

**ECONOMIC CONSEQUENCES
OF THE
DOHA ROUND FOR IRELAND**

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Foreword

The exceptional performance of the Irish economy over the last two decades has been facilitated by our openness to international trade. In 2004, Irish exports to the rest of the world amounted to €123 bn, while imports amounted to €100 bn, making Ireland one of the most open economies in the OECD. Since 1973, total Irish trade has increased from 81% to over 150% of GDP today. Over the same period, Irish GNP per capita grew from 60% to 104% of the EU average, providing strong evidence that international trade has been good for Irish living standards.

The work of the World Trade Organisation (WTO) – along with its predecessor in GATT - has had a profound effect on Irish economic development by promoting the opening of international markets to our exporters. As the body that sets the rules of international trade, the WTO has regulated and progressively liberalised international trade and this has been a key factor behind Ireland's economic transformation over recent decades.

More than ever before, global economic growth depends on maintaining an open international economy based on commonly agreed rules. This in turn requires continued acceptance of the legitimacy of the WTO, which will be reinforced by a successful conclusion of the current round of talks aimed at liberalising world trade (the Doha Development Round). The Doha round is an ambitious undertaking as the range of issues and countries involved, makes reaching an agreement more difficult than in previous negotiations.

In an effort to stimulate debate on Ireland's policy stance in the context of the upcoming Hong Kong Ministerial meeting in December 2005, Forfás commissioned Alan Matthews and Keith Walsh to conduct a study to estimate the likely economic impact of the negotiations on the Irish economy. The analysis has a number of very interesting conclusions.

In particular, the forecast of the Irish economic landscape in 2014 shows that Ireland will become even more dependent on international trade over the next decade. Further,

much of the benefit of the Doha round for Ireland is in the liberalisation of the trade in services. We hope that this report will help inform the on-going debate in this area.

Martin Cronin

Chief Executive, Forfás

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Preface

This study provides a quantitative assessment of the implications of further trade liberalisation resulting from the current Doha Round of World Trade Organisation negotiations.

The framework agreed in August 2004 provides a basis for the resumption of negotiations following the near collapse of the Doha Round at the Fifth WTO Ministerial Council in Cancún in September 2003. Outgoing WTO Director-General Supachai Panitchpakdi has set a tentative deadline of August this year for agreement on modalities in the areas of agriculture and manufacturing as well as improved offers in services if there is to be a successful Ministerial Council meeting in Hong Kong in December.

Alan Matthews and Keith Walsh were commissioned by Forfás to produce this report assessing the potential economic consequences of the Doha Round. Whilst the main focus of this analysis is on the effects on the Irish economy, specific consideration is also given to the impact on developing countries. The Global Trade Analysis Project (GTAP) computable general equilibrium model is employed to analyse and quantify these effects. The authors are grateful for comments and suggestions from Forfás, the Department of Enterprise, Trade and Employment and the Department of Agriculture and Food. However, the views expressed in the report remain the responsibility of the authors, and should not be taken to reflect the views of any of the mentioned organisations.

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Executive Summary

Introduction

In Doha, Qatar, in November 2001, the World Trade Organisation (WTO) launched a new round of trade negotiations. With a deadline for the completion of the negotiations initially set by 2005, the topics under negotiation are wide-ranging. A successful outcome would have long-term effects on all countries involved. Despite the failure of the Cancún Ministerial meeting in September 2003, WTO Members have signalled their determination to reach a new agreement. In August 2004 a framework for further negotiations was established, with the aim of achieving substantial progress on modalities of the Round by the 2005 Hong Kong Ministerial Council in December and the expectation of a final agreement to be concluded thereafter.

The aim of this paper is to quantify the effects of the potential outcomes of Doha, using a computable general equilibrium (CGE) model. The emphasis is on the specific outcomes of trade liberalisation scenarios for Ireland, although the nature of the model being used means that Ireland is not seen in isolation, rather as an interdependent part of the world economy. The Doha Round has been termed the ‘Doha Development Round’, as one of the principal ambitions set out in the Doha Declaration is that this Round should address the needs of developing countries and that its outcome should be beneficial to them. Reflecting this and Ireland’s commitment to assisting developing countries, this study pays particular attention to the outcomes for developing countries of the Round.

Methodology

The model used in this study is the Global Trade Analysis Project (GTAP) model. The base year of the latest version of the GTAP database, Version 6.0, is 2001. Even if WTO negotiations reach a successful conclusion in the near future, the time-span for implementation and the impact of reforms will stretch over a number of years. With this in mind, the base data are projected forward to 2014 to allow more realistic modelling of the effects of any agreement.

This baseline updates the GTAP 2001 database using macro-economic forecasts and by incorporating events including China's accession to the WTO, enlargement of the EU, the Agenda 2000 and Luxembourg Agreement reforms of the Common Agricultural Policy and the Everything But Arms (EBA) agreement. The simulation of trade liberalisation scenarios is then implemented by introducing shocks to this baseline. A shock, in this context, means an exogenous change in a policy variable, such as the level of import tariffs or the cost of acquiring services from suppliers abroad.

Trade Liberalisation Scenarios

Four simulations are run, each focusing on a particular area: reductions in agricultural tariffs, domestic support and export subsidies; reductions in manufacturing tariffs; reductions in barriers to services trade; and improvements in trade facilitation. Generally these simulations are stylised, they do not seek to approximate any particular negotiation modalities likely to emerge from WTO talks. Rather they examine the effects of broad liberalisation measures, thus providing a context in which specific liberalisation proposals which might emerge from the Doha negotiations can be evaluated. Special and differential treatment of developing countries is incorporated as appropriate in these scenarios. The shocks required to implement each of the trade liberalisation scenarios are implemented against the baseline featuring the global and Irish economy as projected in 2014.

Results

Overall, Ireland's welfare will increase as a result of further trade liberalisation as simulated here, with particularly strong gains from services liberalisation. The industrial liberalisation scenario also generates positive gains to Ireland, while agricultural liberalisation has a slightly negative effect on the overall economy. The total welfare effect amounts to 0.08 per cent of GDP. While this overall impact may seem small (and reflects, in part, the nature of the simulation model being used which does not capture the dynamic gains from trade liberalisation), the results do highlight the differential impacts by sector and by type of liberalisation. The impacts of each of the four components of the simulation are briefly summarised.

The increased liberalisation of the trade in services produces unambiguous gains for Irish welfare. The main source of the gains is the allocative efficiency improvements from the availability to consumers of lower cost services from abroad. Domestic output decreases in most service sectors. This loss is driven by increased competition from abroad as trade liberalisation lowers the cost of imports into Ireland. Irish service producers can also gain from further liberalisation, reflected in the projected increase in exports of all service sectors. However, given the relatively large share of Irish exports destined for EU markets that are not subject to further liberalisation, compared to the share of imports from non-EU countries, the net effect on Irish producers is negative. It is the large gain to Irish consumers which drives the overall positive effects for the simulation.

The results from industrial liberalisation are also positive. Benefits are generated from both terms of trade improvements and gains in allocative efficiency. Although Irish industry loses from the erosion of its preferential access to EU markets, this is compensated by an increase in exports to other destinations. The liberalisation of trade between Ireland and third country regions generates gains in allocative efficiency, in particular from a considerable expansion of Irish exports to non-EU regions. Domestic production of chemical and petroleum products and mineral and metal products increases, as does output in several service sectors, driven by a growth in demand for Irish exports. By contrast, output in the transport equipment, electronic equipment and other industrial products sectors, and particularly in textiles and clothing, is projected to fall.

The outcome of the agricultural simulation on the economy as a whole is projected to be slightly negative. This is despite the way the decoupling of direct payments has protected EU CAP transfers from further reduction in the Doha Round. Gains in allocative efficiency from a reduction in agricultural protection are offset by the loss of EU transfers through the elimination of export subsidies. The way the results are presented in the report, a consequence of the structure of the model used, needs careful interpretation. Gains are shown from tariff liberalisation and the elimination of export subsidies, on the assumption that high protection to Irish agriculture is paid for by the Irish taxpayer. In fact, the operation of the Common Agricultural Policy and its

principle of common financing leads to significant net inflows from the EU budget. Once the loss of EU net budget transfers is factored in, the welfare change from agricultural trade liberalisation for the economy as a whole is slightly negative. Output of all primary agricultural sectors (with the exception of milk and dairy products) is projected to fall, with particularly sharp reductions projected for cattle and sheep (and also output in the meat processing sector), as well as sugar. The milk quota remains binding and thus milk production is not expected to change. However, cheaper raw materials mean that output in the beverages and tobacco, and other processed food sector, will expand.

Perhaps surprisingly, measures to further trade facilitation generate a negative welfare change for Ireland overall. This arises as an indirect effect of such measures when implemented by other, non-EU, industrialised regions and developing countries. Trade facilitation is modelled as a cost saving on imports into a region. It is a productivity shock and this generates positive welfare effects for Ireland when implemented by industrialised countries, including Ireland itself. In the case of liberalisation by both industrialised and developing countries, however, there is a term of trade loss. Increased imports into developing countries, stimulated by improved trade efficiency, will lead to greater competition on export markets as developing countries expand their exports to pay for these imports, thus driving down the world prices received by Irish exporters for their goods. On a sectoral level, the results for Ireland in this simulation are mixed. Chemical and petroleum products, other primary products and transport equipment show a drop in output, while food processing and other industries register large increases. The production in service sectors increases, driven by a strong growth in demand for Irish exports. While the trade facilitation shock only applies to agricultural and industrial sectors, services benefit from lower prices and decreased costs.

