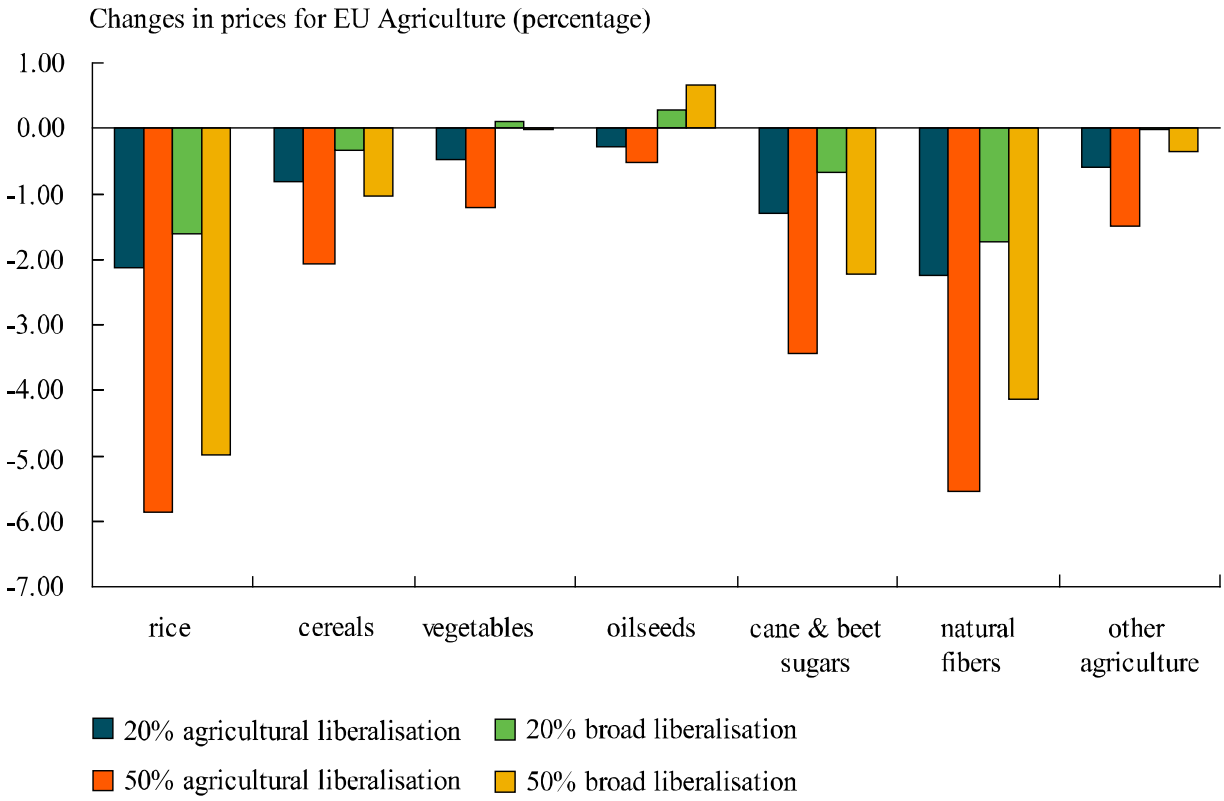

Figure 3.8 Changes in prices for EU agriculture (%)

Finally, consider the impact on domestic prices. This is presented in figure 3.9. Here, we see more significant differences between scenarios, with the direction of price changes depending for both oilseeds and vegetables on the scope of the scenario. Significantly, all negative pressures o EU agricultural prices are moderated in the context of broad liberalisation. With broad liberalisation, increased incomes exert enough pressure to pull prices up somewhat from the depressed levels that follow from agriculture-only liberalisation. This sug-

gests that price support schemes could be more easily maintained under a broad liberalisation, because of income-demand linkages.

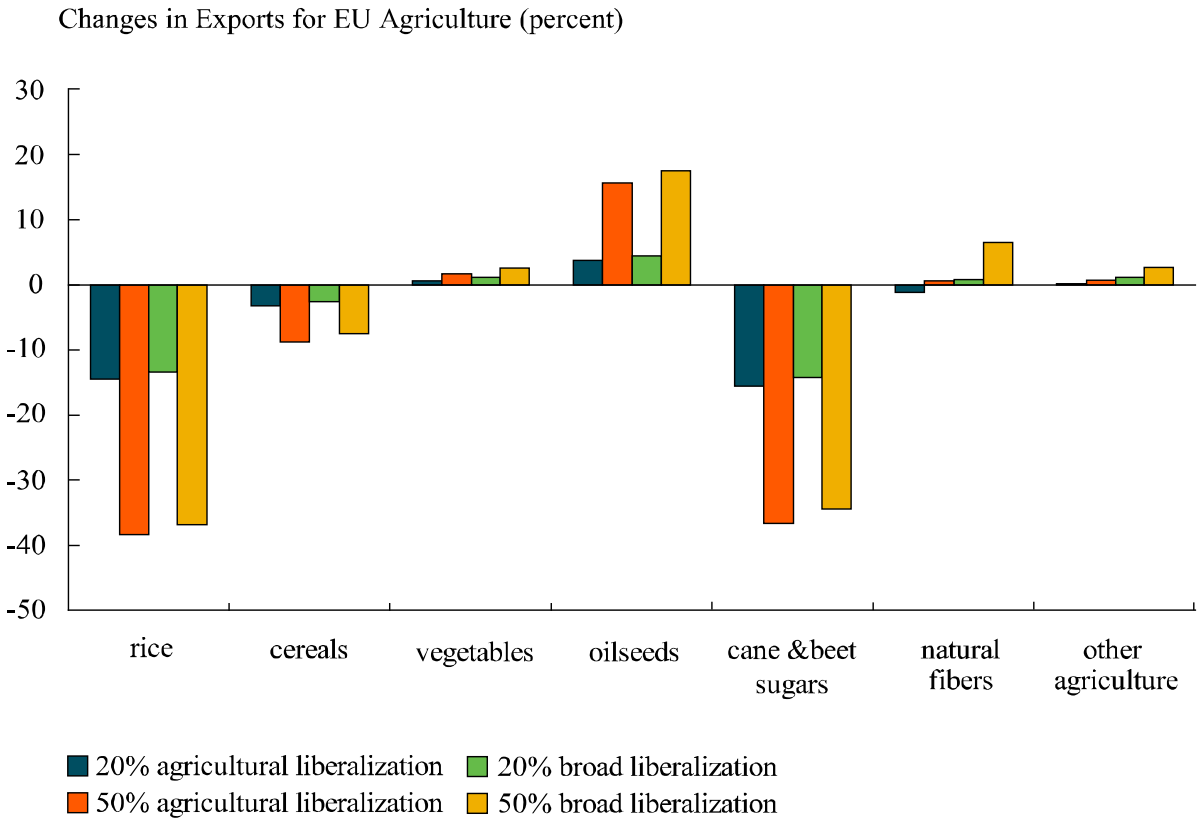

Figure 3.9 Changes in exports for EU agriculture (%)

EU macroeconomic indicators

We turn next to EU macro indicators. These are summarised in table 3.2. Here, we obviously see greater differences between scenarios as we move to the macro level. This is because we have liberalisation of industrial and service barriers. The income effects provide some rough metric of the relative importance of agriculture in a broad multilateral round. From the table, agriculture would be a source for between 22 and 28% of the total gains to be realised from a broad multilateral round. The same weighting holds for wage changes. It is clear that, for labour, agricultural liberalisation is relatively unimportant. The discernible wage gains result from the broad scenarios.

Table 3.2 Macro Effects for the EU

	20% agricultural liberalisation	50% agricultural liberalisation	20% broad liberalisation	50% broad liberalisation
percent changes				
terms of trade	0.03	0.07	0.03	0.07
equivalent variation (%)	0.06	0.15	0.30	0.54
real unskilled wages	0.06	0.16	0.47	0.96
real skilled wages	0.10	0.24	0.50	1.02
million dollar changes				
national income (EV based)	4,298.95	9,909.70	19,616.64	35,946.30

Trading Partners

Finally, we turn to the impact of our liberalisation scenarios on EU trading partners. As noted at the opening of this section, there is particular concern (among NGOs, UNCTAD, and tc) about the impact of agricultural policy on developing countries. These concerns are supported by the results shown in table 3.3. Under the narrow liberalisation scenarios, we have net welfare losses for the former Soviet Union, Sub-Saharan Africa, and the Rest of World (of course, for all of these regions, poor domestic policy and agricultural infrastructure play in a critical role in this result). These results are reversed, qualitatively, once we move to a broad round. Yes, we can expect losers from agricultural liberalisation, particularly in the world's poorest countries. However, this is more than compensated for if liberalisation is expanded to include manufactures and services.

Table 3.3 National Welfare Effects (%)

	20% agricultural liberalisation	50% agricultural liberalisation	20% broad liberalisation	50% broad liberalisation
European Union	0.06	0.15	0.30	0.54
Japan	0.09	0.18	0.38	0.72
ASEAN	0.18	0.43	2.25	3.98
India	0.08	0.16	0.90	2.23
United States	0.00	0.01	0.25	0.43
Brazil	0.07	0.16	0.35	1.19
Central America	0.09	0.26	0.89	1.60
Central European Associates	0.03	0.08	0.62	1.26
Former Soviet Union	-0.07	-0.19	0.57	1.01
Sub-Saharan Africa	-0.03	-0.07	0.68	1.24
Rest of Africa	-0.13	-0.32	0.67	1.27
Rest of World	0.03	0.05	1.16	1.98

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4. The agenda 2000 CAP reform, world prices and URAA GATT-WTO export constraints

Hans van Meijl and Frank van Tongeren

4.1 Introduction

At the European Summit in Berlin, 26 March 1999, the EU Heads of States reached agreement on the Agenda 2000 package, which contains reforms of the European Common Agricultural Policy (CAP). This paper discusses whether and to what extent the reform package contributes to fulfilment of the EU's commitments on reduction of export subsidies made under the earlier GATT Uruguay Round Agreement on Agriculture. Furthermore, we obtain a quantitative assessment of the effects of alternative world market price developments on the fulfilment of these commitments.

We use a modified version of the GTAP model and its database to reflect the essentials of the EU Common Agricultural Policy and the Agenda 2000 reforms. Our modifications follow recommendations made in Veenendaal (et al. 2000), who assessed the usefulness of GTAP for CAP reform analysis. We introduce new equations and new variables to represent the EU's price insulation from world markets, and we include an explicit modelling of intervention (floor) prices.. We also introduce set-aside rates in the EU's cereal sectors and a milk production quota system in the EU's dairy sector. In addition, we make some modifications to the database in order to achieve an improved representation of compensation payments.

The Uruguay Round Agreement on Agriculture (URAA) in 1994 had a major impact on the EU's CAP policy, as domestic farm policies have become subject to international governance through the GATT. The set of rules established under the GATT limits the scope for domestic agricultural- and trade policies. Specifically, the agreement had implications in three areas: market access, export competition and domestic support. Of these, the constraints on the value of export subsidy expenditures and on the volume of subsidised exports are expected to become most pressing. Binding constraints on export subsidies imply that insulation of EU markets from world markets is more difficult because some excess supply cannot be disposed on world markets at reduced prices. The reduction of intervention prices under the Mac Sharry and Agenda 2000 reforms allow the EU to meet the exports constraints more easily (for a summary of Agenda 2000, see Veenendaal, et al. 2000). The paper is structured as follows. Section 4.2 gives a summary of the Agenda 2000 reform package and it provides some data on the degree to which the Uruguay Round Agreement on Agriculture export subsidy reduction commitments are binding for the EU. Section 4.3 gives some theoretical background on the relationship between price insulation and export subsidies, and it discusses a price transmission mechanism between intervention prices and market prices. The implementation of

Agenda 2000 in the GTAP model is discussed in section 4.4, and section 4.5 provides quantitative numerical results. Finally, section 4.6 concludes.

4.2 Agenda 2000 reforms and export subsidy commitments

4.2.1 Agenda 2000 reforms

The Agenda 2000 reforms, which basically continue along the same lines as the earlier Mac Sharry reforms (1992), have been prompted by a combination of factors. First, the envisaged enlargement of the EU by a number of Central and East European Countries (CEECs). Their relatively high share of agriculture in production would lead to unsustainable budget implications for the EU. In addition, given a large share of food in CEECs household expenditures, the current high EU food prices would bear severe consequences for households.

Product	Measure	Implementation
Cereals	15% price decrease	2000 minus 7.5%; 2001 minus 15% Compensation increases from € 54.34/ton to € 63.00/ton
	Reduction of area set-aside	Compulsory set-aside from 15% to 10%, extraordinary set-aside abolished, voluntary set-aside maintained
Oilseeds	A decrease of compensation payments	Compensation payments will be equal to those for cereals: a decrease from € 94.24/ton to € 63.00/ton
Milk	15% price decrease	2005 minus 5%; 2006 minus 10%; 2007 minus 15% Compensations for beef and milk price decreases
	1.5% linear increase of milk quota	In 3 years from 2005 onwards (0.5% a year)
	0.9% increase of milk quota through specific allocations	Italy, Greece, Spain, Ireland, Northern Ireland.1.39 million tons, in two unequal stages in 2000/01 and 2001/02
Beef	20% price decrease	2000 minus 6.7%; 2001 minus 13.3%; 2002 minus 20% Compensations per head and slaughter premiums

Figure 4.1 Summary of agenda 2000 reforms

Second, the anticipation of a new round of trade negotiations under auspices of the WTO is expected to generate the need for further adjustments in the CAP. Third, and foremost, without reforms, the EU would not be able to fulfil its earlier commitments made under the Uruguay round agreement. Specifically, surpluses in grains and beef have been expected to emerge, which could not be disposed on world markets without violation of the UR agreement. Although Agenda 2000 in itself implies only minor changes it continues the fundamental swing of European agricultural policy set in motion by the 1992 Mac Sharry

policy reform from market price support towards direct income support. Figure 4.2 summarises the policy measures for the most relevant products [1].

For cereals, the agreement specifies a reduction of the intervention price by 15% (to be achieved in two steps by 2001/2002). The price decrease will be partially compensated through direct payments to farmers, which are expected to compensate for about 50% of the income drop. This is achieved by area payments, which result from the multiplication of historic reference yields with fixed money amounts per tonne. The set-aside area is reduced from its Mac Sharry levels. Note that the policy measures do not differentiate between foodgrains and feedgrains, hence maintaining the practice of equalising the intervention price levels for both types of grains, whereas there is a clear price differential on international markets. For oilseeds and protein crops, which do not have a fixed intervention price, similar area payments continue to exist, but these payments are to be reduced over time. The compulsory set-aside of 10% of arable land is retained, and the compensation occurs according to identical rates for all arable crops.

In addition, farmers can opt for voluntary set-aside. In the dairy sector, the intervention prices for skimmed milk powder and butter will be reduced by 15% in three steps from 2005/2006 onwards. The milk quota regime is extended to 2008, and the quota will be increased by 1.5% over three years in Member States from 2005/2006 onwards [2]. To compensate for the fall in dairy prices, farmers receive payments related to their historic quota holdings. Additional compensation is offered through 'national envelopes' allocated to member states to compensate dairy farmers. Note that part of the quota increase precedes the fall in intervention prices, which implies that existing problems with regard to meeting the URAA constraints on subsidised dairy exports will only be harder to meet [3]. The quota regime is due to be reviewed in 2003. The intervention price for beef and veal is to be reduced by 20% in three steps over the period 2000/2002. Compensatory premiums are related to the number of animals and there also are slaughter premiums. The total number of animals qualifying for special premium and suckler cow premium are limited to two (standard) livestock units per hectare. Additional premiums are granted if the number of livestock falls below 1.4 units per hectare.

[1] We leave aside other elements of the reform package that deal with integrated rural development, as the second pillar of the CAP, and we leave aside environmental and farm employment policy measures. A complete description of the agricultural chapter of Agenda 2000 is found in European Commission CAP 2000 series of the DG-Agri (http://europa.eu.int/comm/dg06/index.htm).

[2] Except Italy, Greece, Spain, Ireland and Northern Ireland. For these countries, specific quota increases totalling 1.39 million tons are to be implemented in two unequal stages in 2000/01 and 2001/02 already. The two measures will lead at the end of the implementation period (over the next eight years) to a quota rise of approximately 2.4%.

[3] In fact in the second half of the year 1999 EU milk prices already declined significantly due to the impossibility to dispose surplusses at subsidised prices on world markets.

4.2.2 The European Union's export subsidy commitments

Under the GATT-URAA in 1994, both a reduction in the value of export budget expenditures by 36% over 6 years, and a reduction on the volumes of subsidised export by 21% over 6 years have been agreed. Despite the positive effects of the 1992 CAP reforms, which led to lower EU domestic guaranteed prices, there is still ample reason for concern, as figure 4.2 and figure 4.3 illustrate. If the market situation of 1997/98 were repeated in the year 2000, then the volume of subsidised exports for 7 commodities (Poultry meat, cheese, eggs, beef, other milk products, wine and sugar) would be beyond their year 2000 GATT bounds, while the export subsidy budget would be exceeded for 4 commodities (processed products, other milk products, sugar and alcohol) [1]. It is apparent that many products are exceeding, or are close to, their year 2000 GATT bounds [2].

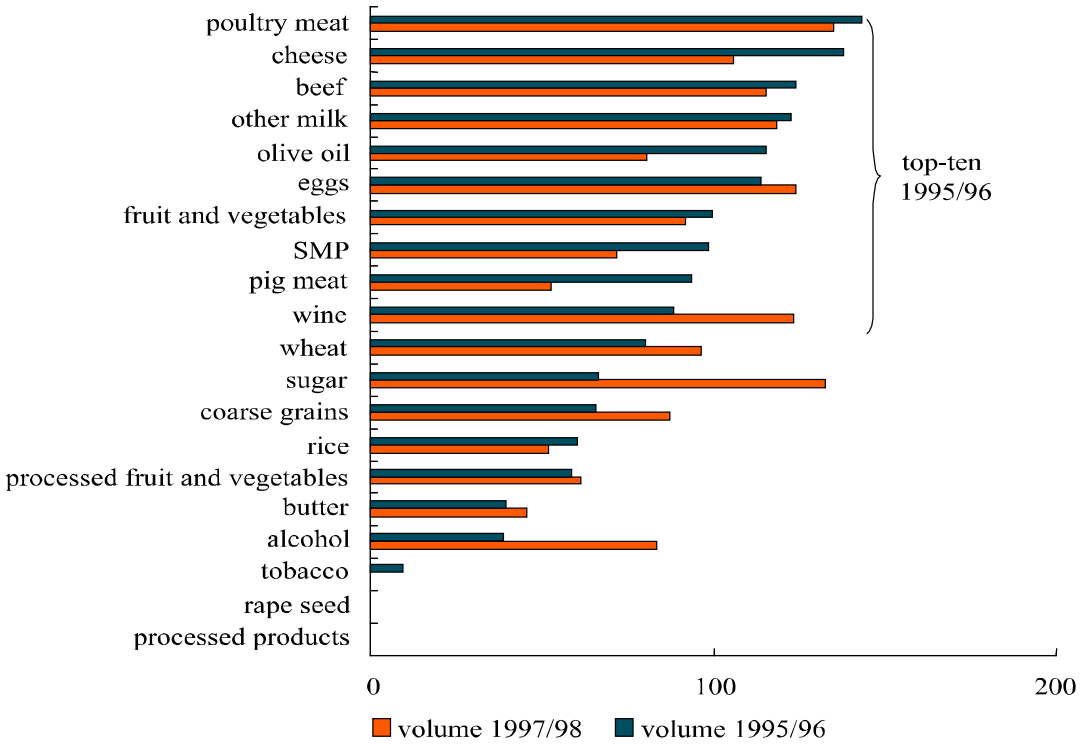

Figure 4.2 EU volume of subsidised exports 1995/96 and 1997/98 as ratio to WTO commitments in 2000
Source: WTO notifications.

[1] It should also be noted that the EUR/USD exchange rate has an impact on the fill rate of subsidy bounds. A lower exchange rate reduces the USD denominated value of the export subsidies. The declining value of the EUR relative to the USD during the year 2000 has contributed to a slackening of the export subsidy constraints that the EU is facing.

[2] It should be noted that up to the year 2000 it was possible to carry over unused subsidies and exports of the previous year. In the year 2000 this is not possible anymore.

These figures also reveal several other noteworthy phenomena. First, there is a large variability observed in both indicators. Both the volume and the value constraints have become less binding for a number of products, while other products have come dangerously close to the constraints, or are even exceeding it [1]. Dairy products (especially cheese, but not butter) and beef products, are clearly among the group of products for which export subsidy constraints are a problem. While wheat and coarse grains have stayed clear of both constraints over the period considered, the volume of subsidised exports has nevertheless been increasing. While cereals world prices have been rather high, EU cereals prices had already declined substantially following the Mac Sharry reforms. These two factors combine to alleviate the restriction on the export subsidy budget, as the gap between cereals world prices and EU prices has been diminishing. It should also be noted that pig- and poultry meat, as well as fruit and vegetables are clearly giving reasons for concern in terms of export subsidy commitments.

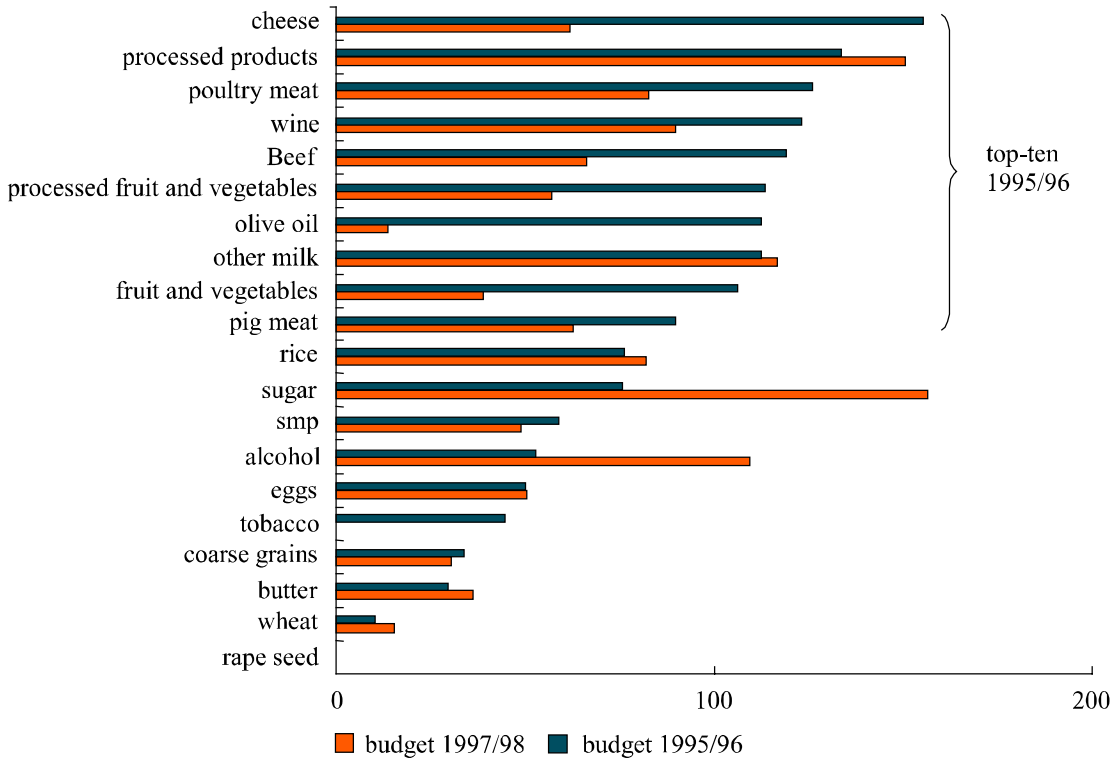

Figure 4.3 EU export subsidy budget 1995/96 and 1997/98 as ratio to WTO commitments in 2000
Source: WTO notifications.

[1] Obviously, there are no reduction commitments with respect to processed products, but the value of subsidies is related to the subsidy content of the inputs used in processing.

Second, the volume constraints seem generally to be more 'sticky' than the budget constraints. The value constraints display a larger variation which can be attributed to the fact that the size of the budget depends on both a volume component (the volume of exports) and a price component (the price differential between the EU and the international export markets). The price component is clearly more volatile. The volume component of exports subsidies declines at a much slower rate, if at all, which is explained by slower adjustments of production levels. Third, while the sugar sector remains outside the Agenda 2000 reforms, the amount of subsidised exports and the subsidy budget have both been rising beyond their year 2000 commitment levels.

4.3 Theory

4.3.1 Price insulation and export bounds

The Agenda 2000 reform package generates indirect effects on world markets, which will depend on a) the reaction of domestic demand to lower prices; b) the reaction of EU farmers to the policy package, i.e. the supply response, and c) the reaction of world markets to changed net supply from the EU. Leaving aside the compensation payments to farmers and leaving aside reductions in set-aside requirements, a lower intervention price will lead to a contraction of production, as market prices will drop (see section 4.2 on the relation between market prices and intervention prices). On the other hand, lower prices will induce a higher demand for domestic products, both for final consumption demand and for intermediate demand in processing industries. These two effects will combine to reduce the net exports of the EU, i.e. the net supply of EU to world markets. This lower supply on world markets will lead to upward pressure on world prices, especially for products where the EU has a significant world market share, and where demand is relatively price inelastic.

As a consequence, the export subsidy that is required to bridge the gap between high EU prices and world prices will decline. In fact there are three factors contributing to this: a) the volume component declines because there is less export supply forthcoming, b) the domestic EU prices are lowered, and therefore move closer to world levels, and c) world prices increase, and therefore contribute to reducing the price gap. Consequently both GATT constraints become less binding as a result of the drop of guaranteed prices under Agenda 2000.

Compensation payments complicate the picture slightly, because the net effect on the EU supply response is ambiguous. For cereals, area payments for crops dampen the supply response that follows a decrease in the institutional price. The supply curve becomes less elastic (Swinbank, 1997), and the reduction in production is less than without such payments. In addition, a decrease in area set-aside obligations, however, implies an increase in production at each price level. The combined effect of lower intervention prices and increased compensatory measures on production is indeterminate. See also Van Meijl and Van Tongeren (2000) for a more elaborate discussion in a partial equilibrium setting. Another effect entering the picture

concerns resource shifts between alternative activities. Changes in the relative profitability of land may induce shifts between alternative cropping and livestock uses.

4.3.2 Cereals intervention prices and domestic market prices

The CAP regime for cereals has always been characterised by a multiple support price system. A minimum floor price has been installed to stabilise farm prices. The insulation of domestic prices from world markets could be achieved by variable import levies on the one hand, and disposal of excess supply on world markets at subsidised prices on the other hand. Under the old system of variable import levies, the difference between a threshold price and the world price determined the size of the levy. The threshold price was set high enough to discourage imports. Although the URAA implied a change in import regimes that abolished the system of threshold prices and variable levies, the EU is still able to effectively isolate its cereals markets from world markets (Swinbank 1997). Although under the new system, fixed tariffs per tonne are applied to imports, there exists a maximum import price equal to the intervention price plus 55%. The resulting maximum import price initially equalled the old abandoned threshold price. The import charges are determined by the EU on a 14-day basis for 6 types of cereals as follows: a reference price is determined taking prices on US grain markets and adding transport cost to Rotterdam.

The import charge is then equal to the 1.55 x intervention price -/- the reference price. In practice this system means that the import tariffs are still variable. One consequence of the import regime is that market prices for cereals have been fluctuating between a ceiling (pre-URAA: threshold price, post-URAA: intervention price x 1.55) and a floor (intervention price). Over the years (since 1976) the gap between these two prices has been widening, which has allowed market prices to be more responsive to market conditions. One empirical regularity is that market prices have been declining towards the intervention price level at times of increasing net exports, or, to put it differently, at times of increasing excess supply on domestic markets. Many modellers assume a fixed relation between the intervention price and the market price. Indeed empirical evidence shows that the market price has usually been higher than the intervention price, but the ratio is certainly not fixed.

In our implementation, we follow Surry (1992) in modelling the transmission endogenously as a function of net-exports in a varying-parameter model. This allows us to investigate the degree of price transmission. This method also allows us to study two further interesting price configurations: a) the case when intervention prices are lowered even further than under Agenda 2000 and below levels that equilibrate domestic supply and demand, b) the case when world prices are in fact higher than domestic EU prices [1].

[1] The approach is similar in spirit to the method followed in the WATSIM partial equilibrium trade model (Lampe, 1999). Introducing such a price transmission specification in a general equilibrium model might appear as an ad-hoc treatment which is not founded micro economically. However, we may refer to Surry (1992) who rationalises his formulation as the outcome of a decision problem by a central price setting agent. In the empirical implementation, we use a logistic function, whose two parameters are estimated econometrically.

See also Van Meijl and Van Tongeren (2000) for a discussion of the model implementation and the features of the transmission equation.

4.4 Implementation

Standard GTAP model features

Our Agenda 2000 implementation uses a modified version of the GTAP multi-sector multi-region AGE model, Hertel (1997). This multi-region model allows us to capture inter-country effects, since the CAP reform influences demand and supply on the world market and therefore world market prices, and hence will affect trade flows and welfare. As was argued in section 4.3, endogenous world market price play a crucial rule for GATT bounds.