Overall, Ireland stands to gain significantly from the successful conclusion to the Doha Round. The outcome of the simulations for developing countries is more mixed. Our main table of overall benefits shows gains to all developing country groups distinguished in the simulations. However, this result is driven by the large expected gains from improved trade facilitation. These gains depend on measures to be taken by developing countries themselves, and whether they will materialise must be uncertain.

The more direct impact of the removal of trade barriers is more ambiguous. One important conclusion is that the gains to developing countries from further liberalisation of industrial trade are likely to exceed those they can expect from further liberalisation of services trade and, a fortiori, from further liberalisation of agricultural trade. This also holds true even if liberalisation by industrialised countries only is considered. In the case of agricultural trade liberalisation, the Mercosur group, non-least-developed ACP countries and the Rest of the World (which includes Australia, New Zealand and South Africa) will benefit significantly. However, EBA countries and Mediterranean countries will lose because of the erosion of their benefits from preferential access to industrialised country markets. The gains from industrial trade liberalisation are more broadly based, with strong gains going to China, India, the Rest of Asia, Mediterranean countries, the Rest of the World and the more developed ACP countries. However, once again, EBA countries are likely to be hurt because of the erosion of the benefits of their current preferential access, not least in the EU market. If all developing countries are to profit from the Doha Round, the issue of preference erosion, which particularly affects the poorest and most vulnerable developing countries, will have to be addressed. Development assistance to help these countries to improve their supply-side responses may be more important than further trade liberalisation per se.

1 Introduction

1.1 The Doha Development Round

In Doha, Qatar, in November 2001, the World Trade Organisation (WTO) launched a new round of trade negotiations. With the deadline for the completion of the negotiations initially set for 2005, the topics under negotiation are wide-ranging. A successful outcome would have long-term effects on all countries involved. Despite the failure of the Cancún Ministerial meeting in September 2003, WTO Members have signalled their determination to reach a new agreement. In August 2004 a framework for further negotiations was established, with aim of achieving substantial progress on the modalities of the Round by the 2005 Hong Kong Ministerial Council in December and the expectation of a final agreement to be concluded thereafter.

The aim of this paper is to quantify the effects of the potential outcomes of Doha, using a computable general equilibrium (CGE) model. The emphasis is on the specific outcomes of trade liberalisation scenarios for Ireland, although the nature of the model being used means that Ireland is not seen in isolation, rather as an interdependent part of the world economy. The Doha Round has been termed the ‘Doha Development Round’, as one of the principal ambitions set out in the Doha Declaration is that this Round should consider the needs of developing countries and that its outcome should be beneficial to them. Reflecting this and Ireland’s commitment to assisting developing countries, this study also pays attention to the outcomes for developing countries of the Round.

The Doha negotiations are comprehensive both in terms of their country coverage (nearly all countries are now WTO members) and sectoral coverage (they cover liberalisation of agricultural, manufacturing and services trade as well as clarification of WTO rules). To quantify the effects of such negotiations requires the use of a model of the global economy.

1.2 Methodological Approach

The model used in this study, the Global Trade Analysis Project (GTAP) model, is well suited for modelling the impact of changes in the world trading system. It is a

comparative static, multi-regional, computable general equilibrium (CGE) model of the world economy, with over eighty regions and fifty sectors separately distinguished. These are connected via demand and production linkages within countries/regions, and bilateral trade data between them. All markets in the model are perfectly competitive and exhibit constant returns to scale. The structure of the model and its database are described in detail in Appendix 1.

The base year of the latest version of the GTAP database, Version 6.0, is 2001. Even if WTO negotiations reach a successful conclusion in the near future, the time-span for implementation and the impact of reforms will stretch over a number of years. With this in mind, the base data are projected forward to 2014 to allow more realistic modelling of the effects of any agreement. This baseline updates the GTAP database using macro-economic forecasts and by incorporating events including China's accession to the WTO, enlargement of the EU, the Agenda 2000 and Mid-Term Review reforms of the Common Agricultural Policy and the Everything But Arms (EBA) agreement. The simulation of trade liberalisation scenarios is then implemented by introducing shocks to this baseline. For example, a reduction of import tariffs is implemented by shocking the appropriate tariff variable by the desired percentage.¹ The new model equilibrium is then compared to the baseline model equilibrium and the differences in the value of the model variables (production, prices, trade, welfare) are calculated and reported as the impact of the policy shock.

In this paper, Ireland is distinguished as a separate region, allowing for the breakdown of scenario outcomes at both national and global levels. The three largest EU economies as well as the USA, Canada, China and India are also individually represented. A high level of disaggregation of other developing country regions is included in order to allow assessment of the impact of the Round on developing countries. In particular, the aggregation used distinguishes the EBA countries, other ACP countries, Mercosur, other Latin American and other Asian economies. Nine agrifood sectors have been

¹ A standard general equilibrium closure is used in all simulations in this study. This implies all prices (except the numeraire), regional incomes and quantities of producible commodities are determined endogenously. Tax (or subsidy) rates, technology and factor endowments are exogenously fixed. A medium-term closure is assumed. Labour and capital are assumed to be perfectly mobile between sectors. Land and natural resources are imperfectly mobile (or sluggish) between sectors. No factor endowments are mobile between regions. All factor endowments are assumed to be fully employed within regions. There is no unemployment of labour or capital under the standard GE closure assumptions used in this study. In terms of macroeconomic closure, investment is savings-driven and the current balance is assumed to be exogenous.

distinguished, consisting both of primary agriculture and processed products. There are also nine manufacturing industries (including electronics, textiles and chemical products sectors separately distinguished) and five service sectors. Table 1.1 shows the full regional and sectoral aggregation chosen, whilst Table 1.2 indicates the mapping of the regions and sectors represented in the GTAP model to this aggregation.

1.3 Objectives of this Study

Although the Doha Round is just under three years old, much analysis has already been undertaken by both international agencies and other bodies. However, there has been no full-scale study of the impact of further trade liberalisation on the Irish economy to date. A research report commissioned by Forfás last year (Matthews and O'Toole, 2003) employed the results of a global study carried out by the Dutch research institute LEI (Francois et al., 2003) to generate shocks simulating the effects of further trade liberalisation for the EU. These shocks were then subsequently used with a national CGE model of the Irish economy to generate indirectly estimates of the impact on Ireland. The effectiveness of this indirect approach is limited. In particular, it does not allow for a detailed decomposition of results nor understanding of what is driving them as is the case when simulations are applied directly to a model in which Ireland is individually distinguished. Matthews and O'Toole also highlight the potential for error in assuming that the shocks experienced by the rest of the EU would be relevant to the Irish economy.

This report examines specifically the effects of further trade liberalisation on Ireland as well as for developing countries. As a small open economy with numerous export oriented sectors, quantification of likely outcomes of the Doha Round on Ireland is particularly important. Given the preferential access which Ireland enjoys to other EU country markets as a member of the EU, the effects of further liberalisation of world trade are ambiguous. This report quantifies directly for the first time the relative importance of the various effects.

Four trade liberalisation scenarios are implemented in this report, focusing on agriculture, manufacturing sector, services trade and trade facilitation. The direct methodology employed in this report, with Ireland identified separately in the

simulations, allows for a detailed economic breakdown of the results of each of the liberalisation scenarios. In the absence of specific modalities from the negotiations as yet, these scenarios are chosen to illustrate a range of possible outcomes from the Doha Round.

A primary aim of the Doha Round is the promotion of the development needs of less developed countries. The trade liberalisation scenarios simulated in this paper are broken down between the impact of liberalisation by industrialised and developing countries. The GTAP model allows for the shocks applied to the various regions to be altered to simulate special or differential treatment to developing countries and this is reflected in the scenario implemented.

This report is structured as follows. The next section describes the process of projecting the world economy forward to 2014 and the structural changes that result. Section 3 outlines the trade liberalisation scenarios simulated in this report and the results of these simulations. Section 4 presents the conclusions.

2 Construction of the Baseline 2001 - 2014

2.1 Introduction

The base year of the current version 6.0 of the GTAP database is 2001. Even if WTO negotiations reach a successful conclusion in the near future, the time-span for implementation and impact of reforms will stretch over a number of years. With this in mind, the base data is projected forward until 2014 to allow more realistic modelling of the effects of any agreement. In addition, the standard GTAP model is extended to incorporate the agricultural budget of the European Union in order to capture the impact of further agricultural trade liberalisation on the net flow of funds between EU member states arising from EU agricultural policy.

The construction of this baseline is achieved by running a pre-simulation experiment, the outcome of which is used as a baseline against which to compare the results of the trade liberalisations scenarios implemented in the study. As is illustrated in Figure 1, the construction of the baseline is divided into two components. Firstly, policy changes, both events that have already occurred since 2001 and those that are expected to occur in the future, are implemented to create a more realistic policy landscape. Secondly, macroeconomic projections are used to simulate the expected changes to the world economy between the dates in question. The trade liberalisation simulations that are the focus of the next section are then modelled in the second period.,

2.2 Methodology

2.2.1 Macro-Economic Projections

The first phase in constructing a baseline to 2014 is to shock factor endowments in the model following the approach of Walmsley *et al.* (2000). These shocks are implemented at a regional level, based on forecasts of factor growth rates over the baseline period.

GDP, skilled and unskilled labour, population and capital stock in each region are the variables chosen to be shocked. In the standard general equilibrium closure, all of these variables are exogenous with the exception of GDP. However, in the closure used here GDP is swapped with an exogenous technology variable. This means that GDP in each

region is exogenously determined and the technology variable fluctuates as a residually determined measure, representing change in total factor productivity (TFP).