In the standard GTAP model each single region is modelled along relatively standard lines of multi-sector AGE models. All sectors are producing under constant returns to scale, and perfect competition on factor markets and output markets is assumed. Firms combine intermediate inputs and primary factors (land, labour and capital). Intermediate inputs are used in fixed proportions, but are themselves CES composites of domestic and foreign components. In addition, the foreign component is differentiated by region of origin (Armington assumption), which permits the modelling of bilateral (intra-industry) trade flows, depending on the ease of substitution between products from different regions.

Primary factors are combined according to a CES function. Regional endowments of land, labour and capital are fixed. Labour and capital are perfectly mobile across domestic sectors. Land, on the other hand, is imperfectly mobile across alternative agricultural uses, hence sustaining rent differentials. Each region is equipped with one regional household which distributes income across savings and consumption expenditures according to fixed budget shares. Consumption expenditures are allocated across commodities according to a non-homothetic CDE expenditure function.

The model is calibrated to the GTAP version 4 database, which takes 1995 as its benchmark equilibrium [1]. A distinguishing feature of this data set is the inclusion of bilateral trade flows and protection databased on WTO data on pre-Uruguay round protection. A drawback for CAP analysis is that all actual input subsidies are converted into output subsidy equivalents in the database, see also Veenendaal (et al. 2000). Our implementation of the GTAP model uses an aggregation that divides the world into eight regions (aggregated from the original 45 GTAP regions), each with eighteen sectors (aggregated form the original 50 sectors), see the appendix to this chapter for the complete aggregation scheme.

[1] The year 1995 has been characterised by rather high world prices for most agricultural commodities, and as a consequence the nominal protection rates for OECD countries have historically been rather low. It might therefore be argued that 1995 is not a proper benchmark year for our study. However, any choice of a base year will always reflect some specific features of that particular year. One solution to this ubiquitous problem in policy modelling may be the construction of an artificial 'average' benchmark year.

CAP essentials and deviations from the standard model

To incorporate the main features of the CAP we include the following deviations from the standard model. First, the domestic market is insulated from world price changes through a variable import tariff [1]. Second, a price transmission mechanism between intervention price and market price is introduced as described in section 4.2. Price transmission from intervention to market price is dependent on the net-export position (extra-EU trade position). Third, a variable export subsidy is introduced to dispose excess supply on the world market. Fourth, some alteration to the database have been made to reflect the fact that subsidies to agriculture are a combination of input subsidies and output subsidies. The changes to the database are highlighted below, and follow the lines of earlier GTAP-based CAP model exercises, most notably Frandsen (et al. 2000).

Agenda 2000

The Agenda 2000 reforms, as summarised in figure 4.1, are implemented as follows:

- Cereals (food- and feedgrains):
  A price transmission mechanism is implemented between market and intervention price. The intervention price is lowered from €119.19 per tonne to €101.31 per tonne. Area payments are taken out from the output subsidy figures in the original GTAP (v4) database and implemented as a subsidy to value added [2]. In the Agenda 2000 simulation the intervention price is reduced with 15% and compensations payments to inputs are increased to compensate 50% of the income reduction. Furthermore, the set aside rate is reduced from 15 to 10% [3]. Set aside reduction is implemented as a positive factor-neutral productivity shock, as in Frandsen (et al. 2000).
- Dairy:
  We make a distinction between raw milk and dairy products. CAP policies apply to raw milk, which is essentially non-tradable, whereas trade policies apply to dairy products. A quota system is introduced in the raw milk sector. Output is fixed and a quota rent is introduced which is accounted as an income flow in the regional household income

[1] In addition to the variable import tariff, we fix the ratio of the domestic market price to the price of the import composite foreign prices. This eliminates substitution effects between domestic products and imported products.
[2] The value of area payments is equal to USD 10,389 million (ECU 13,506 million, source: European Commission, report 1996). This amount is larger than total land costs in GTAP for all kind of cereals. Therefore we have introduced area payments as subsidies to value added, and not to land.
[3] The assumption that the reduced set aside area is fully utilized for crop production is certainly a bit extreme. In as far as farmers first take marginal land out of production under a set-aside regime, the slackening of set-aside rules will not lead to a one-to-one increase in area planted and harvested. In other words, our assumption does not take into account such 'slippage' effects.

equation [1]. In the Agenda 2000 simulations quota are increased with 1.5% [2]. No new policy measures are introduced in the dairy sector.

- Cattle/beef:
  A price transmission mechanism is implemented between market and intervention price, which drops from €3,475 per tonne (carcass weight, type R3) to €2,7870 per tonne. The intervention price is introduced in the cattle sector, rather than in the beef sector, because the intervention price applies at the very unprocessed meat level. We assume a perfect transmission between intervention and market price, as beef market prices have historically been on par with intervention prices. Headage payments are partly netted out from the output subsidy in the original database and are implemented as a subsidy to capital. Slaughter premiums are considered as output subsidy, while suckler cow premiums are introduced as capital subsidy in the cattle sector. In the Agenda 2000 simulation the intervention price is decreased with 17.4% [3] and the compensation payments are increased to obtain 100% compensation. Furthermore, we assume that output development in the beef sector has a one-to-one relation with output in the cattle sector because of complementarity in production.
- Sugar and Oilseeds:
  For Oilseeds compensation payments to land are reduced by 33% and for Sugar there is no influence from Agenda 2000.

Finally, we created a short run model by introducing sluggish primary production factors. Both land and labour are considered to be imperfectly mobile across sectors, but not completely sector specific.

4.5 Results

4.5.1 Agenda 2000

Figure 4.4 illustrates the Agenda 2000 effects of the price transmission mechanism as introduced in section 4.3.2. The 15% reduction of the intervention price leads to a decrease of the market price by 13.2% for foodgrains and 12.3% for feedgrains. A full price transmission is obtained for cattle. The high degree of price transmission for grains is the result of the positive net export position of the EU, which has even improved under the Agenda 2000 simulation, see table 4.2. This is mainly caused by a positive output effect, see figure 4.5. For the cat-

[1] With this is an approximation we abstract from the fact the dairy quota is also tied to a reference fat content of the raw milk.
[2] Hence we do not include the allocation of new specific quota to some member states. The overall quota increase in Agenda 2000 is 2.4%, of which we only capture the linear increase of 1.5% (see also figure 4.1).
[3] In the GTAP database, cattle is aggregated with other bovine animals. Because sheep represent 13% of bovine production, the intervention price is reduced with 87%*20% = 17.4%.

tle/beef complex the price transmission is perfect, as there continues to be massive excess supply, which manifests itself in a positive net export position.

Figure 4.5 shows simulated Agenda 2000 effects on output and export volumes of agricultural products in the EU15. Especially noteworthy are the expected positive output effects for grains and dairy products. This positive output effect seems to run counter to intuition. How can this be explained?

There are two elements in understanding the positive output effects: the compensation package and the reduction of area set-aside. The income compensation to farmers which is linked to land (or to livestock in case of cattle farming), does not induce a drop, but rather an expansion, of production. One would expect an output decline because the compensation is not complete, as it compensates for only about 50% of the income loss, ceteris paribus. However, an increase in cropped area is expected to lead to an expansion of output. This is a result of the reduction of compulsory area set-aside combined with a shift of land from other sectors (e.g. oilseeds) into grains production [1]. This latter effect is due to a decline of relative profitability of land in these sectors. Finally, domestic feedgrains consumption increases at the expense of imported feedgrain substitutes, providing another boost to domestic production [2].

The dairy sector expansion follows the increase of production quota for raw milk, despite a drop in prices by about 10%. Production of livestock (cattle) diminishes notably with 3%.

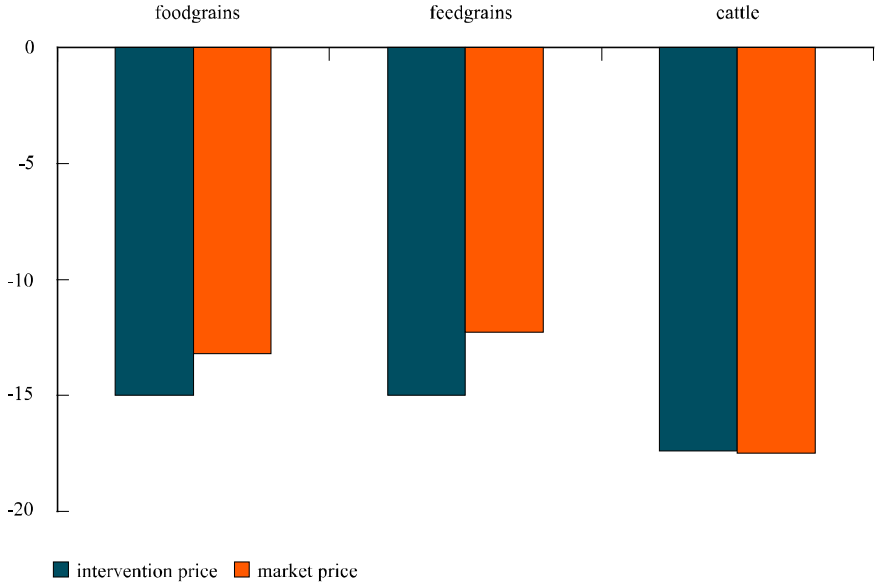

Figure 4.4 Price transmission between intervention and market prices under agenda 2000 (% change)
Source: Model calculations.

[1] We should reiterate, however, that we did not take 'slippage effects' into account, and may therefore overestimate the production increase.

[2] It could be instructive for a future application to numerically decompose output effects into constituent components (lower intervention price, increase compensation payments, decrease set aside, limited price transmission and intersectoral effects).

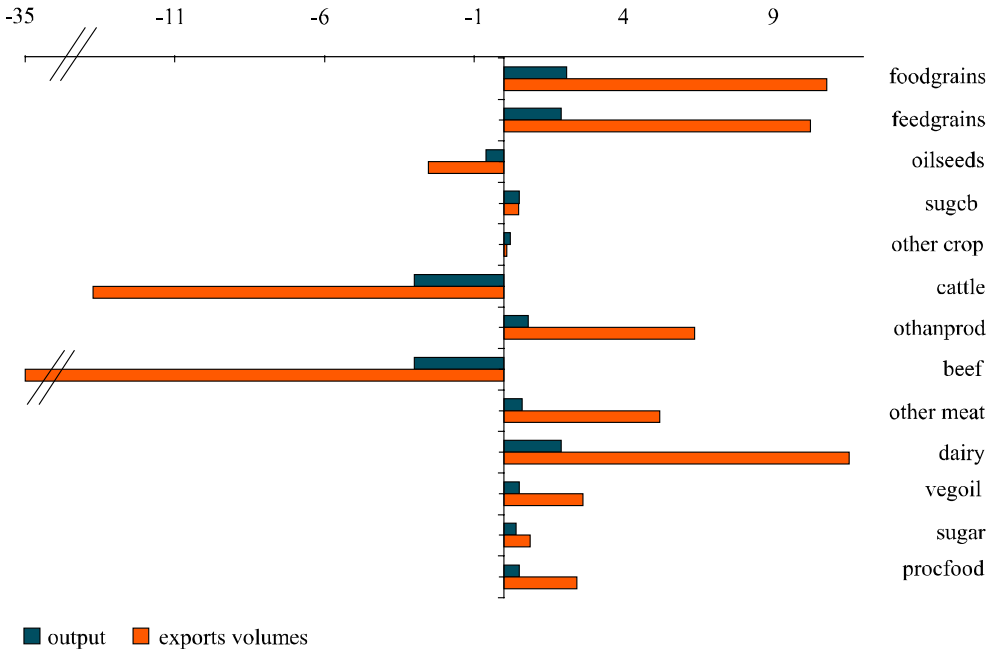

Figure 4.5 Simulated agenda 2000 effects: EU output and exports, % change relative to 1995 base
Source: Model calculations.

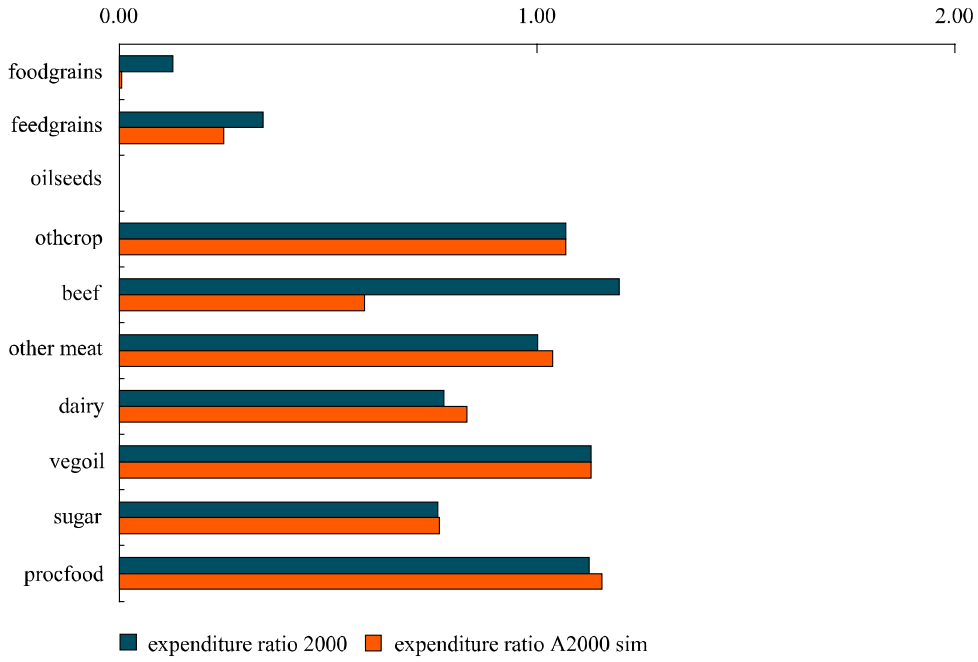

Figure 4.6 Simulated agenda 2000 effects: EU export subsidy expenditures bounds
Source: WTO notifications, author's calculations.