The predictions of factor growth rates assumed are shown in Table 2. The main source is Brockmeier *et al.*, 2003, which followed a similar aggregation to that chosen in this paper, with additional data from Frandsen and Jensen (2003).² For Ireland, additional data from the Economic and Social Research Institute (ESRI, 2003) have been used to further augment the forecasts. The initial pre-simulation experiment suggested an unrealistically high growth of agricultural production in the EU, evaluated on the basis of expert opinion. In the baseline represented here, the growth of primary agricultural sectors has been constrained to target the growth rates expected (in the absence of policy change) in the most recent EU Commission forecast of the likely market balance for agricultural products up to 2014 (Commission, 2004). The same growth rates were applied to each of the separate EU countries and regions distinguished in the model database.

2.2.2 Structural Changes to the World Economy

The choice of events to be included in the baseline needs to strike a balance between accuracy and feasibility. As it is not possible to model all changes over the next decade, the structural adjustments that form the core of the baseline have been chosen as the events that are expected to be the most relevant for Ireland. This explains the decision to incorporate reform of the Common Agricultural Policy (CAP) whilst leaving out similar policy measures that could have been included, for example the US Farm Bill. We also assume that Russia joins the WTO during the baseline period. The terms of accession are not specifically modelled, but Russia is assumed to participate in the liberalisation scenarios based on its tariff structure in 2001.

The structural changes to the world economy included in this baseline, each of which are discussed further below as is the methodology used to implement them, are:

- Accession of China to the World Trade Organisation.

² In the case of the both Brockmeier *et al.* (2003) and Frandsen and Jensen (2003), the primary source of data is the World Bank's Global Economic Perspective's Database and several other sources cited in Walmsley *et al.* (2000).

- The Agenda 2000 Reform of the Common Agricultural Policy and the 2003 Luxembourg Agreement.
- Eastern Enlargement of the European Union.
- The Everything-But-Arms Agreement.
- Elimination of MFA textile quotas.

The Accession of China to the WTO

In 2001 agreement was reached on the accession of the People's Republic of China to the WTO, thus also paving the way for the accession of the separate customs territory of Taiwan, Penghu, Kinmen and Matsu (Chinese Taipei) in 2002. This is modelled as the implementation of import tariffs based on Francois and Spinanger (2002), Francois *et al.* (2003) and AMAD³ to reflect China's new trading position since obtaining WTO membership. Additionally, all Chinese export subsidies in the 2001 database are eliminated as agreed in the accession protocol.

Agenda 2000 Reform of the CAP

The Agenda 2000 reforms of the CAP were agreed in Berlin in 1999.⁴ The reforms were to be phased in over the current EU budget period 2000-2006. The Agenda 2000 package is a continuation of the previous MacSharry reforms, including further reductions in intervention prices compensated by increases in compensation payments. Other elements of Agenda 2000, including measures to promote rural development and agri-environmental policies, are not considered in the context of this study as their impact on agricultural protection and trade is considered to be negligible.

The reforms that are the core of Agenda 2000 are to be phased in over a period, hence the version 6.0 GTAP database, base year 2001⁵, includes some of these measures such as changes in arable crop intervention prices and support payments already in the data.

³ See <http://www.amad.org/> for more information concerning the Agricultural Market Access Database (AMAD), a database operated jointly by USDA-ERS, UNCTAD, European Commission, FAO and the World Bank.

⁴ http://europa.eu.int/comm/agenda2000/index_en.htm or Van Tongeren, van Meijl and Veenendaal (2000) provides a good summary in a CGE context.

⁵ Domestic support in the database is based on EAGGF-Guarantee expenditures for 2001 for animal premia and 2002 for hectare premia (Jensen 2004).

However, other measures are only partially implemented (e.g. changes to domestic support in cattle production) or not yet begun in the case of dairy market reforms.

Therefore, those reforms that were not yet fully phased in 2001 have been included in the baseline construction. Changes to intervention prices are modelled implicitly via reduced border protection (import tariffs and export subsidies are altered by the target rate percentage change). Following Bach and Frandsen (1998), variations to the set-aside rate for agricultural land can be simulated via productivity shocks to land in the sector in question. Modelling of the raw milk and sugar quotas follows the approach of Brockmeier *et al.* (2001) of fixing output exogenously and allowing the relevant output subsidy to fluctuate endogenously. This change in the subsidy is interpreted as the change in the quota rent.

Domestic support in the form of direct payments to farmers is already represented in the GTAP database as their price wedge equivalents. Hectare and headage based premia are modelled as land and capital subsidies respectively in the sector in question, with the exception of slaughter premia, which are considered output subsidies.

The CAP Luxembourg Agreement

In June 2003, with the CAP facing the twin challenges of EU enlargement and the continuing Doha Round, the European Council agreed a further set of CAP reforms known as the Mid-term Review (MTR). The MTR maintains the trend of further reducing intervention prices and increased direct payments, strengthening of rural development measures and improved budgetary discipline.

However, the most innovative feature of the MTR is the decision to decouple most direct support payments from production and hence lessen their impact on production decisions and their distortionary effects on agricultural trade.⁶ Once decoupled, a range of payments to cereals, cattle, sheep and other products will be unrelated to the current level of production; instead, farmers will receive a “single farm payment” subject to cross-compliance conditions.

⁶ See <http://europa.eu.int/scadplus/leg/en/lvb/111062.htm> for more details.

The modelling of decoupling in this paper is based on the approach of Frandsen and Jensen (2003). Direct payments to be decoupled are transformed into uniform payments to agricultural land across all sectors in EU countries – the “single farm payment”. The justification for this approach is that land must be kept in good agricultural condition to receive the payment and that land has no use outside of agriculture in GTAP apart from in forestry, which is included in the other primary products sector in the aggregation chosen in this report. As modelled here, decoupling of direct payments is effective only in the cattle and sheep, cereals and dairy sectors.⁷ The subsidy instruments representing those payments that have been decoupled are set to zero (e.g., some capital subsidies in the cattle and sheep sector). The new decoupled payment to land is a region-specific payment and, as the subsidies have simply been transferred, the cost is unchanged.

National governments in the EU have been given some discretion concerning the extent of decoupling they decide to implement.⁸ With respect to the regions of the EU as represented here, Ireland, the United Kingdom and Germany have decided to implement full (100 per cent) decoupling, albeit with some differences in timing and measurement of payments (Agra Europe, 2004). France has opted for a more limited approach, as have most of the other members represented in the aggregated EU11 region. The European Commission (2004a) suggests an informal estimate of 90 per cent of all payments decoupled by 2011. In this study all EU members are assumed to implement full decoupling of the appropriate sectors, assuming that this will be the case by 2014, as arguably the logic of decoupling will be so persuasive that the remaining support will be decoupled by the end of the implementation period for the Doha Round reductions even in the absence of any further WTO-driven discipline on direct payments.

Enlargement of the European Union

In May 2004, ten central and eastern European countries acceded to the European Union. Bulgaria and Romania are currently negotiating their entry to the EU and are

⁷ Representing the suckler cow premium, the male animal premium, the slaughter premia, the ewe premium, the arable aid premium and the dairy cow premium.

⁸ See http://europa.eu.int/comm/agriculture/capreform/index_en.htm

expected to join in due course.⁹ Consequently, in the baseline the EU is assumed to be enlarged to a community of twenty-seven members by the end of 2006.

These twelve countries are modelled as a single region (“CEEC”) in the aggregation chosen in this paper. Accession to the EU implies the elimination of all remaining trade barriers between the new and old members. Import tariffs and export subsidies between the two regions, and between the CEECs themselves, are set to zero and the new members implement the EU’s common external tariff towards third countries, including preferences for developing countries.

In addition, the CAP is extended to the CEECs upon entry. Price support measures have been transferred upon accession. However, to reduce the budgetary costs of enlargement, agreement was reached whereby new members would not become immediately entitled to the full level of direct payments existing in the EU15 countries.¹⁰ Direct payments in the CEECs commence at 25 per cent of the level of the EU15, increasing to 100 per cent over a ten-year period with a facility for national governments in the new members to top-up these payments, up to a specified level. Thus by the end of the baseline the CEECs will be fully integrated into the CAP. All CAP direct payments are transferred at the full EU15 rate in the form of a land subsidy similar to decoupled payments.

An aspect of the EU enlargement not incorporated in this model is the use of Structural Funds. The accession countries are significantly below the average income level in the EU15. Post-enlargement they will receive considerable inflows of structural funding to boost convergence between new and old members. However, due the nature of structural funds, both their sourcing and disbursement, their representation in a model such as GTAP is not straightforward. Because structural funds are not targeted at specific commodities, this is incompatible with the structure of the model, see Frandsen and Staehr (2000) for a full discussion. However, the use of structural funds and cohesion funds is implicitly taken into account by assuming a relatively high level of

⁹ Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

¹⁰ Usually referred to as the Copenhagen Agreement, agreed by the European Council in Copenhagen in December, 2002.

GDP growth in the accession economies (see Table 2), implying a degree of economic convergence over the baseline period.

The Everything-But-Arms Agreement

The Everything-But-Arms (EBA) agreement covers trade between the EU and fifty of the world's least developed countries.¹¹ Simply put, the EU has agreed to the unilateral elimination of tariffs and quotas on imports from these countries, on all commodities except those related to the arms trade. Effective from 2001 for most products, the EBA agreement was fully phased in by beginning 2004.¹²

Elimination of MFA Textile Quotas

The system of quotas on textile and clothing imports from some developing countries to industrialised countries, established by the Multi-Fibre Agreement (MFA), is eliminated as foreseen under the Agreement on Textiles and Clothing (ATC) from the end of 2004. These quotas, implemented in GTAP as export tax equivalents on the textiles and clothing sectors, are set to zero.

2.2.3 The EU Agricultural Budget Module

In the standard GTAP model there is no direct link between tax revenue and government expenditure and there is no explicit representation of the EU budget.¹³ Agricultural subsidies (direct payments, input and output subsidies, market price support and export subsidies) in Ireland are assumed entirely financed through the Irish regional household, and there are no intra-European revenue or expenditure flows. This underestimates the negative impact of reforms which lower market prices and thus the inflow of CAP funds for a net exporting country in the EU.

For example, when modelling EU enlargement, this implies that new members will have to fund new CAP measures themselves, without receiving any contributions from

¹¹ Due to the limited number of developing countries separately distinguished in the database it was not possible to include all 50 countries in the region named "EBA". Table 1.2 indicates which GTAP regions have been included in this EBA grouping.

¹² Full market access will be delayed for some sensitive products: sugar (July 2009), rice (September 2009) and bananas (January 2006).

¹³ All taxes (or subsidies) are collected (or disbursed) by a regional household and there are no flows between regions.

the EU, neither CAP payments nor rural development funding. From an Irish perspective, the accession of new members would not therefore imply a cost as might be expected in reality due to an increased contribution level to the EU budget.

To accurately model shocks such as enlargement or, at a later stage, to simulate the effects of trade liberalisation within a regional union such as the EU, the standard GTAP model is extended to incorporate an EU agricultural budget module based on the approach of Brockmeier (2003). This is accomplished via the addition of a new social accounting matrix (SAM). This SAM moves the EAGGF revenues and expenditures from the regional household to the EU budget. The EU collects 75% of import tariff revenues¹⁴ from agents in the model and a GDP¹⁵ tax is levied on the regional households of the member regions. This tax is determined endogenously to ensure the overall EU agricultural budget is balanced and it thus approximates both the VAT and GDP elements of revenue that accrue to the EU. The difference between revenues and expenditures of each member state is the net transfer to that region arising from the operation of the CAP. The sum of the net transfers of each region is zero to ensure that the overall agricultural budget balances. To avoid misunderstanding, it should be stressed that what is being modelled here is the EU agricultural budget, and not the full EU budget. Structural fund contributions, for example, are excluded. This should be borne in mind when interpreting the budget figures later in this report.

2.3 The Irish Economy in 2014

This section describes the structure of the Irish economy in 2014 following the updating of the baseline as described in the previous section. This is important as the impact of WTO liberalisation will be determined by both the production and consumption structure of the economy and by the structure of protection assumed in the baseline in that year, rather than the economic and protection structures in 2001. It is a stylised representation of the Irish economy, and is not intended to capture detailed projections of individual sectors.

¹⁴ This was reduced from 90% in 2000.

¹⁵ In reality, the EU taxes gross national income (GNI), however in GTAP any such taxes are levied on the regional household.

The growth rate assumed for Ireland over the baseline period is greater than for the other EU countries as shown in Table 2. Between 2001 and 2014, GDP increases by eighty per cent, capital more than doubles and the population and labour force increases by between seven and ten per cent.

Tables 3.1 and 3.2 show the structure of the Irish economy, including trade flows, output and domestic consumption, before and after the changes described in the section above are implemented, providing a baseline against which to compare the results of the simulations to follow. The importance of intra-EU trade to Ireland is a key factor underlying many of these results, hence the value for Ireland of intra-EU and extra-EU trade are indicated.¹⁶

In Table 3.3, the sectoral changes between 2001 and 2014 are shown. All non-agricultural sectors expand in line with the projected overall growth of the economy over the period. The growth in the primary agricultural sectors, apart from sugar and raw milk, is constrained to meet the Commission's forecasts for output growth in the EU as a whole. Output of sugar and raw milk is assumed constrained by quota. Domestic consumption of all commodities, except for other livestock, increases, in particular chemical and petroleum products and other private services.

These changes are shown at a more aggregated level in Table 3.4. The growth of output in agriculture trails far behind that in industry and services. As incomes increase and a region becomes richer, consumption tends to shift from primary commodities to industrial goods and services. In the case of Ireland in 2014, the increase in industrial output compared with 2001 is particularly strong, reflecting the open, export-orientated nature of the economy. The increase in industrial output is driven by an increase in demand for Irish exports. The strength of this effect is shown by the negligible impact on the relative shares of industry and services in GDP and employment over the period, contrary to what might be expected on a priori grounds.

¹⁶ The figures in Table 3.1 reflect those in the GTAP Version 6.0 database. These data may underestimate the degree of self-sufficiency for some agrifood sectors, for example, beef and sheepmeat and dairy products, and this caveat should be noted in interpreting the results.

The levels of trade protection applied to Irish imports and exports in 2001 and 2014 by industry are shown in Table 3.5. The data are calculated as the ratio of tariff revenue collected to the value of trade at world prices, and thus represent trade-weighted average applied tariffs by sector.¹⁷ The calculated applied tariffs on ‘All Trade’ are lower than those shown for ‘Extra-EU Trade’ as they take into account the zero tariffs that apply on intra-EU trade. The dramatically higher levels of protection for some of the agrifood sectors stand out.

Applied trade protection for Irish exports and imports by source and destination are shown in Figures 2.1 and 2.2. The only notable changes are the elimination of barriers to trade between Ireland and the new EU members and of import tariffs levied on commodities exported from the EBA countries entering the EU. This is particularly important in the case of sugar.

2.4 Changes to Developing Countries over the Baseline 2001-2014

The same breakdown of changes as illustrated for Ireland in the previous section is shown in Tables 4 and 5 for the Everything But Arms (EBA) group of countries and the Rest of African-Caribbean-Pacific (ACP) region respectively.

The dependence of EBA countries on exports of other primary products (primarily minerals and oil) as well as textiles is highlighted by the self-sufficiency indicators in Table 4. Domestic output in the EBA region increases across all sectors with particularly strong growth projected in sugar (among primary commodities), the transport and electronic sectors (in industry) and public services. This is driven by higher domestic consumption and by increased exports in these sectors. As is the case with Ireland, the changes reflect a shift from consumption of agricultural products to industrial goods as the region grows and becomes richer over the period of the baseline. Exports to EU and non-EU markets both increase, by approximately 30 per cent and 50 per cent respectively, encouraged in part by the implementing of the EU’s EBA scheme.

¹⁷ These tariff values may be sensitive to very small volumes of trade in some sectors. Also, the method of calculating average tariffs may underestimate the degree of protection provided to Irish agriculture, to the extent that the volume of imports at world prices may represent preferential import prices rather than the ‘true’ world price. This is likely to be important in the case of sugar, for example, where EU import values reflect the price paid to ACP exporters which is linked to the EU producer price rather than the world price.

Unlike the EBA region, the export surplus of the Rest of the ACP region is driven by high ratios of output to domestic consumption in the crops, sugar and transport services sectors (Table 5). Changes for the Rest of ACP region are broadly similar, if less pronounced, than for the EBA region. Output in the textiles and clothing sector increases by less than the average in both regions, and indeed exports from the Rest of ACP region in this sector are projected to fall, reflecting the more intense competition from Asia, and in particular China, following the removal of MFA quotas.

3 Trade Liberalisation Scenarios

3.1 Introduction

This section describes the trade liberalisation scenarios implemented in this report and presents the results. Four simulations have been run, each focusing on a particular area: reduction in agricultural tariffs, domestic and export subsidies; reduction in manufacturing tariffs; reduction in barriers to service trade; and trade facilitation. Generally these simulations are stylised, they do not seek to approximate any particular negotiation modalities likely to emerge from WTO talks. Rather they examine the effects of broad liberalisation measures to provide a context in which more specific negotiating modalities that may emerge during the Round can be evaluated. Special and differential treatment of developing countries is incorporated in each scenario where appropriate.

All of the trade liberalisation shocks are implemented using the updated database created from the baseline experiments described in the previous section. The shocks required to implement each of the trade liberalisation scenarios are thus implemented against this baseline featuring the Irish and global economy as projected in 2014.

3.2 Simulations

3.2.1 Agricultural Trade Liberalisation

The first simulation focuses on agricultural liberalisation. The modalities on agricultural products agreed in August 2004 do not include specific targets for the cuts in import tariffs or domestic support. This simulation encompasses the three pillars of the Agreement on Agriculture: market access, domestic support and export competition.

For agricultural import tariffs, the simulation imposes a linear cut across all agricultural sectors. Industrialised countries (ICs) implement reductions of 50 per cent. To reflect the special and differential treatment of developing countries (DCs), the import tariffs of these regions are subjected to a 34 per cent reduction (two-thirds of the levels of ICs), and least developed countries (LDCs) are exempted from any reduction commitment.

To aid in the analysis of the outcome of this simulation, the results are decomposed¹⁸ into the effects due to liberalisation of ICs and effects due to liberalisation in DCs.¹⁹

The tariff rates in the GTAP model and database are effective (or applied) rates. WTO negotiations are based on bound tariff levels. In many cases, there will be a degree of tariff overhang whereby the bound ceiling exceeds the applied rate by a considerable amount. A 50 per cent in the bound rate may not translate into an equal reduction in applied rates. This is particularly the case in DCs but can also occur in ICs. Implementing reductions in applied rates by 50 per cent, as done in this study, may overestimate the gains from trade liberalisation unless the average cut in bound rates agreed in the Doha Round negotiations is substantially greater (Bouet *et al.*, 2004). In other words, cutting effective tariffs by 50 per cent implies agreement on a substantially larger cut in bound tariffs once the tariff overhang impact is factored in.