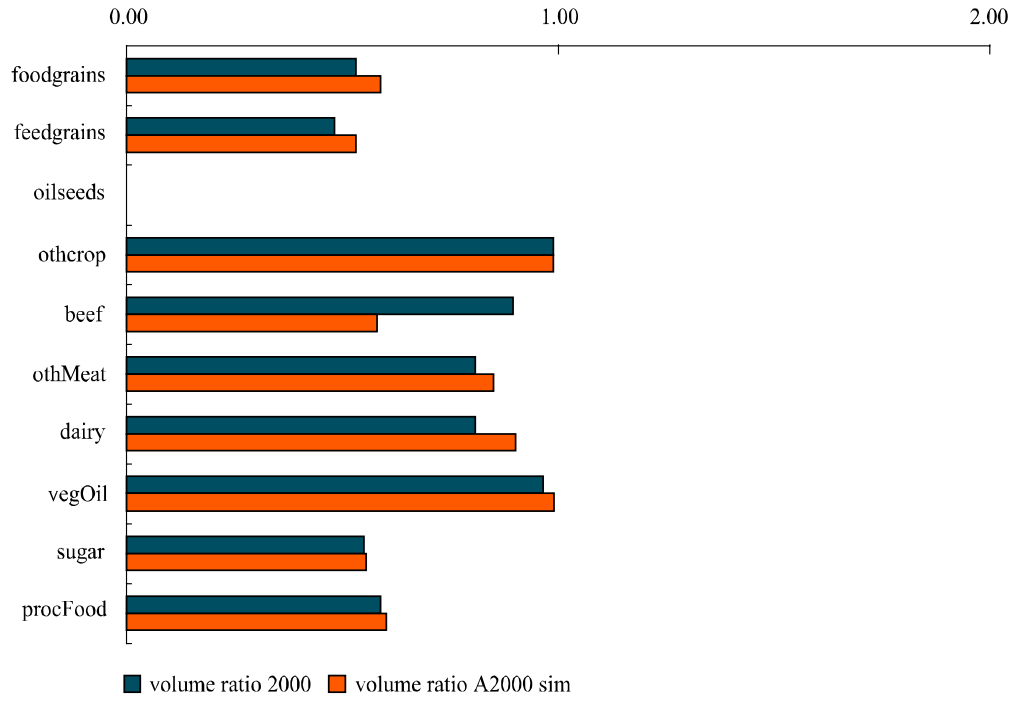

Figure 4.7 Simulated agenda 2000 effects: EU export volume bounds
Source: WTO notifications, author's calculations.

It is seen that the Agenda 2000 effect on EU export volumes is actually positive for most products except for oilseeds, Cattle and Beef. The negative export growth in cattle and beef corresponds straightforwardly to the intuition outlined in section 4.3.1: the decline in internal prices stimulates domestic consumption, which reduces EU's export supply. For food- and feedgrains the exports increase because of output increases.

Figure 4.6 and figure 4.7 show the estimated effects on the GATT export subsidy commitments, both in volume terms and in budget terms. These figures show the simulated change with respect to their year 2000 commitment levels. This reveals that the Agenda 2000 package is expected to almost eliminate the need for export subsidies in foodgrains, hence achieving one of the goals of this CAP reform. Substantial reduction is expected to occur for feedgrains and beef. In the dairy sector, export subsidies will remain on the agenda [1]. There is also some reason for concern in the Other Crop, Vegetable oil, Other Meat (mainly pig and poultry meat) and processed food products, since for these products the export subsidies commitments are

[1] It should be noted that the simulation exercise only assumed an increase in production quota for raw milk, and did not specify a fixed intervention price. This leads in the GTAP model to a simulated price change for raw milk of about -10%, or about 2/3 of the proposed decrease of EU intervention prices. This shows that the scheduled review of the EU dairy policy in 2003 is certainly worthwile.

binding. With respect to export volumes, no export subsidy commitment is binding. Except for beef, the influence of Agenda 2000 is that all products move closer to the 2000 commitments.

It is important to recognise an aggregation problem that is hunting almost all model exercises, and the present one is no exception. The movement from the commodity level (figures 4.2 and 4.3) to the more aggregate GTAP level can obscure bindings at a more disaggregated level.

Table 4.1 shows that Agenda 2000 has rather limited effects on producers outside the EU15. For crops, some limited negative output effects occur in those regions which directly compete with EU15 producers, that is North America and Australia-New Zealand, while also the regions that are geographically close to the EU, CEECs and Mediterranean countries are somewhat affected by the output expansion in the EU grains sectors. The contraction of the EU15 cattle/beef complex and the consequent drop of subsidised exports provides an incentive for non-EU producers to expand production, including producers in LDCs.

Table 4.2 illustrates the changes to the bilateral trade balance between the EU15 and other regions. For grains the bilateral trade balance for the other countries deteriorates and it improves for the EU [1]. Rather big improvements in the EU trade balance are observed for processed food products. As this sector benefits from the use of cheaper inputs through Agenda 2000, its domestic- and export prices are declining which in turns leads to a growth in exports. Observe that the deterioration of the bilateral agrifood trade balances with the EU is more than compensated by an improved trade balance in manufacturing and services.

Table 4.1 Output effects of A2000 (% change relative to 1995 base)

	EU15	NorthAm	AusNZL	CEEC	MED	LDC	MDC	ROW
Foodgrains	2.1	-0.6	-0.4	-0.4	-0.3	-0.1	-0.1	-0.1
Feedgrains	1.9	-0.1	-0.1	-0.3	-0.3	-0.1	-0.2	-0.2
Oilseeds	-0.6	0.1	-0.1	0.1	0	0	0	0
SugCB	0.5	0	-0.1	-0.1	-0.1	0	-0.1	0
Othcrop	0.2	0	-0.1	0	0	0	0	0
Rmilk	1.5	-0.2	-1.9	-0.2	-0.3	0	-0.3	-0.8
Cattle	-3	0.4	2.2	1.9	1	0.1	0.8	0.7
Othanprod	0.8	-0.2	-0.5	-0.5	-0.2	-0.1	-0.2	-0.2
Beef	-3	0.4	3.9	1.3	1.5	3.3	1.2	0.8
OthMeat	0.6	-0.1	-0.4	-0.5	-0.4	-0.2	-0.3	-0.1
Dairy	1.9	-0.3	-2.5	-1.1	-1	-1.1	-0.5	-1.1
VegOil	0.5	-0.1	-0.2	-0.4	-0.3	-0.1	-0.2	-0.2
Sugar	0.4	0	-0.2	-0.2	-0.1	0	-0.1	-0.1
ProcFood	0.5	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1

Source: Model calculations.

[1] As we have seen earlier, this leads to a high degree of price transmission in the EU grains sectors.

Table 4.2 Change in bilateral trade balance with EU15 (1995 USD mln.), Agenda 2000 simulation

	NorthAm	AusNZL	CEEC	MED	LDC	MDC	ROW
Foodgrains	-39	-1	-8	-54	-52	-22	-20
Feedgrains	-54	-1	-5	-24	-15	-20	-17
Oilseeds	31	0	3	2	3	16	3
Othcrop	1	0	2	1	4	-1	1
Cattle	25	1	38	53	0	3	18
Othanprod	-23	-69	-15	-31	-34	-42	-70
Beef	117	260	51	129	59	495	205
OthMeat	-17	-8	-41	-17	-18	-38	-83
Dairy	-57	-42	-24	-75	-35	-104	-173
VegOil	-10	-1	-3	-19	-31	-27	-14
Sugar	0	0	-1	-5	-5	-3	-3
ProcFood	-173	-19	-50	-67	-84	-229	-295
Manu	569	31	137	247	255	325	796
Svces	178	4	11	42	26	56	128
Total	547	155	95	183	73	409	476
Trade balance with EU (initial situation)							
Agrifood	2,393	2,499	-1,375	-4,921	8,707	15,362	-11,428
Total	5,660	-10,709	-11,536	-30,559	19,128	-17,187	-898
Value of exports (initial situation, excl. intra trade)							
Agrifood	62,202	20,477	6,406	8,090	37,056	70,795	18,767
Total	616,957	71,021	94,038	212,753	358,247	551,351	823,181

Source: Model calculations.

4.5.2 What if? Production-neutral reduction of set-aside in cereals

The unexpected positive output growth effect in the grains sector indicates that the increase in area payments and/or the reduction of area set-aside are too high in relation to the reduction of the intervention price. The height of the set-aside rate that keeps the production of food- and feedgrains constant can be obtained by a simulation where food- and feedgrain production is exogenously kept at pre-Agenda 2000 levels. It turns out that the reduction in the set aside rate that keeps grain production constant is equal to 2% for foodgrains and 3.5% for feedgrains, and therefore lower that the 5% reduction of Agenda 2000. In this case, the market price drop is less than in the previous simulations, because the excess supply on the EU15 market (and consequently net-exports) is reduced: a 15% reduction in the intervention price leads to a decrease of the market price by only 9.6% in foodgrains and 10.1% in feedgrains. The adverse effects on the cattle/beef complex are aggregated though, due to a smaller decline in input cost (feedgrain prices) as compared to the Agenda 2000 simulation. The compensation scheme for

the grains sector under Agenda 2000 therefore generates indirect benefits to the cattle/beef complex.

4.5.3 What if? Agenda 2000 under lower cereals a world prices

Simulated effects on export subsidies are contingent on assumptions on world price developments. Since the base year 1995 witnessed high international cereal prices, the export subsidy commitment was not constraining the CAP. However, low world market prices (as in 1998/99) immediately put upward pressure on the export subsidy budget, even if the Agenda 2000 package had been implemented. This is illustrated by conducting another experiment where, a bumper cereals harvest in North America is simulated to occur, which leads to a drop in world prices. It is assumed here that North American output of food- and feedgrains increases by 10% due to favourable conditions that affect total factor productivity.

The EU is assumed to implement Agenda 2000, maintains its intervention price levels, and keeps a variable export subsidy to bridge the gap between world prices and domestic intervention prices. It is seen from table 4.1 that a bumper harvest in North America limits the reduction of the export subsidy budget that was achieved under Agenda 2000. For feedgrains the reduction in export subsidy budget is only 17% with a bumper harvest and agenda 2000, while it was 27% with the default Agenda 2000 assumptions. For foodgrains the reduction diminishes from 96 to 69%. If there is a bumper harvest, when only 75% of the price cuts of Agenda 2000 have been effected, then there is only 9% reduction in the export subsidy budget for feedgrains, but still 43% reduction in the export subsidy budget for foodgrains. Although the drop in world cereal prices following the favourable harvest is of the same magnitude in both cases, the additional budget burden for the EU is higher if the price reductions of Agenda 2000 have not been fully implemented.

Also note that the EU's policy of equal intervention prices for food- and feedgrains implies a higher export subsidy for feedgrains, as there is a positive price differential between the two on international markets. These simulations show that situations on the world market strongly influences the export subsidy budget of the EU and therefore whether or not the export subsidy constraints may become binding. Figure 4.8 below reveals another interesting feature of the CAP and Agenda 2000. Cereals output in third countries is very negatively affected by the world price drop that follows the increased supplies from North America. The EU15 appears to be less hurt by this, which is a consequence of the limited transmission of world market signals to the EU15 markets. Even under Agenda 2000, the EU15 is rather effectively isolating itself from world market influences.

Table 4.3 Changes relative to 1995 base (%) under alternative scenarios

		Foodgrains	Feedgrains
Full Agenda 2000	World price index (f.o.b. weights)	-1	-1
	Export subsidy budget	-96	-27
	Export volume	11	10
	Change of export subsidy rate a)	-12	-14
	(new ad valorem % rate)	(0.5)	(30)
Bumper harvest North America after full implementation of Agenda 2000	World price index (f.o.b. weights)	-7	-10
	Export subsidy budget	-69	-17
	Export volume	7	5
	Change of export subsidy rate a)	-9	-6
	(new ad valorem % rate)	(4)	(39)
Bumper harvest North America after 75% implementation of Agenda 2000	World price index	-7	-10
	Export subsidy budget	-43	-9
	Export volume	5	3
	Change of export subsidy rate a)	-5	-1
	(new ad valorem % rate)	(7)	(43)

a) This is the ordinary change of the ad-valorem subsidy rate in percentage points
Source: Model calculations.

4.6 Concluding remarks

Agenda 2000 is a small step, which is mainly directed towards alleviating future problems with regard to EU enlargement and fulfilment of existing URAA commitments. At the same time, Agenda 2000 sets the stage for the imminent WTO negotiations.

As far as international trade is concerned, the main effects of Agenda 2000 are expected to occur in those markets where EU exporters face international competition from its main competitors, i.e. North American Grains and Beef, Dairy and Beef from Australia and New Zealand. As far as export competition is concerned, this paper shows that the Agenda 2000 package certainly continues the move in the direction of further liberalisation, with EU and world prices of main export products moving closer towards each other. This paper also shows that there is reason to temper the optimism. Even with the full Agenda 2000 implemented, the successful reduction of export subsidies depends crucially on world market developments.

The multi-sector, multi-region modelling approach employed in this paper highlights the importance of taking into account world market linkages, even for a modest reform as Agenda 2000. The incorporation of price insulation, the *sine qua non* of the CAP, into the standard GTAP framework is an important methodological contribution of this paper. Without a proper treatment of price insulation (through intervention floor prices and variable import tariffs and export subsidies) the EU market and world market effects of Agenda 2000 can only be imperfectly captured. Without fixed intervention (floor) prices incorporated into the modelling exercise, price effects will be underestimated, especially in a constant returns GE framework.

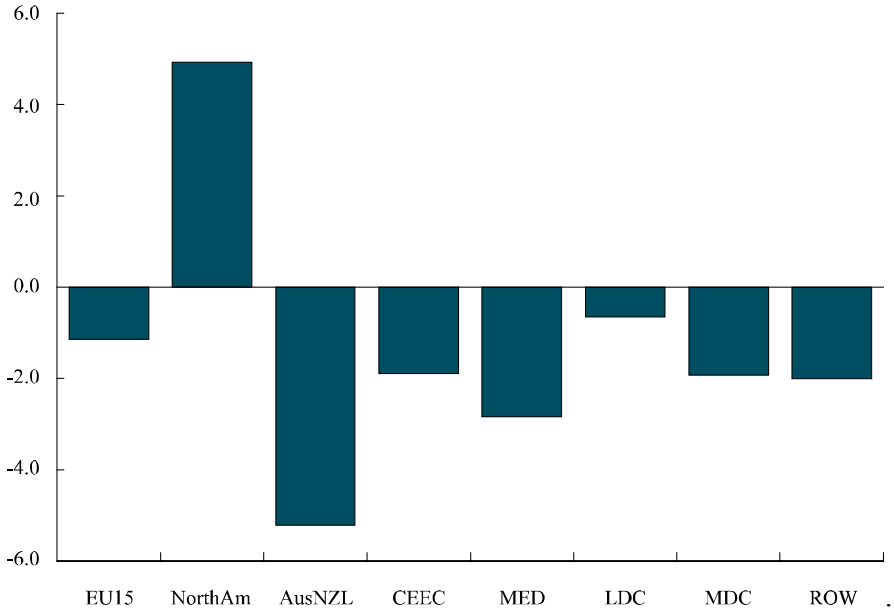

Figure 4.8 Simulated effects of bumper harvest in cereals in North America: Output effects for cereals (% change relative to 1995 base)
Source: Model calculations.

The framework employed here already incorporates some of the instruments that EU policy makers are able to manipulate: floor prices, compensation payments and land set-aside. A fruitful area for future research will be the modelling of endogenous bindings of export subsidy constraints, which may lead to policy adjustments in 4 areas: a) formation of intervention stocks, b) lowering intervention prices, c) measures affecting production, such as production control (quota, set-aside) and reduction of input subsidies, and finally d) abolition of domestic price insulation. Even without endogenous bindings, the incorporation of intervention stocks (a) is certainly a relevant exercise, as this is an additional policy instrument available to the EU. However, this is more relevant if the model is cast in a dynamic setting, which would also allow for phasing of the policy package.