The August 2004 Framework contains a commitment to fully phase out the use of export subsidies for agricultural products and therefore their complete elimination has been implemented in Simulation 1.

On domestic support, the only firm commitment contained in the Framework is the agreement that overall trade distorting support will not exceed 80 per cent of its current level by the end of the first year.²⁰ This includes final bound AMS (aggregate measure of support), the permitted *de minimis* levels and permitted blue box levels²¹, with future reductions to be based on a tiered formula implying greater reductions for those countries that maintain the highest levels of support.

Domestic support as currently represented in the GTAP model does not allow for a full analysis of overall distorting support as defined in the August Framework. In this

¹⁸ A feature of GTAP / GEMPACK allows for the results of any particular shock in a simulation to be decomposed into parts known as “subtotals”. Subtotals may be decomposed by region (in the example above) or by commodity. The sum of subtotals need not necessarily equal the total result, as will be the case if all component parts of a shock are not specified. The result of a shock specified as a subtotal as part of larger simulation is equivalent to the result of implementing the same shock individually. See Harrison *et al.* (1999) for more detailed discussion.

¹⁹ Industrialised countries / regions in this paper are: EU27, USA, Canada, High Income Asian countries, Rest of EFTA and the Former Soviet Union. Developing countries / regions are: Mediterranean, China, India, Rest of Asia, Rest of the ACP countries, Mercosur, Rest of Latin America and Rest of the World. Least developed countries are approximated by the EBA group of countries.

²⁰ Details of August 2004 agreement available at www.wto.org.

²¹ Payments partially decoupled and aimed at limiting production fall under this box.

simulation, reductions in domestic support are simulated as cuts to direct payments linked to production, intermediate input subsidies and output subsidies. Payments decoupled from production in the EU and USA are assumed to qualify for the Green Box and therefore are exempt from reductions. The market price support components of AMS are not modelled. Table 7 shows the levels of domestic support in the EU in 2014 prior to this simulation. The scenario implemented is a modest reduction of 20 per cent for non-exempt support in the EU and USA and 5 per cent for all other regions reflecting the tiered formula approach whereby those with higher levels of trade distorting support are expected to implement the most substantial cuts. As in the case of market access, results are decomposed by the source of the reductions.

3.2.2 Manufacturing Trade Liberalisation

Simulation 2 focuses on tariffs in industrial sectors, of which there are nine in the aggregation chosen in this study. The August Framework text on non-agricultural market access (NAMA) contains few details. WTO members have agreed that improvements in non-agricultural market access in the Doha Round are to be based on a formula approach, with the precise details, and other issues such as the treatment of tariff escalation and tariff peaks, still the subject of negotiation.

A consensus is emerging that an agreement on NAMA will not be reached until negotiations on agriculture are nearer to conclusion with members waiting to judge the perceived ambition of any such agreement (ICTSD, 2005). The US and many ICs are pressing for a sector-based approach. However, they face opposition from DCs who favour a broad tariff reduction formula with the possibility of specific sectoral arrangements only once the overall reduction formula has been agreed upon.

In this simulation, manufacturing liberalisation is assumed to be a linear reduction. The same reductions are applied as in the case of agricultural tariffs with cuts of 50 per cent, 34 per cent and 0 per cent for ICs, DCs and LDCs respectively.²² As in the first simulation, the overall results are decomposed to demonstrate the effects of liberalisation by industrialised and developing countries separately.

²² The same caveat as discussed in Section 3.2.1, regarding differences in bound and applied tariff rates and the degree of tariff overhang, applies in this simulation also.

3.2.3 Services Trade Liberalisation

For the third simulation, the focus shifts to trade in services. To model service liberalisation requires quantitative estimates of trade barriers. However, unlike the case of agriculture and manufacturing, in services these barriers tend to be qualitative rather than quantitative in nature. Such barriers include the existence of national monopolies in service sectors, restriction of certain activities to domestic firms or regulation on the establishment and operation of foreign service providers. The difficulties in measuring non-tariff barriers are well documented (e.g., Francois, 2001 or Dee and Hanslow, 2000).

GTAP is lacking on two fronts in terms of trade in services. The model structure does not allow for foreign direct investment and the database includes no import barriers (tariff equivalents to the qualitative barriers) for service sectors. Given the large share of trade in services that is accounted for by FDI in services and, in particular, its importance to the Irish economy, the outcome of any agreement on services will have significant consequences for Ireland.

In this simulation estimates by Francois *et al.* (2003) of barriers to trade in services are employed. The tariff equivalents of the barriers have been calculated using a gravity model approach. Neither the regional or sectoral aggregations of Francois *et al.* is the same as the aggregations chosen in this paper, so the average for ICs and DCs has been used here. The tariff equivalents assumed are shown in Table 6. These are tariff equivalents for services imported in a country or region. In the case of the EU regions, they apply to both intra-EU and extra-EU trade.

The trade liberalisation scenario in this simulation is a 50 per cent cut to these tariff equivalents. This is modelled as a positive productivity shock to imports of service commodities entering a region, implemented by exogenously shocking the appropriate technology variable in each of the five service sectors in this aggregation. For EU regions, it is applied only to imports from third countries. Whilst barriers to trade in services within the single market remain, they are not subject to WTO negotiations but rather they fall within the competence of the European Community. Service trade

imports from the USA to Ireland are also exempted from this shock. The Irish economic landscape is dominated by multinational firms, primarily from the US, who in the main produce goods. The Irish services trade balance is distorted as a result of this with very large license and royalty payments that are not really imports *per se*. As these are effectively paper transactions, it is assumed that they do not face any trade barriers. While most countries will have this effect to a degree, the unusual feature of Ireland's economy justifies taking explicit account of this fact. As in the previous simulation, the subtotals distinguish between the effect of liberalisation of ICs and DCs.

3.2.4 Trade Facilitation

Similar to the previous simulation in some respects, Simulation 4 focuses on trade facilitation, which is now the only one of the four so-called Singapore issues still under negotiation in the Doha Round. Bagai *et al.* (2004, p2) define trade facilitation as encompassing "the domestic policies, institutions and infrastructure associated with the movement of goods across borders". In the WTO, the definition of trade facilitation is less broad. The Doha Declaration text cites fees and formalities, transit and transparency.

It has been estimated (Wilson, 2003) that, with increased liberalisation of world trade and reductions in import tariffs, the cost of moving goods across borders is as important as the cost of tariffs. An OECD (2002) survey finds that trade transactions costs vary between 2 per cent and 15 per cent of total trade costs. Its importance and sensitivity were clearly illustrated in Cancún with the break-down of negotiations due to the refusal of DCs to accept EU proposals over the Singapore issues.

An agreement on trade facilitation will have to balance the desire for reductions in transactions costs (and the increased costs due to heightened security fears since September 11th), with the political will and physical capacity of DCs to achieve trade facilitation programmes. Walkenhorst and Yasui (2003) suggest that DCs have the most scope to gain from trade facilitation as they have less efficient border procedures and because of the nature of their trade patterns (importance of primary goods and the predominance of small and medium-sized firms).

Improved trade facilitation is assumed not to apply to services, to prevent an overlap with the previous simulation. In the context of the WTO trade facilitation is generally used to refer to the removal of impediments to the trade in goods (customs procedures, technical standards, etc.), as opposed to barriers to trade in services as discussed in the section above which fall under the auspices of the General Agreement on Trade in Services (GATS).

This scenario follows the approach of Francois *et al.* (2003) and simulates an agreement on improved trade facilitation as a positive technology shock to imports entering into a county or region. Based on a survey of a range of estimates of the benefits of trade facilitation, Francois *et al.* simulate a conservative saving of 1.5 per cent in the cost of importing agricultural and manufacturing commodities. In this report, the shock is tiered to reflect that DCs have the greatest potential to gain from trade facilitation. Improved trade facilitation is assumed to imply a cut of 1.5 per cent of import costs for LDCs, 1 per cent for DCs and 0.5 per cent for ICs.

As before, to maintain consistency with the other simulations, results will be decomposed for ICs and DCs. In the case of the EU countries, this shock is only applied to extra-EU imports on the assumption that membership of the single market should have already eliminated many of the non-tariff barriers to trade between members and hence reduce the scope of possible gains from trade facilitation.

Box 1: Summary of Trade Liberalisation Scenarios

Simulation 1 – Agriculture: applied agricultural import tariffs are reduced by 50, 34 and 0 per cent for industrialised, developing and least developed countries respectively. This is combined with a global elimination of export subsidies. In addition, trade-distorting domestic support is reduced by 20 per cent in the EU and USA and by 5 per cent elsewhere.

Simulation 2 – Industry: a 50 per cent reduction in applied import tariffs on manufacturing commodities by all regions. Again, special and differential treatment applies to developing regions.

Simulation 3 – Services: a 50 (34) per cent reduction in the tariff equivalents of barriers to trade in services in industrialised (developing) countries. This is not applied to intra-EU trade in services or exports from the USA to Ireland.

Simulation 4 – Trade Facilitation: modelled as a reduction in the cost of importing all agricultural and manufacturing commodities (1.5 per cent cost reduction for least developed, 1 per cent for developing and 0.5 for industrialised countries). In the case of the EU, this applies only to imports from non-member countries.

3.3 Results

The results of the experiments outlined above are presented in this section. The overall effects for the world economy are first discussed, followed by more detailed analysis of the impacts on Ireland and on the least developed countries of further liberalisation as simulated in this study. All results presented are net of the effect of the macro-economic projections and policy changes built into the baseline, allowing the isolation of the effects due to the various trade liberalisation scenarios.

3.3.1 Global Effects

The global changes in welfare of the trade liberalisation experiments, as measured by the equivalent variation in millions of US\$ and as a percentage of Gross Domestic Product in 2014, are presented in Table 8.1.²³ All four scenarios are run independently, with the total change in welfare shown for each in Tables 8.2 to 8.5 (Table 8.1 shows the sum over all four simulations). The total welfare effect in each is decomposed as discussed in the previous section. The final column in each table shows the net effect of the simulation on the contribution (or receipts) by EU members to the agricultural

²³ The welfare decomposition feature in GTAP is described in the Appendix.

budget of the European Union. A positive figure represents an increase in net receipts or a decrease in net contribution. The net result is a gain for the world economy as whole of 0.30 per cent of gross domestic product (GDP). Within the simulations, the results are more mixed.

All regions gain overall across the four simulations. In GDP terms, the largest gains are for the Rest of the African Caribbean Pacific (ACP) group, China, India, the Rest of EFTA, the Mercosur region and the Rest of Asia.

An alternative view of these welfare effects is presented in Table 9, comparing the contribution to global gains by regions implementing reform to those that capture the benefits. At the world level, approximately 57 per cent of the welfare gains are due to liberalisation of industrialised countries (ICs) compared to 43 per cent from developing countries (DCs).

Clearly indicated in Table 9 is that the main source of gains, for both industrialised and developing, derives from liberalisation within their own group of countries. Overall, this accounts for over 80 per cent of the gains they each achieve.²⁴ The gains to ICs from reductions of manufacturing tariffs in DCs are an exception in that ICs benefit more in this case from DC liberalisation than IC liberalisation in this experiment.

The simulation that adds most the welfare change of the world economy, almost half the total global gains, is the improvement in trade facilitation (Table 8.5). It should be noted that the results of any such simulation depend on the magnitude of the shock implemented. If the cost saving assumed due to trade facilitation (between 0.5 and 1.5 per cent of cost in this simulation) were less, then the welfare impact achieved would be reduced.

Most regions are winners overall in terms of this simulation, with the USA and Asian countries accounting for a substantial share of the gains in value terms. In GDP terms, the Rest of ACP group and Rest of Asia perform exceptionally well. The results for the

²⁴ 44.2% out of total 54.3% for ICs and 43.9% out of 45.7% for DCs.

EU are more mixed, perhaps due to the large share of intra-EU trade in their exports, which are excluded from the trade facilitation shock.

The second most significant contribution to welfare is industrial tariff liberalisation (Table 8.3). The results of this simulation are dominated by the large gains to Asian countries. The gains from liberalisation by DCs account for over 60 per cent of the total gains to the global economy in this simulation. By contrast, tariff reductions by ICs have a negative impact on many regions, in particular industrialised regions themselves. This arises from a negative terms of trade effect for these countries. As countries reduce import tariffs, they must export more to maintain their trade balance in the face of increased imports due to liberalisation. To realise this increase, the exports of the region must become more competitive. This is achieved by reduced factor prices relative to world factor prices. This depreciation implies lower export prices relative to the composite world price, generating the negative terms of trade effect and the welfare loss observed for many ICs in Table 8.3.

The results from services trade liberalisation are the most uniform (Table 8.4). All regions gain overall. The Mediterranean region receives the largest gain in GDP terms. Developing regions such as Rest of ACP and Rest of Asia achieve higher than average gains. Positive welfare gains are to be expected in a simulation such as this, where liberalisation has been modelled as a positive productivity shock to reduce non-tariff barriers. The price of services falls across all regions due to lower cost imports and through the use of services as intermediate inputs, and this effect feeds into the rest of the regions' economies.

Services liberalisation by the ICs provides the bigger share of the welfare effect. Given that richer regions consume more services it implies that they are the ones to gain the most. In addition, service barriers in ICs were reduced by more than in DCs allowing for greater gains in allocative efficiency. However, the existing tariff equivalent barriers were on average considerably higher in the DCs, hence the 34 per cent reduction applied to such barriers helps to generate the relatively large gains in those countries seen to result from their own liberalisation.

The agricultural liberalisation simulation contributes the least to the overall change in welfare (Table 8.2). This may be partly explained by the modest nature of the assumed shocks to domestic support and targeting of coupled support only for reductions. The major winners are the EU15, the USA and the high-income Asian countries. These are the countries that impose the most significant distortions on agricultural trade and it is typical in such simulations to observe welfare gains due to improved allocative efficiency when these distortions are reduced. Net exporters of agricultural commodities, such as Mercosur, also perform strongly. The EU gains from the export subsidy elimination at the expense of net-food importing regions.

The effect of the reduction in agricultural tariffs is considerably greater in magnitude than the cuts in domestic support and the elimination of agricultural export subsidies. The interaction of these results with the EU budgetary effect is discussed in more detail in the following section.

3.3.2 Ireland's Results

Overall, Ireland's welfare will increase as a result of further trade liberalisation as simulated here, with particularly strong gains from services liberalisation. The industrial liberalisation scenario also generates positive gains to Ireland, while agricultural liberalisation has a slightly negative effect. The total welfare effect amounts to 0.08 per cent of GDP.

The GTAP welfare decomposition results for Ireland are shown in Table 10. Allocative efficiency effects and technological improvements drive the positive welfare result. The latter are due to the exogenous shocks introduced to the model in order to simulate trade liberalisation in services and trade facilitation.²⁵ The investment and savings price effect is a terms of trade effect for the capital account. The decomposition for agricultural trade liberalisation needs to be interpreted in the light of the way the model is set up.

The allocative effects stem mainly from agriculture, reflecting the high levels of protection for agricultural sectors in the 2014 baseline. Allocative efficiency gains arise

²⁵ The change in endowments is also exogenously determined. As they are not shocked in any simulation there is no endowment effect.

when distortions such as domestic support and import tariffs are reduced or eliminated, as this allows the market to move closer to its competitive equilibrium and reduces the efficiency losses associated with any tax or subsidy.

The terms of trade effect is negative for each simulation. The reduction of export subsidies in agriculture and increased trade facilitation both contribute to a fall in export prices relative to import prices. For a small, export oriented economy like Ireland this results in a loss as Irish producers receive a lower price for their goods on the world market relative to the cost of what they buy. In addition, given the high degree of Irish trade destined for EU markets, the erosion of preferential access to EU markets leads to some welfare losses for Irish producers.

Agricultural Liberalisation

The decomposition of the welfare effects of Simulation 1 is shown in Figure 3. The largest effect is the effect on Ireland's contribution to the EU budget. Overall, Ireland experiences a slight negative loss in terms of GDP from this simulation. This result arises because the gain from improved allocative efficiency is offset by the reduction in net transfers from the EU agricultural budget.

As noted above, in the GTAP model CAP support instruments are assumed to be financed domestically, rather than by the EU, hence all allocative efficiency gains are captured by the region in question. The integration of the EU agricultural budget module described in Section 2.2.3 allows the calculation of the effect of changes in budgetary flows resulting from the liberalisation scenario.

As shown in Table 19, prior to the simulation in 2014 Ireland is a net recipient of EU funds. The effect of this trade liberalisation simulation is to reduce the size of the net transfer to Ireland by nearly \$200 million. The elimination of export subsidies implies that Irish producers no longer receive support to sell exports to third countries. However, as the majority of domestic support in the EU is decoupled in 2014, there is little change in the related revenues and expenditure. The changes in the "tariff revenues collected and domestic support" section of Table 19 are driven mainly by the reduction in import tariff revenue to the EU budget.

The changes at a sectoral level arising from the agricultural trade liberalisation simulation can be seen in the first panel of Table 11.1. Although the market price of nearly all agricultural commodities falls, the effects on agricultural sectors in Ireland are varied.²⁶

There are large drops in production of cattle and sheep and in the output of the beef and sheepmeat processing sector. Imports of beef and sheepmeat, as well as sugar, increase as tariffs on imports are reduced. Exports of beef and sheepmeat, other meat products and dairy products fall. Figure 4.1 shows the changes in exports by destination market. There is a strong switch in export destinations from non-EU to EU markets (or, in the case of beef and sheepmeat, a much greater fall in exports to non-EU markets than in to EU markets). Whilst the percentage changes in trade for the other meat products, raw milk, dairy and sugar sectors appear impressive in Figures 4.1 and 4.5, it can be seen from Table 11.1 that they are starting from a very low base in value terms. The reduction in resource use in agriculture allows an expansion in the output of most non-agricultural sectors.

Manufacturing Liberalisation

Table 8.3 shows the Irish economy gains by 0.05 per cent of GDP from further trade liberalisation in industrial goods, close to the overall gain for the world economy from this simulation and much greater in relative size compared to other EU regions. The welfare decomposition (Figure 3) shows that the gain in this simulation arises mostly from liberalisation among industrialised countries. This result for Ireland is not typical of those for ICs. The results show, in general, that ICs benefit more from liberalisation by the DCs, as this allows them access to markets in regions previously protected by high tariffs and they do not incur the terms of trade losses they suffer in the case of IC liberalisation (as discussed in Section 3.3.1).