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Appendix 4

The 18 sectors are:

1	Foodgrains	and Wheat and Rice
2	Feedgrains	and Feedgrains
3	Oilseeds	and Oilseeds
4	SugCB	and Sugar cane, sugar beet
5	O thcrop	and Other crops
6	Rmilk	and Raw milk
7	Cattle	and Cattle
8	Othanprod	and Other animal products
9	Beef	and Beef
10	OthMeat	and Other meat
11	Dairy	and dairy products
12	VegOil	and vegetable oils and fats
13	Sugar	and Sugar
14	ProcFood	and Processed food
15	Extract	and Natural res and extraction
16	Tex	and Textiles and wearing
17	Manu	and Manufacturing
18	Svces	and Services

Original GTAP v4 sector		New sector
pdr	Paddy rice	and Foodgrains
wht	Wheat	and Foodgrains
gro	Cereal grains nec	and Feedgrains
v_f	Vegetables, fruit, nuts	and Othcrop
osd	Oil seeds	and Oilseeds
c_b	Sugar cane, sugar beet	and SugCB
pfb	Plant-based fibers	and Othcrop
ocr	Crops nec	and Othcrop
ctl	Bovine cattle, sheep and goats	and Cattle
oap	Animal products nec	and Othanprod
rmk	Raw milk	and Rmilk
wol	Wool silk-worm cocoons	and Othanprod
for	Forestry	and Extract
fsh	Fishing	and Extract
col	Coal	and Extract
oil	Oil	and Extract
gas	Gas	and Extract
omn	Minerals nec	and Extract
cmt	Bovine cattle, sheep and goat	and Beef
omt	Meat products nec	and OthMeat
vol	Vegetable oils and fats	and VegOil
mil	Dairy products	and Dairy

pcr	Processed rice	and ProcFood
sgr	Sugar	and Sugar
ofd	Food products nec	and ProcFood
b_t	Beverages and tobacco products	and ProcFood
tex	Textiles	and Tex
wap	Wearing apparel	and Tex
lea	Leather products	and Tex
lum	Wood products	and Manu
ppp	Paper products, publishing	and Manu
p_c	Petroleum, coal products	and Manu
crp	Chemical, rubber, plastic prod	and Manu
nmm	Mineral products nec	and Manu
i_s	Ferrous metals	and Manu
nfm	Metals nec	and Manu
fmp	Metal products	and Manu
mvh	Motor vehicles and parts	and Manu
otn	Transport equipment nec	and Manu
ele	Electronic equipment	and Manu
ome	Machinery and equipment nec	and Manu
omf	Manufactures nec	and Manu
ely	Electricity	and Manu
gdt	Gas manufacture, distribution	and Manu
wtr	Water	and Manu
cns	Construction	and Manu
t_t	Trade, transport	and Svces
osp	Financial, business, recreatio	and Svces
osg	Public admin and defence, educ	and Svces
dwe	Dwellings	and Svces

The regional aggreagtion attempts to distinguish the main trading partners of the EU and major developing regions. The 8 regions are:

No.	String	
1	EU15	EU15
2	NorthAm	USA and Canada
3	AusNZL	Australia and New Zealand
4	CEEC	Central and East European Countries
5	MED	Mediterranean
6	LDC	Less developed countries
7	MDC	Middle develop countries
8	ROW	

Original GTAP v4 region		new region
AUS	Australia	and AusNZL
NZL	New Zealand	and AusNZL
JPN	Japan	and ROW
KOR	Republic of Korea	and MDC
IDN	Indonesia	and LDC
MYS	Malaysia	and MDC
PHL	Philippines	and MDC

SGP	Singapore	and ROW
THA	Thailand	and MDC
VNM	Vietnam	and LDC
CHN	China	and LDC
HKG	Hong Kong	and ROW
TWN	Taiwan	and MDC
IND	India	and LDC
LKA	Sri Lanka	and LDC
RAS	Rest of South Asia	and LDC
CAN	Canada	and NorthAm
USA	United States of America	and NorthAm
MEX	Mexico	and NorthAm
CAM	Central America and Caribbean	and MDC
VEN	Venezuela	and MDC
COL	Colombia	and MDC
RAP	Rest of Andean Pact	and MDC
ARG	Argentina	and MDC
BRA	Brazil	and MDC
CHL	Chile	and MDC
URY	Uruguay	and MDC
RSM	Rest of South America	and MDC
GBR	United Kingdom	and EU15
DEU	Germany	and EU15
DNK	Denmark	and EU15
SWE	Sweden	and EU15
FIN	Finland	and EU15
REU	Rest of European Union	and EU15
EFT	European Free Trade Area	and ROW
CEA	Central European Associates	and CEEC
FSU	Former Soviet Union	and ROW
TUR	Turkey	and MED
RME	Rest of Middle East	and MED
MAR	Morocco	and MED
RNF	Rest of North Africa	and MED
SAF	South African Customs Union	and MDC
RSA	Rest of Southern Africa	and LDC
RSS	Rest of Sub Saharan Africa	and LDC
ROW	Rest of World	and ROW

5. Effects of a unilateral or harmonised tax on fertiliser and pesticide use in EU agriculture

Martina Brockmeier, Josef Efken, Claudia Herok and Frank van Tongeren

5.1 Introduction [1]

Within the last two decades a major shift in public perception of fertilisers and pesticides used in agriculture has taken place. Whereas the 'green revolution' has put emphasise on higher yields and lower unit costs due to chemical use in agriculture, public debate in most industrialised countries nowadays focuses on environmental and health risks which might be related to the application of these two inputs. Consequently, some industrialised countries moved a step further and introduced institutional restriction on chemical use in agriculture. To this group of countries belong some member countries of the European Union (EU) as well. Does a national restriction on chemical use in agriculture make sense within a Customs Union or does this only produce some kind of leakage effect between member countries?

To answer this question correctly, it is necessary to calculate the benefits and risks of fertilisers and pesticides used in agriculture on a global or regional basis. However, this is a very comprehensive and difficult task which certainly goes beyond the scope of a so called minor application. Nevertheless, the objective of the paper is to show how the multi-regional general equilibrium model GTAP (Global Trade Analysis Project) can be adopted to make a first step towards the analysis of restricted chemical use in agriculture. For this reason, we firstly discuss measures and policies related to chemical use in EU agriculture (section 5.2). Subsequently, section 5.3 presents a brief overview discussing the quantitative analysis which can be found in the literature. Furthermore section 5.3 shortly introduces the standard GTAP model, explains how the tax instruments can be implemented and what kind of extensions are made to enable an analysis of restricted use of chemical agricultural inputs. In section 5.4 the simulations are presented and results are discussed. The final section summarises the main findings and gives some qualifications of the analysis.

5.2 Restriction on chemical use in agriculture in the EU

Chemical inputs in agriculture are mainly pesticides and fertiliser. Pesticides or plant protection agents (PPA) are utilised to protect the plants against different parasites and diseases. They are divided into four main groups namely insecticides, fungicides, herbicides, and plant

[1] The authors would like to thank Cornelia NÖTH and Rainer KLEPPER for their useful comments and support. The usual caveats apply.

growth regulators. Fertilisers mostly contain nitrogen, phosphorus, potash and lime (N, P, K, Ca). PPA, but in some extent also fertilisers can eventually harm the environment and/or humans [1]. An intensive use can have a negative impact like the pollution of ground and surface water, the loss of species and the contamination of food. Both, the risks regarding the user of agricultural chemicals and the adverse environmental and food safety effects have let to a demand for regulations in most industrialised countries. Governments have therefore put into practice regulations with regard to production, marketing, and use of chemical inputs in agriculture. These PPA and fertiliser policies mostly consist of two simultaneously applied strategies (see footnote 1):

- firstly, PPA and fertilisers have to undergo detailed checks and resultant rules for usage of PPA and fertiliser have to ensure that the correct application does not have negative effects on the environment with exception of the desired effect;
- due to inappropriate application of chemical inputs the farmers represents themselves a possible source of environmental hazards. Therefore, an intensive consulting and training system (e.g. Codes of Practice for the Safe Use of Pesticides) exists which protects the user as well as the environment against harm due to misuse.

Accordingly, the use of controlled products by trained farmers should ensure that no threat to the environment can occur. However, there are critics of this double-strategy who despite education and training believe the farmer to be a factor of uncertainty and hence the reason for too high dosages of chemical inputs. As a result some countries introduced additional non-fiscal policy instruments (see figure 5.1).

Limits related to ...	
area	where nutrients can be applied
amount	of manure, fertiliser and mineral N
surpluses	of N and P
number	of livestock units per ha;
timing	of manure and fertiliser application
methods	of manure and fertiliser application
methods	of manure storage
duration	of manure storage
method	of soil cultivation and land use changes
growth	of catch crops and green covers in winter

Figure 5.1 Measures in EU member countries that aim at a decrease of nutrient losses in agriculture
Source: Oenema, Chardon and Ehlert: Nutrient Management Strategies Across European Agriculture (http://www.asa-cssa-sssa.org/branch/ne/oenemapaper99. html).

[1] COUNCIL OF THE EUROPEAN COMMUNITIES (2000) 'Whereas one of the most important ways of protecting plants and plant products and of improving agricultural production is to use plant protection products; Whereas these plant protection products can have non-beneficial effects upon plant production; whereas their use may involve risks and hazards for humans, animals and the environment, especially if placed on the market without having been officially tested and authorized and if incorrectly used; 'Council Directive of 15 July 1991 concerning the placing of plant protection products on the market (91/414/EEC) http://europa.eu.int/eur-lex/en/lif/dat/1991/en_391L0414.html

Germany for example implemented a law that obliges farmers to set up a balance of the main nutrients (input-output book-keeping system) which is supposed to guarantee that this balance will not permanently be unequal.

A similar but more strict input-output system exists in the Netherlands (Dutch Ministry of Agriculture, Nature Management and Fisheries, 2000). Besides, thresholds controlling the maximum quantity of livestock farmers could have per hectare are implemented in Germany and on a regional level also in the Netherlands.

Denmark:	Tax on pesticides in order to reduce pesticide use; Different levels between product groups
Belgium:	Tax on specific pesticides
Sweden:	Tax on biocides and fertiliser incl. special cadmium tax
Finland:	Tax on pesticides
Netherlands:	Tax on nutrient surpluses if they exceed a levy-free surplus

Figure 5.2 Taxes on Agricultural Inputs in the European Union Member States
Source: European Commission, Database on environmental taxes in the European Union Member States plus Norway and Switzerland (http://europa.eu.int/comm/environment/enveco/env_database/database.htm).

In addition to these measures, tax instruments are discussed to internalise the negative externality of chemical inputs in agriculture and hence to achieve a reduction in the use of fertiliser and pesticides. Figure 5.2 presents an overview of taxes on chemical inputs in agriculture of different EU member countries. It clearly shows that taxes on chemical use in agriculture are implemented only in some EU member countries while others do not put a limit on its use at all.

Is it efficient to implement measures and policies related to the use of chemical inputs in agriculture at different levels in the single EU member countries? It seems to be interesting to evaluate this issue further. For this reason we first take a closer look to the analysis of this problem in the literature.

5.3 Adoption of the Standard GTAP Model

5.3.1 Literature on the Economic Effects of Restrictive Use of Chemicals in Agriculture

The international literature only presents a few studies on the impact of restricted use of chemicals in agriculture. The micro-level literature arising in the late 1960s mostly deals with new developments in integrated pest management. Here, farm cost effectiveness of alternative pest management strategies and the issues related to market performance, pesticides resistance and the risk and uncertainties of pesticide use on a farm level are the main topics (Lichtenberg et al. 1990). In contrast to that, the macro-level literature of the early 1980s was initiated by the advances in the science of toxicology as well as institutional change. Due to improved

technological test procedures many pesticide residues with adverse effects on health were detected that were considered to be negligible at the initial time of registration. In the US, the macro-level literature on the one hand deals with problems of registration and a special review of pesticides used in agriculture by the US Environmental Protection agency. On the other hand, the US macro level literature focuses on the procedure [1] a pesticide must go through before registration and on the consequences of a given pesticide cancellation (Michalek, 1994, pp. 2-3).

In Europe, a number of macro-level studies emerged when institutional restriction on the use of pesticides were about to be introduced. However, compared to the relatively large amount of US literature, only a very few studies were found relating the macro level effect of certain pesticide cancellation, registration or total ban. An overview of the studies using different kind of models to quantify the impacts of restricted chemical use in agriculture can be found in Hartmann and Schmitz (1992) and Michalek and Hanf (1993). National general equilibrium models are frequently applied to analyze this issue (e.g. Komen, Oskam and Peerlings, 1997; Frandsen and Jacobsen, 1999). Only a few studies concentrate on measures described in table one, whereas all of the studies deal with the implication of taxes on fertiliser and pesticides. However, no application on the basis of a multi-regional general equilibrium model is found in the literature. In the following it is discussed how GTAP can accommodate the analysis of a restricted use of chemicals in agriculture. We start with a brief description of the standard GTAP model and the production structure and will than focus on the implementation of taxes on fertilisers and pesticides in the GTAP model.

5.3.2 Standard GTAP Model

The quantitative analyses in this paper is based on the GTAP model. GTAP is a comparative-static [2] standard multi-regional model that provides an elaborate representation of the economy including the linkages between farming, agribusiness, industrial and service sectors of the economy. Trade is represented by bilateral trade matrices based on the Armington assumption. The GTAP model is innovative in its treatment of private household preferences, implemented via the non-homothetic constant difference of elasticity (CDE) functional form, the explicit treatment of international trade and transport margins, and a global banking sector which links global savings and consumption. Further assumptions of the standard model are perfect competition in all markets as well as a profit and utility maximising behaviour of producers and consumers. The framework of the standard GTAP model is documented in the GTAP book (Hertel, 1997) and available on the internet.

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[1] As in most industrialized countries, this procedure involves a calculation of benefits and cost. The pesticide is registered if the calculated benefit outweighs the risk caused to the environment and human health (compare also chapter 2).

[2] Most recent developments in the Global Trade Analysis Project include a dynamic version of the model. For further information see http://www.gtap.org

On the production side the model has a so-called 'nested structure' (see figure 5.3). It is assumed that producers on one side decide at the boarder on the source of the intermediate inputs to be used in the production process. Once this decision is made, the imported input is combined with the domestic intermediate input to form a so called composite commodity. On the other side, the producer merge different kind of factors to constitute the value added commodity. Finally the producer combines value added and the composite commodity to produce the output of a certain commodity. The theoretical framework also includes a zero profit condition leading to constant return of scales.