²⁶ The change in market prices in simulations as shown in Table 11 is relative to the change in the consumer price index (CPI) in Ireland. Tables 13 and 14 provide more detailed information on price changes across all simulations. Note that all prices are initially equal one; changes are shown relative to the numeraire.

Table 16.2 presents an alternative decomposition of the welfare effects of this simulation on Ireland.²⁷ Liberalisation of tariffs on trade between Ireland and the rest of the EU has zero effect as these tariffs are already set to zero (Subtotals 1 and 3 in Table 16.2). The welfare gains to Ireland from this simulation are generated from opening of third country markets (i.e., non-EU) to Irish exporters and the reduction of barriers to import of goods from those regions to Ireland (Subtotals 2 and 4). Subtotal 2 is the main source of the gains in allocative efficiency reported in Table 10. Ireland suffers a welfare loss from the liberalisation of trade between the rest of the EU and third countries as indicated in the final three subtotals in Table 16.2. This is driven by lower cost goods from third countries replacing some Irish exports to the rest of the EU and to other third countries. Figure 4.2 confirms that Irish exports to the EU fall across all manufacturing sectors. However, overall industrial exports from Ireland increase in value terms by approximately \$200 million.

The reduction of import tariffs in this simulation causes a fall in world prices that impacts negatively on net-exporters of manufacturing commodities.²⁸ Because expenditure on imports increases, countries must export more to pay for these imports and this drives down the price of export goods. Whilst this result is consistent across all countries, there is a second terms of trade effect at work. Due to the large share of Irish exports destined for EU markets, the fall in Irish export prices is lower than the fall of other EU countries. As much of Ireland's trade is with other EU countries, the reduction of import tariffs following WTO liberalisation does not lead to as substantial an increase in imports into Ireland as faced by other countries. The pressure on Irish exporters to increase competitiveness and so increase exports is therefore also less relative to other countries which must raise the level of their exports to maintain their trade balance. EU members that trade more with third countries, usually ICs, face a greater terms of trade loss because a larger share of their exports face lower world

²⁷ The results for Ireland are decomposed into seven subtotals representing the impact of reducing Irish import tariffs on goods from the EU (1) and from third countries (2) and the reduction on tariffs on Irish exports to the EU (3) and to the rest of the world (4). The values of sub-totals (1) and (3) are, of course, zero because of the customs union but are included for logical completeness. The final two subtotals calculate the impact on Ireland of the reductions in EU tariffs on goods from the rest of the world (5) and of rest of the world tariffs on EU exports (excluding Ireland) (6). Subtotal (7) calculates the residual effect from trade liberalisation between third regions. The total welfare gain (\$373million) is equal to the outcome shown in Table 5.3 less the EU budgetary effect.

²⁸ Statements about price changes arising from a simulation must be interpreted in the context of the model closure. Because all prices are endogenous in a CGE model, one price (or price index) must be chosen as a numeraire in which to express relative price changes. In this model, the numeraire is a composite world price index of primary factors. Thus, a reduction in world import prices relative to this fixed basket of factor prices implies a real increase in wages (factor returns).

prices due to the reduction in import tariffs. This translates into a relative terms of trade gain for Ireland.²⁹ In terms of contribution to welfare, it exceeds the loss due to lower world prices and leads to the small terms of trade gain for Ireland in this simulation (Table 10). For most ICs, the terms of trade effect has a negative impact on welfare.

The second panel of Table 11.1 shows the impact at the sectoral level of liberalisation of trade in industrial goods. The effect is mixed. Overall, the changes in output in manufacturing sectors are quite small. In value terms, the largest reductions are in transport equipment, electronic equipment and other industrial products, although they are small in percentage terms (1.16 per cent, 1.48 per cent and 0.86 per cent per cent fall respectively). There is a sharper percentage fall in the output of the textiles and clothing sector. However, output increases in the chemicals and pharmaceutical products and mineral and metal products sectors, as well as in most services sectors.

In all of the sectors in which output expands, the additional output is to supply increased demand for Irish exports. As noted above, Figure 4.2 indicates the general pattern is an increase in Irish exports to DCs and other ICs, with some decreases in exports to other EU regions. Imports of manufacturing goods into Ireland show a similar picture (Figure 4.6) with large increases from other ICs and DCs reflecting lower barriers to imports from these countries, although it should be noted in value terms these changes are lower than those for exports.

Chemical and petroleum products and electronic equipment account for approximately 50 per cent and 25 per cent of Irish exports of industrial goods in 2014 pre-liberalisation. The domestic output of the former increases 0.56 per cent in simulation 2 whereas production of latter falls 0.86 per cent. How to explain these disparate trends? Domestic demand for both falls, as Irish producers substitute towards imported intermediates as their price decreases due to the lower import tariffs. The differences in the output changes are explained by changes in export demand.

²⁹ The calculation of this relative terms of trade effect is only possible when commodity varieties from different regions are treated as imperfect substitutes – as is the case with the Armington assumption in GTAP. See Appendix Section 2.1.4.

Export demand for chemical and petroleum products rises. While exports of these products to many EU markets fall, exports from this sector to the USA increase. The decrease in demand for Irish exports in the EU is due to tariff cuts on imports from third countries into the EU, resulting in Irish exports to other EU countries being pushed out of some markets. However, consumers and firms in the USA are substituting towards Irish exports. This arises because the price of Irish exports into the US fall by more than the decrease in composite import prices for the US (i.e., the price of Irish exports to the US falls by more than the average for exports from other regions). This results from the tariff on Irish exports of chemical and petroleum products being higher initially than for many other ICs, hence a 50 per cent cut in tariffs implies a greater reduction in the price of Irish goods.

For electronic equipment, the demand for Irish exports falls. Exports to the rest of the EU decrease for the same reason as chemical and petroleum products (increased competition from third country exporters). In addition, in terms of export market shares, EU destinations are more important for electronic equipment than for chemical and petroleum products. Exports of electronic equipment to the USA also decrease. In this sector, the effective tariff rate is zero for Irish exports to the USA; there is therefore no gain from the reduction in tariffs.

Table 8.3 indicates that the relative importance of IC liberalisation for the Irish economy compared to DC liberalisation of manufactures. The large share of Irish exports destined to the EU implies that the export price Irish producers receive is protected to a large degree from the fall in world prices and resulting terms of trade losses from IC liberalisation. However, as Table 16.2 shows, there are strong benefits to Ireland from DC liberalisation as it allows Irish exporters to find new markets for goods pushed out of EU markets.

Services Trade Liberalisation

The decomposition of the results of Simulation 3 for Ireland (Figure 3) indicates that the welfare gains arise almost entirely from trade liberalisation by industrialised countries. Due to the nature of the shock, a productivity increase to imports of service sectors to reflect a reduction in non-tariff barriers, it is expected that imports would increase in all

service sectors as shown in Table 11.2. Despite relatively strong increases in the export of these commodities, domestic production falls in trade, transport and business and financial services.

The change in imports by source shows a consistent pattern (Figure 4.7) of increased imports into Ireland from all non-EU regions in most sectors. As intra-EU trade was exempt from this liberalisation, imports of services from other EU regions are less competitive due to the shock. The growth in imports from DCs slightly exceeds those from the other ICs. On average, the tariff equivalents of barriers to trade in services were higher for DCs, therefore allowing for a larger relative impact on this group of countries and their exports. The dominance of the gains from IC liberalisation, as indicated in Figure 3, is due to efficiency gains achieved from replacing imports from the rest of the EU with relatively cheaper services from other sources.

As Figure 4.3 indicates there also gains to Irish exporters who, despite being pushed out of some EU markets by imports from third countries, are able to increase exports to other ICs and DCs. Overall in this simulation, the volume of exports of services from Ireland decreases, therefore the losses from the former must outweigh the gains from the latter. The terms of trade effect on Ireland in this simulation is relatively insignificant.

The impact on the domestic Irish market is mixed. The largest change is a 0.31 per cent fall in output in the business and financial services sector. Output increases in all manufacturing sectors and most agriculture sectors. As these sectors consume service commodities as intermediate inputs, they benefit from lower cost imports due to the liberalisation of the service trade. This contributes to the overall positive effect for the Irish economy from this simulation.

Trade Facilitation

Measures to further trade facilitation generate a negative welfare change for Ireland when implemented by ICs and DCs (Figure 3). This result is in line with most other EU regions. The welfare change arising from IC or DC trade liberalisation is markedly different.

Trade facilitation is modelled as a cost saving on imports into a region. It is a productivity shock and this generates positive welfare effects for Ireland (see Table 10) when implemented in the IC region (including by Ireland itself). When DC liberalisation occurs there is a term of trade loss, due to lower export prices received by Irish producers. This arises because of the greater competition in export markets as DCs strive to increase their exports to balance the increase in imports from the trade facilitation shock.

Measures to improve trade facilitation when implemented by Ireland generate welfare gains due to the allocative efficiency gains from reducing the costs of imports into Ireland. In the case of the IC trade facilitation, this gain counters the terms of trade loss. In the DC subtotal, however, the terms of trade loss is not compensated by increased trade efficiency at home, thus Ireland experiences a negative welfare effect. That intra-EU trade, and thus a large share of Irish trade, is excluded from the positive productivity shock exacerbates the impact of the adverse terms of trade effect for Ireland.