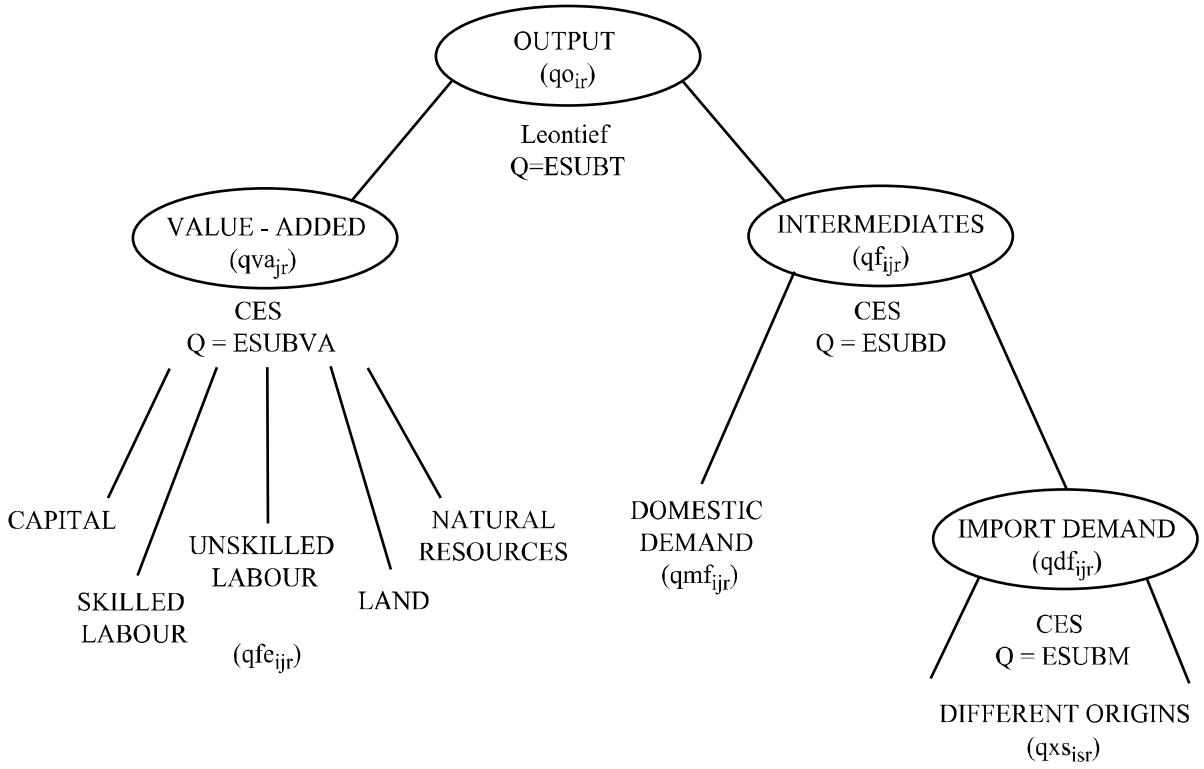

Figure 5.3 Production structure of the standard GTAP model

Figure 5.3 also gives some information on the functional forms used in the standard GTAP model. It can be seen that in most places a CES functional form is used. The only exception is given at the top level of the production tree. Here, value added and the composite intermediate are combined with the help of a Leontief functional form which implies that these two components of the production process can only be combined in fixed proportions. Under these circumstances a tax on chemicals used in agriculture would not result in a substitution between factors and intermediates, but only in a decrease of agricultural output. It seems to be

clear that the production structure of the standard GTAP model needs to be adopted to accommodate substitution possibilities between factors and intermediates. Before this procedure is explained in more detail we first turn to the GTAP database to see how fertiliser and pesticides are represented.

5.3.3 Pesticides and fertiliser in GTAP

In the GTAP database fertiliser and pesticides are combined with other chemical products in one sector called chemical, rubber and plastic products. The first choice for the analysis in this paper would be the implementation of a separate tax on fertiliser and pesticides. However, this would require a disaggregation of the GTAP database (version 4) [1] and/or a supplement national or regional general equilibrium model [2] which goes beyond the scope of this paper. We therefore decided to implement a tax on chemical use in agriculture in a somewhat ad hoc manner using the existing GTAP database. Starting point is the value of domestic commodity *i* purchased by sector *j* in region *r* evaluated at agents' prices ($VDFA_{ijr}$) and the value of imported commodity *i* purchased by sector *j* in region *r* evaluated at agents' prices ($VIFA_{ijr}$) of the GTAP database. Based on the assumption that all value flows from the chemical sector to the agricultural sectors only consist of fertiliser and pesticides, we are able to at least identify chemicals used in agriculture (compare table 5.1 which shows the value of $VDFA_{ijr}$ as an example).

Table 5.1 Value of domestic commodity i purchased by sector j evaluated at agents' prices in Denmark

	Grains	Oilseed	Sugar cane and beet	Other crops	Raw milk	...
Grains	163.8	0	0	0	27.8	...
Oilseed	0	18.2	0	0	0.1	...
Sugar cane and beet	0	0	6.1	0	2.6	...
Other crops	0	0	0	165.9	3.7	...
Raw milk	0	0	0	0	803.2	...
...	...	...	...	...	...	...
Chemicals	91.7	7.6	4	33	52.5	...
...	...	...	...	...	...	...

[1] The newest version of the GTAP database is version 5. Although version 5 of the GTAP database is more disaggregated than version 4, it does also not differentiate between fertiliser, pesticides and other chemicals.

[2] Within a two year project KO and SCHMITZ (forthcoming) disaggregated the GTAP database to differentiate between fertiliser, pesticides and other chemicals and supplemented the GTAP model by a national general equilibrium model.

The GTAP database also includes the value of domestic commodity *i* purchased by sector *j* in region *r* evaluated at market prices ($VDFM_{ijr}$) and the value of imported commodity *i* purchased by sector *j* in region *r* evaluated at market prices. Every difference between these two values are due to governmental intervention and represented in the variables $TFD_{ijr} = VDFA_{ijr}/VDFM_{ijr}$ and $TFM_{ijr} = VIFA_{ijr}/VIFM_{ijr}$. These tax instrument will be used in the simulations for the implementation of a tax on chemicals used in agriculture.

5.3.4 Extension of the standard GTAP model

In the simulation it is assumed that a decrease in the use of chemicals can be partially substituted by an increase in labour. This necessitates an expansion of the standard production structure in the GTAP model. Here, we introduce an additional nest (see figure 5.4) which allows for new substitution possibilities between unskilled labour and chemicals.

On the basis of this new production structure, the producer firstly decides again at the boarder where to buy the imported intermediate input. As before, these imported intermediates are then combined with domestic production to build the composite commodity. The chemical composite commodity, however, is firstly put together with unskilled labour before this combination enters the value added nest. Finally, the non-chemicals and the enlarged value added composite form the output based on a CES functional form.

5.4 Simulations

5.4.1 Aggregation of the GTAP Database

In the simulations version 4 of the GTAP database is used that allows a maximum aggregation of 45 regions and 50 sectors. The model aggregation used in this paper covers 10 regions with 14 sectors and highlights those agricultural sectors which apply fertiliser and pesticides (compare figure 5.5).

5.4.2 Additional elasticities

According to the adopted production structure it is necessary to supplement the database with additional elasticity's for ESUBT, ESUBCL and ESUBCLI. These elasticities are responsible for the substitution possibilities within the new nest. We also relax the strong assumption implied by the Leontief functional form of the standard GTAP model at the top level of the production tree (compare figure 5.4).

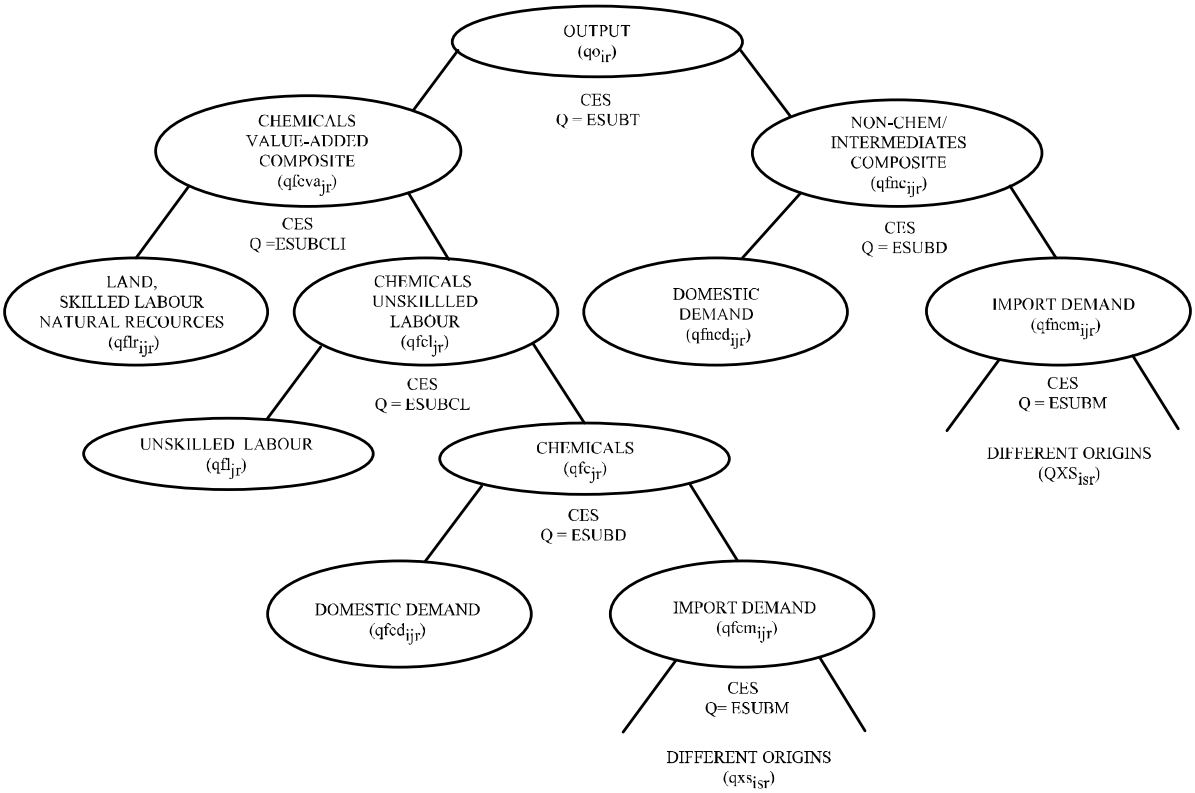

Figure 5.4 Adopted production structure

Here, a CES functional form is used that requires additional values as well. It would be desirable to estimate these parameters econometrically as they are crucial for the simulations. However, for this demonstrative application it would be too much of an effort, so that we adopted the values from the literature (compare table 5.2). For the substitution elasticity's at the top level of the production tree we choose a value of 0.1 for all commodities.

Regions	Sectors
Denmark	Grains
Finland	paddy rice, wheat, cereal grains nec
Germany	Oilseeds
Great Britain	Sugar Crops
Sweden	Other Crops
Rest of the EU 15	vegetables, fruits, nuts,
Cairns Group	plant-based fibers, crops nec
Australia, New Zealand, Indonesia, Malaysia, Philippines, Thailand, Argentina, Brazil, Chile, Colombia, Uruguay, South African Customs Union	Cattle
	Milk
	Other Animal Products
	bovine cattle, sheep and goats, horse meat products, meat products nec, wool, silk-worm cocoons, animal products nec
North America	Sugar
USA, Canada, Mexico	Other Food Products
Rest of South Asia	processed rice, vegetable oils and fats, food products nec,
Hong Kong, Singapore, Sri Lanka, Taiwan, Vietnam, Rest of South Asia	beverages and tobacco products
	Fishing
	Other Primaries
Rest of the World	forestry, coal, oil, gas, minerals nec
China, India, Japan, Korea, Venezuela, Central American and Caribbean, Rest of Andean Pact, Rest of South America, EFTA, Central European Associates, Former Soviet Union, Turkey, Morocco, Rest of North Africa, Rest of Southern Africa, Rest of Sub-Saharan Africa, Rest of the World	Chemicals
	Manufactures
	textiles, wearing apparel, leather products, wool products, paper products, publishing, petroleum, coal 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, gas manufacture, distribution, water, construction
	Services
	trade, transport, financial, business, recreational services
	public administration and defense, education, health, dwellings

Figure 5.5 Aggregation of the GTAP database (version 4)

5.4.3 Other specific data

Due to its specific relevance for the analysis of environmental taxes we have to take a deeper look into the 'chemicals' sector. As explained in section 5.3, the chemical sector includes fertiliser and pesticides used in agricultural production. For a separate evaluation of those two components additional information about the regional as well as sectoral distribution of pesticides and fertiliser is needed. These data were taken from other surveys and studies (EFMA (1997), Eurostat (1995), Jacob (2000) compare table A1.1-A1.4 in the appendix to this chapter).

Table 5.2 Additional elasticity's for the extended production structure

Elasticity of Substitution	Value
ESUBCL (all products except capital goods)	0.50
ESUBCL (capital goods)	0
ESUBCLI (all products except capital goods)	0.25
ESUBCLI (capital goods)	0

Source: Adopted from Frandsen and Jacobsen (1999).

5.4.4 Scenarios

The GTAP version 4 database does not provide information about taxes on fertiliser and pesticides, e.g. all values of TFD_{ijr} and TFM_{ijr} are equal to one. For this reason it is necessary to update the GTAP version 4 database somehow before running actual simulations. In doing this, the most recent information about taxes concerning the use of chemicals in the European Union is implemented. Here we used the OECD database on environmentally related taxes, fees and charges levied in OECD member countries. Information in this database has been provided by contact persons in the respective countries (e.g. ministries of finance and ministries of environment. The base year of this database is 1995, but there are estimates on environmentally related tax revenues for 1999 included as well (compare http://www.autoeval.com).

Table 5.3 Taxes on fertiliser and pesticides in the EU (power of the ad valorem tax)

	Pesticides	Fertiliser
Denmark	1.25 to 1.35	-
Finland	1.35	1.35
Sweden	1.40	-

Source: OECD database on environmentally related taxes (2000). http://www.autoeval.com.

This information is utilised in a preliminary simulation to update version 4 of the GTAP database [1]. The resulting updated data representing the most recent information on taxes on fertiliser and pesticides was than used as base data in the following simulations. According to

[1] Beside the information given in table 5.3, the database of the OECD also provides two other kind of data which could not be utilized for an update because the concerning countries are included in the composite region Rest of the EU 15. These are information on taxes imposed in the Netherlands beyond a certain minimum threshold of surplus nitrogen and phosphate and a tax on pesticide in Belgium.

the idea of a harmonisation of 'environmental' taxes across the EU and based on the existing tax rates four different scenarios were developed for the analysis:

- Scenario 1:
  Harmonisation of taxes on fertiliser and pesticides on the highest level ($TFD_{ijr} = TFM_{ijr} = 1.40$) in all member countries (SIM1)
- Scenario 2:
  Harmonisation of taxes on fertiliser and pesticides on a level that lies in-between ($TFD_{ijr} = TFM_{ijr} = 1.20$) in all member countries (SIM2)
- Scenario 3:
  Reduction of taxes on fertiliser and pesticides to the lowest level ($TFD_{ijr} = TFM_{ijr} = 1.00$) in all member countries (SIM3)
- Scenario 4:
  Harmonisation of taxes on fertiliser and pesticides ($TFD_{ijr} = TFM_{ijr} = 1.40$) in all Scandinavian countries of the EU (SIM4)

The results of these simulation will be presented in the following sections.

5.5 Results

5.5.1 Agricultural output

Figure 5.6 shows the percentage change of agricultural output of the EU as a whole. Due to the increase in taxes on chemicals in scenario 1 and 2 the agricultural producers in the EU, with the exception of some Scandinavian countries, face augmenting production costs. This leads to a decrease in agricultural output. The largest effect can be observed in the oilseeds sector with a decline of 5.8% in scenario 1 respectively 4.2% in scenario 2, followed by the production of grains and sugar. In scenario 3 slight increase of agricultural production can be observed, whereas the opposite is given for scenario 4.

This result is driven by the change of agricultural output in countries where the tax is increased due to the harmonisation. As an example figure 5.7 shows the change in agricultural output in Germany in all four simulations. Here, it can be seen, that the higher tax leads to a reduction of agricultural output in a similar range. Figure 5.8 shows the change in agricultural output in Sweden as an example for a country where the taxes on chemicals are decreased or stayed unchanged in simulation 1 to 3. It is more or less the mirror image of the effects given in figure 5.6. The more taxes on chemicals are decreased the more the Swedish agricultural output is increased. However, as the agricultural output of the Scandinavian countries is only small compared to the remaining part of the EU, agricultural output for the whole region in figure 5.6 shows a decrease.

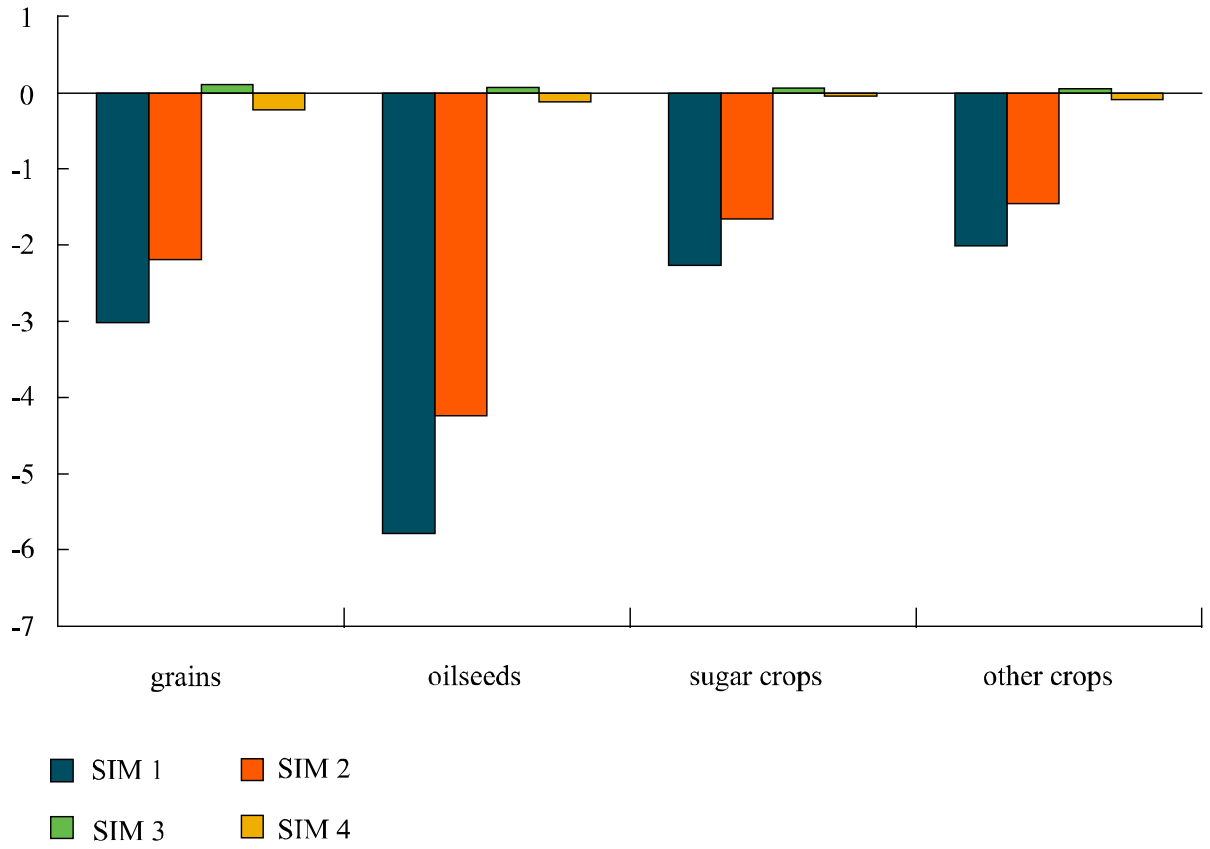

Figure 5.6 Change in agricultural output in the European Union (in %)

5.5.2 Change in volume of fertiliser and pesticides

Figure 5.9 presents the change in the volume of fertiliser and pesticides in the EU. The calculations of these changes are based on the assumption that the percentage change of chemical used in agriculture is equal for all fertiliser and pesticides [1]. It can clearly be seen that there is a significant reduction in nitrogen, phosphate, and potassium in scenario 1 and 2 which follows the decrease in agricultural production within the EU, though the use of unskilled labor is intensified in those countries which suffer from a higher tax on chemicals. In contrast to that the decrease in pesticides is more or less negligible.

[1] The total amount of nitrogen, phosphate, potassium and pesticides is multiplied by the percentage change of chemicals used in agriculture derived by the GTAP model.

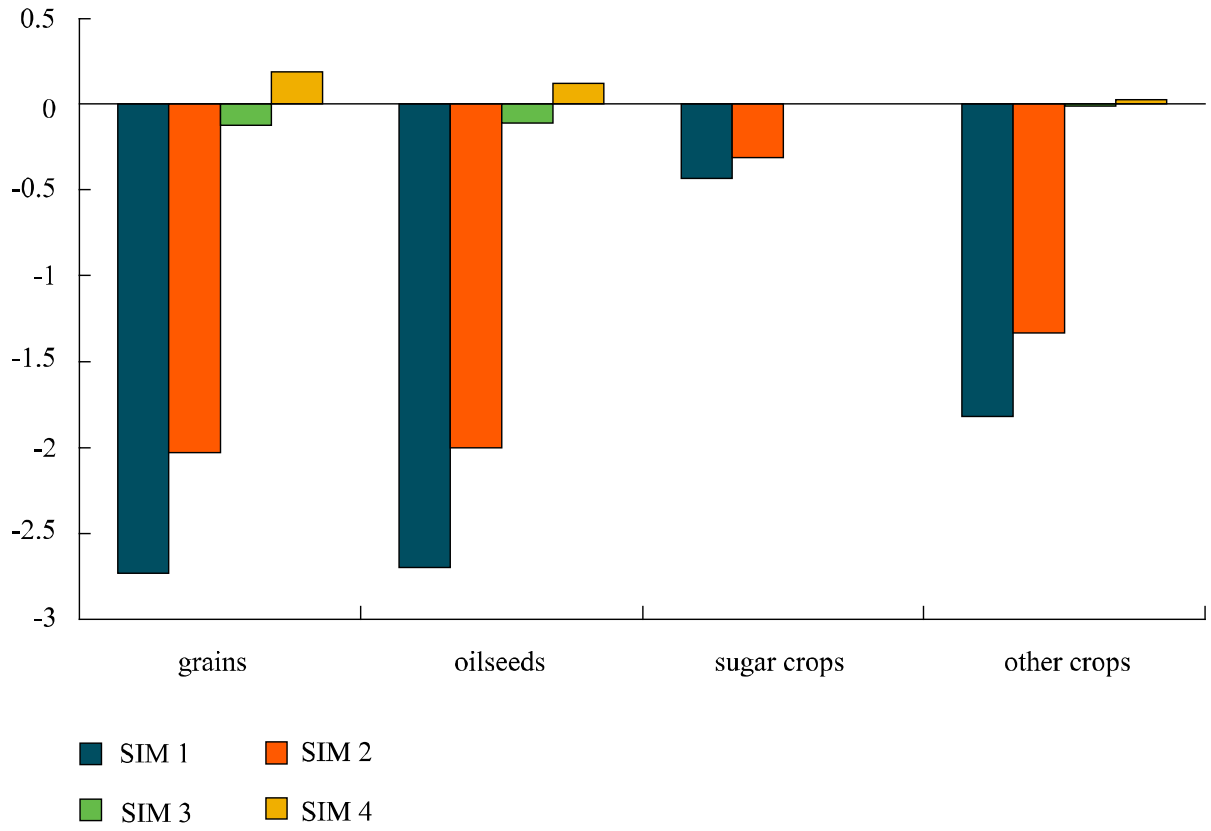

Figure 5.7 Change in agricultural output in Germany (in %)

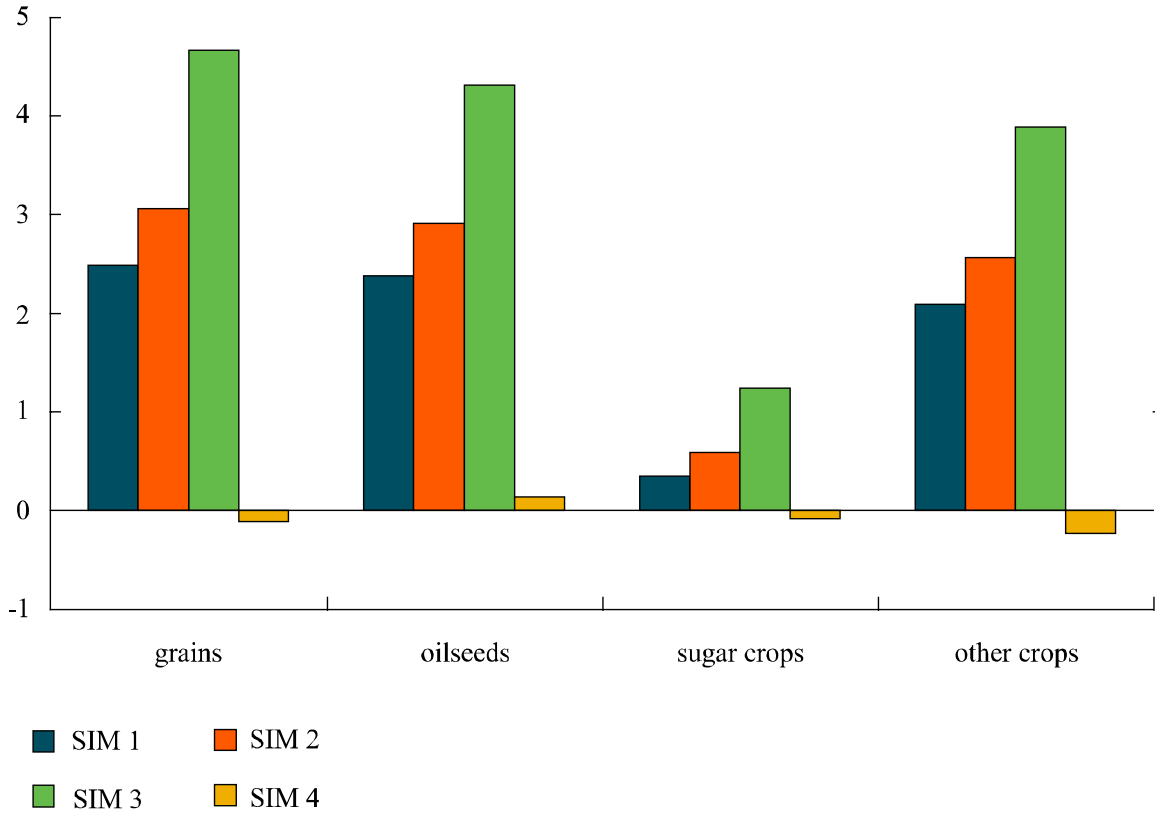

Figure 5.8 Change in agricultural output in Sweden (in %)

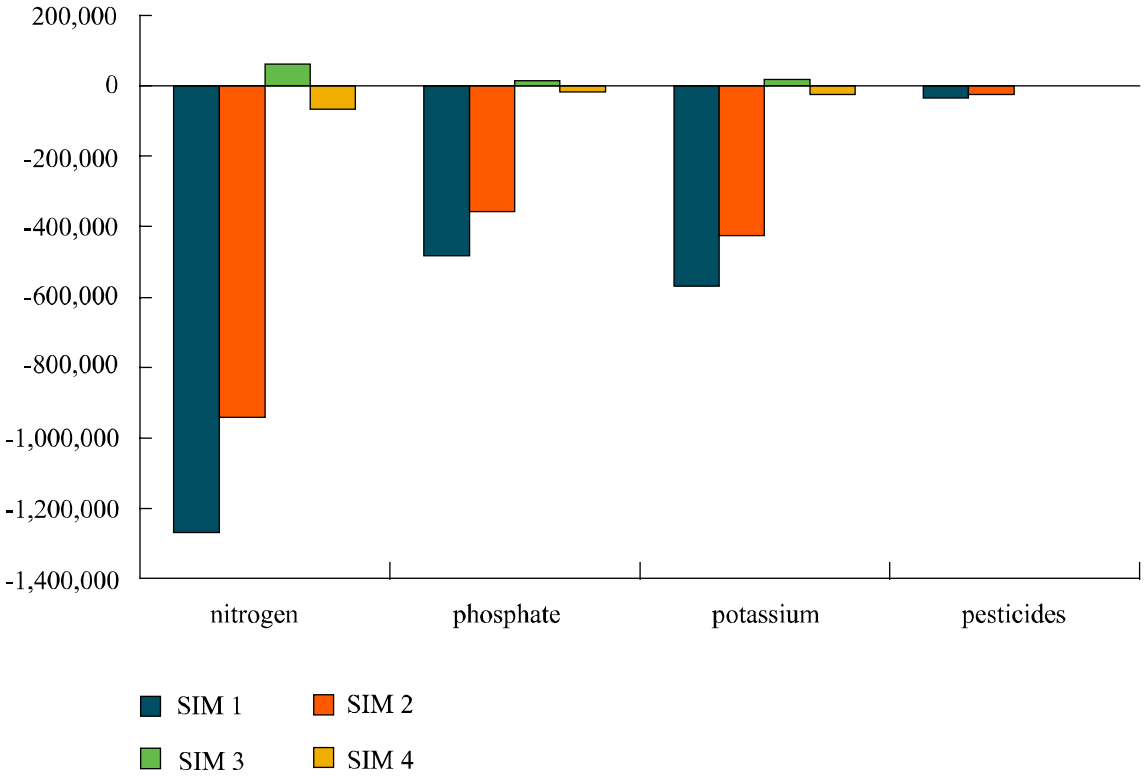

Figure 5.9 Change in volume of fertiliser and pesticides used in EU-15 countries (in t active ingredient)

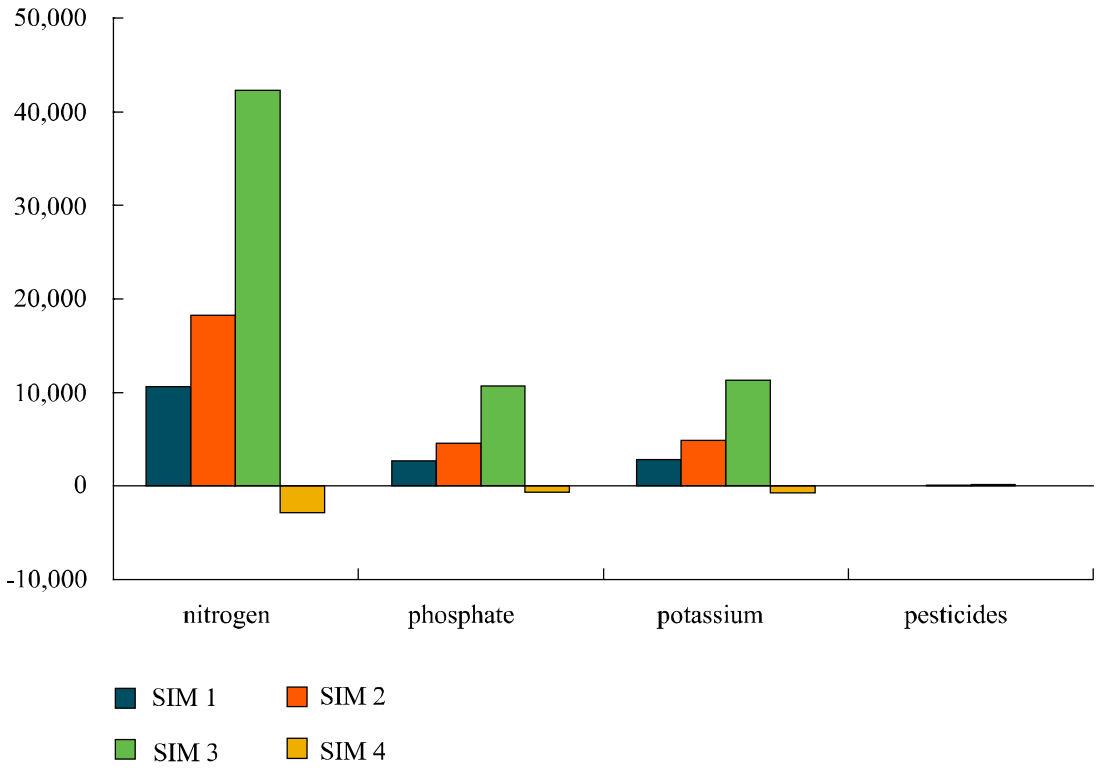

Figure 5.10 Change in volume of fertiliser and pesticides used in Sweden (in t active ingredient)

Figure 5.10 shows the change in the volume of fertiliser and pesticides of Sweden which is again a mirror image of the EU. The increase in the use of nitrogen, phosphate and potassium is the higher, the higher the reduction in tax on chemicals and the increase in agricultural production. The mirror image is given for those countries where an increase in tax on chemicals used in agriculture is given (not shown).

5.5.3 Trade effects

As an example for the main trend concerning trade figure 5.11 shows the change in the value of grain exports from Sweden to the other EU member countries. Similar results are obtained for oilseeds, sugar crops and other crops (not shown). It is obvious that the Swedish exports of crops to other EU member countries and the Rest of the World (ROW) mainly increase in the simulations where the tax on fertilisers and pesticides is increased in the importing countries (SIM 1 - SIM 3). At the same time the imports of grains from other EU member countries decreases (compare figure 5.12). Apparently, Sweden has a competitive advantage, when the tax on chemicals is extended in other member countries.

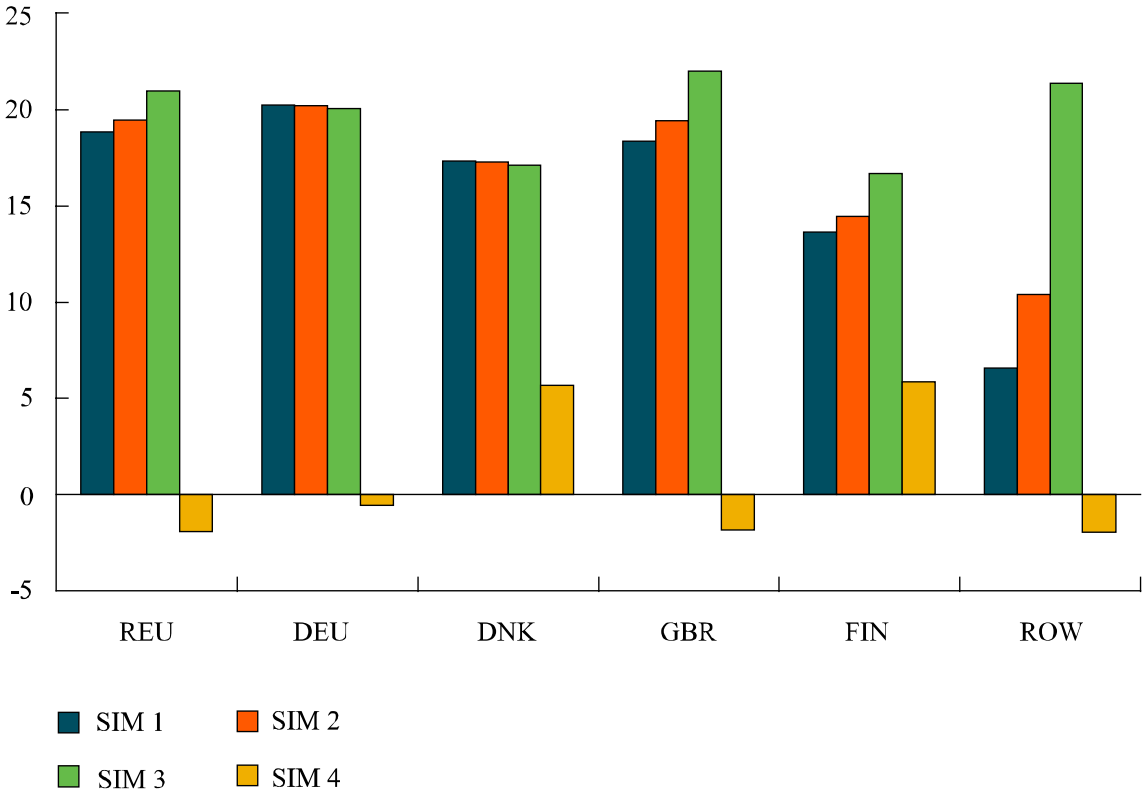

Figure 5.11 Change in the value of grain exports from Sweden (in %)

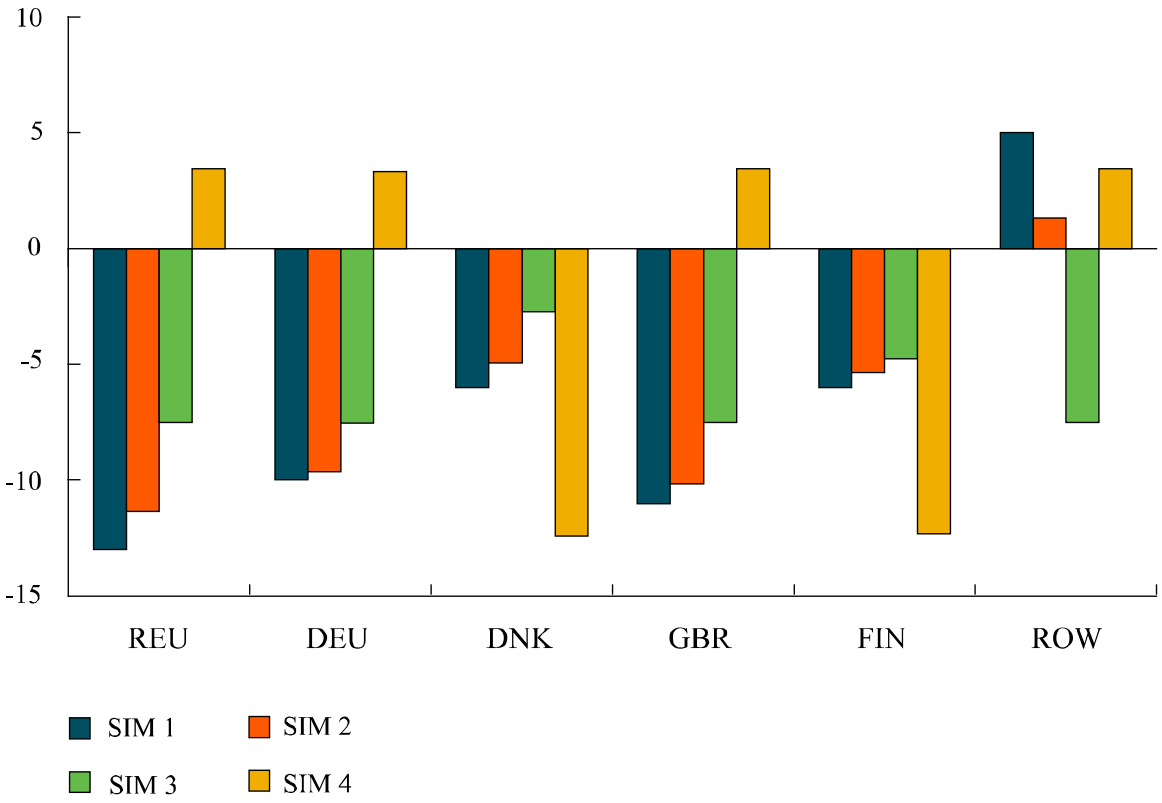

Figure 5.12 Change in the value of grain imports into Sweden (in %)

Figure 5.12 also shows that the increase of taxes on fertilisers and pesticides within a sub-region of the EU, namely Scandinavia, creates a leakage effect (SIM 4), as imports of crops from ROW and other member countries with the exception of Finland and Denmark are raised.

5.6 Conclusion

- The GTAP model is capable of assessing the effects of a tax on fertiliser and pesticides. However, it is necessary to greatly supplement the GTAP database both with data on fertiliser and pesticides as well as with information on tax related to chemicals used in agriculture.

- Taxes on fertiliser and pesticides do not effect the other sectors in the economy in EU member countries as well as the whole economy in third countries very much. With the use of a multi-regional general equilibrium model it can nevertheless be shown that a tax on fertiliser and pesticides within one country of a customs union creates some kind of leakage effect.
- The most critical aspect in the analysis is the aggregation of the GTAP database for fertiliser and pesticides. To get more reliable results it would be most desirable to disaggregate the sector called 'chemicals' into sub-sectors for all regions of the GTAP database or to have more reliable input shares for fertiliser and pesticides. This way, the taxes on fertiliser and pesticides could be implemented more efficiently. In addition the results would be much more exact.
- Furthermore, the substitution elasticity's in the production structure may reveal the ad hoc manner in which the production structure is installed. An econometric estimate or at least a sensitivity analysis for these parameters would help to improve the analysis.
- In summing up, it is necessary to note that GTAP does have the potential to carry out the analysis of a tax on fertiliser and pesticides on a global basis, if the model is slightly adopted and the database is supplemented. As agricultural policy is represented in a very stylised way in this paper, it would be an interesting extension of this paper to consider the explicit interaction of agricultural an environmental policy in more detail.

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Appendix 5

Table A1.1 Amount of fertiliser used in different crops in the EU 1995/96 (in 1000t)

	Cereals				Oilseeds			
	N	P	K	Total	N	P	K	Total
D	868	200	272	1,340	115	38	78	231
DK	168	31	59	258	14	2	5	21
S	100	21	12	133	6	3	2	11
SF	81	36	34	151	7	2	2	11
UK	532	170	184	886	69	20	18	107
Rest of EU	2,754	1,166	816	4,736	166	130	172	468
EU-15	4,503	1,624	1,377	7,504	377	195	277	849
	Sugar crops				Other Crops			
	N	P	K	Total	N	P	K	Total
D	66	36	77	179	720	126	222	1,068
DK	8	3	4	15	101	13	30	144
S	6	3	4	13	85	23	34	142
SF	4	3	2	9	91	31	47	169
UK	21	8	19	48	706	191	252	1,149
Rest of EU	157	95	155	407	2,739	1,199	1,715	5,653
EU-15	262	148	261	671	4,442	1,583	2,300	8,325

Source: EFMA (1997).

Table A1.2 Consumption of pesticides used in different crops in the EU 1995/96 (in t active ingredient)

	D	DK	S	SF	UK	Rest of EU-15	EU-15 Total
Cereals	16,533	1,980	439	300	8,802	43,682	71,736
Oilseeds	1,180	35	20	8	459	4,954	6,656
Sugar	1,893	299	147	94	828	6,049	9,310
Others	5,898	640	137	62	2,013	151,693	160,443

Source: Jacob (2000).

Table A1.3 Value of fertiliser used in different crops in the EU 1995/96 (in million ECU)

	Cereals				Oilseeds			
	N	P	K	Total	N	P	K	Total
D	511	130	92	734	68	25	27	119
DK	100	24	19	143	8	2	2	11
S	57	15	4	76	3	2	1	6
SF	35	21	21	77	3	1	1	5
UK	284	78	62	423	37	9	6	52
Rest of EU	1,553	750	269	2,572	94	84	57	234
EU-15	2,540	1,018	467	4,025	213	122	93	428
	Sugar crops				Other Crops			
	N	P	K	Total	N	P	K	Total
D	39	23	26	88	424	82	75	581
DK	5	2	1	8	60	10	10	80
S	3	2	1	7	49	16	12	76
SF	2	2	1	5	39	18	29	86
UK	11	4	6	21	376	87	84	548
Rest of EU	89	61	51	201	1,545	771	565	2,881
EU-15	149	94	88	330	2,493	985	775	4,253

Source: EFMA (1997), Eurostat (1995).

Table A1.4 Value of pesticides used in different crops in the EU 1995/96 (in million ECU)

	D	DK	S	SF	UK	Rest of EU-15	EU-15 Total
Cereals	340.9	61.3	34.7	23.5	261.2	506.5	1,228.1
Oilseeds	92.6	6.8	4.0	4.3	54.7	235.2	397.6
Sugar	62.5	5.2	3.9	3.3	41.3	130.2	246.4
Others	209.8	51.1	6.0	8.2	261.7	1,460.4	1,997.1

Source: Eurostat (1995), Jacob (2000).

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