On a sectoral level, the results for Ireland are mixed (Table 11.2). Output of chemical and petroleum products, transport equipment, other primary product and dairy products fall. These sectors show increase in output, such as other processed food products, electronic equipment and several agricultural sectors register the large increases. The production in most service sectors increases, driven by a strong growth in demand for Irish exports. While the trade facilitation shock only applies to agricultural and industrial sectors, services benefit from lower prices and decreased costs. They can increase production in response to higher demand for services.

Export growth is not limited to the service sector as Figure 4.4 shows. Irish exports to non-EU regions increase for nearly all sectors (only extra-EU trade was subject to the facilitation shock in this scenario). Whilst in agricultural and manufacturing sectors there is some substitution among imports from EU regions to non-EU due to the decrease in their price (Figure 4.8), in services there is an expansion of EU imports into Ireland and Irish exports to the EU.

3.3.3 Results for Developing Countries

Eight of the twenty regions disaggregated in this study are considered to be developing countries (DCs) or regions. This section presents the results for DCs overall initially, before focusing on two of these groups of countries in more detail: the Everything But Arms (EBA) region and the Rest of the African-Caribbean-Pacific (ACP) region. These regions are selected for two reasons. Firstly, between them these regions represent most of the poorest countries in the study. Secondly, despite their similarities, they experience very different outcomes from further trade liberalisation as simulated in this report. Comparison of the two illustrates the challenges and opportunities for DCs in the Doha Round.

Overall Impact of Further Trade Liberalisation on Developing Countries

As indicated in Table 8.1 and in subsequent tables, DCs as a whole benefit from further trade liberalisation. In GDP terms, China, Rest of ACP, Rest of Asia and India are the regions that experience the biggest gains from this liberalisation.

This result holds in general across the four simulations, with the possible exception of Simulation 1 in which the results are more mixed. For most commodities, other than agriculture, DCs face import tariffs higher than those they levy themselves. DCs gain from improved access to markets for their exports and, for most regions, achieve allocative efficiency improvements as their own protection is reduced. Table 9 illustrates the importance to DCs of liberalisation within their own group of countries (43.9 per cent of the global gains), compared to liberalisation by ICs (10.1 per cent).

Changes in wages are shown in Table 15, calculated as the change in ratio of the return to skilled and unskilled labour to the CPI in each region, respectively. These results reinforce the welfare change results. Regions that enjoy improved welfare from liberalisation will also see return to labour also increase.

As indicated in Table 8.1, the EBA group of countries experiences a relatively small welfare improvement in GDP terms, compared to other developing regions. By contrast, the Rest of ACP region is the one of the biggest winners in GDP terms. By comparing the results of Simulations 1 and 2 for these regions (their results for Simulations 3 and 4

are relatively consistent), we can identify and examine the two principal reasons for these differences: (i) the importance of allocative efficiency gains; and (ii) the impact of the erosion of preferential access to the IC markets.

Allocative Efficiency Effects

As already noted, for most regions in this study, the major benefits are driven by their own trade liberalisation and the improvements in allocative efficiency that arise from the elimination of their own barriers to trade. This is illustrated by the plight of the EBA region. Special and differential treatment of developing countries implies that this region, composed of the least developed economies in the world, is exempt from commitments to liberalise. Their lack of liberalisation means they do not enjoy the gains in allocative efficiency that other regions achieve. This contrasts sharply with the outcome for the Rest of ACP group, which gains in welfare terms in all four simulations.

Erosion of Preferences

The second loss from trade liberalisation faced by the EBA region and, to a lesser degree, the Rest of ACP group arises from a loss of preferential access to EU markets. Under the EBA Agreement, implemented in the baseline, all exports from this region receive tariff free access to EU markets. The Rest of ACP also receives preferential access to EU markets, granted under the Cotonou Agreement. However, the preference margin is considerably smaller as tariffs are still imposed on imports of many commodities from this region to the EU (see Table 5.5).

As tariffs on EBA exports to the EU (and, indeed, also to the US) are already abolished, further liberalisation is not possible between regions. However, the Common External Tariff of the EU, imposed on imports of third countries entering the EU, is reduced as part of the liberalisation process and thus third countries get to sell their goods more cheaply on the EU market. This erodes the preference margin of the EBA region exporters against third country producers and they face increased competition on EU markets.

Tables 17 and 18 show an alternative decomposition of the welfare effects of the tariff liberalisation elements of Simulations 1 and 2 on the EBA and Rest of ACP regions respectively. In Tables 17.1 and 18.1, the effect of reducing tariffs on agricultural goods from the region in question to the EU (Subtotal 3) illustrates the gains achieved by the Rest of ACP region from cuts in the tariffs faced by their exports to the EU (\$727 million) compared to same effect for the EBA region (\$0 as no such barriers remain to be cut). Subtotal 7 in Tables 17.2 and 18.2 (tariffs on industrial goods from third countries to the EU) shows that, as expected, the adverse impact of erosion of preferences is greater for the EBA as third country exporters gain greater access to EU markets.³⁰

3.4 Sensitivity Analysis

The results of any CGE analysis are dependent of the parameters and assumptions of the model and database. In this section, the robustness of several such assumptions underlying the model is tested.

3.4.1 Armington Elasticities

As noted above, the GTAP model assumes that products are differentiated by source following the Armington assumption (Armington, 1969) – imports and domestic production, as well as imports from different sources, are treated as imperfect substitutes. The Armington assumption is described in more detail in the Appendix section 2.1.4.

Given the role of the Armington elasticities in determining substitution between domestic and foreign produced goods in the model, the results of trade liberalisation scenarios are sensitivity to the values assumed for these elasticities. Recent research (Hummels, 1999, and Hertel *et al.*, 2003) suggests that the values of the Armington elasticities in the GTAP version 5 database were too low (these values are shown in Appendix Table A2). Their estimates suggest that the values should be approximately doubled and these results were adopted in the construction of the version 6 database and

³⁰ Whilst it might be expected that this Subtotal would also be negative (but of smaller magnitude) for the Rest of ACP region, it should be noted that welfare measures also captures some impacts on the terms of trade that may benefit the region.

used in this report. Table 20 shows the values assumed here for the sectoral aggregation chosen.

The GTAP model includes a programme to analysis the sensitivity of the outcome of simulation to the parameter values chosen. An example of this sensitivity analysis applied to the results of Simulation 4 is shown in Table 21. The first column shows the welfare change due of the simulation (less the EU budgetary effect shown in Table 8.5). The second and third columns indicate the mean and variance of this result when this experiment is repeated and a probability distribution is created for the parameter in question. In this case, the parameter is the Armington elasticity and the distribution is specified such that the elasticity varies between 50 per cent above and below its currently calibrated value. In the final column, Chebyshev's inequality (Hogg and Craig, 1970) is used to create a 95 per cent confidence interval for each result.

Only one variable (change in welfare measured as equivalent variation) is reported here, however the results for each endogenous variable in the model may be calculated. It is clear from Table 21 that the outcome of the simulation is extremely sensitive to the parameter values chosen. This underlines the importance of selection of such values. As noted above, the values used in this analysis are based on the most recent and detailed research currently available (Hertel *et al.*, 2003).

To further illustrate the sensitivity of the results to the Armington elasticities, the agricultural trade liberalisation (Simulation 1) is re-run with the values for the Armington elasticities for all agricultural commodities increased by 50 per cent. The results of this alternative Simulation 1 are shown in Table 22. Compared the results of the simulation using the Armingtons in the standard GTAP model (Table 8.2), welfare change has approximately doubled for most regions, with some exceptions.

3.4.2 Sensitivity of the Baseline

As described in Section 2, the construction of the baseline requires a number of assumptions and in some cases the use of secondary data sources. An additional experiment is implemented to assess the sensitivity of the model results to changes in this baseline.

Two new, simplified versions of the baseline (2001-2014) are created, consisting only of macro-economic projections and accession of China into the WTO. Baseline 1 uses the same macro-economic projections as before (see Table 2). Baseline 2 is based on the same projections, however the growth rate for the Chinese economy is reduced by half. A 50 per cent tariff cut is then applied to both baselines. The resulting overall welfare effects are reported in Table 23. The sensitivity of the results is low. For example, the welfare gain to Ireland decreases by 0.5 per cent with the use of the lower growth rate for China.

4 Conclusions

This report provides a quantitative study of the economic effects of a stylised series of further trade liberalisation simulations for Ireland. The GTAP model is used to estimate the potential effects on the Irish economy of a successful conclusion to the Doha Round.

Trade liberalisation as simulated in this report consists of four scenarios, focused on agriculture, industry, services and trade facilitation. These simulations are implemented against a baseline projection of the Irish and world economy over the next decade.

The shocks do not represent attempts to model specific modalities of the ongoing negotiations, rather they are broad measures designed to generate results that will be indicative of future changes. Particular attention is given to comparing the differences in results of liberalisation by industrialised countries and by developing countries.

For Ireland, the results of further liberalisation are strongly positive. Two of the four simulations individually generate welfare gains, while agricultural trade liberalisation has a slightly negative effect on the overall economy as does improved trade facilitation. The gains from the liberalisation of service trade are particularly strong. This and the increased liberalisation of the industrial trade produce unambiguous gains for Irish welfare. The negative effect from agricultural trade liberalisation arises because gains in allocative efficiency from lower agricultural protection are offset by the loss of net transfers from the EU agricultural budget as export subsidies are eliminated. The small loss in welfare due to trade facilitation is driven by terms of trade effects from improvements in trade facilitation in other countries. Trade facilitation by Ireland itself has a positive impact on welfare.

The study draws important conclusions for the outcome of the simulations for developing countries. Most developing regions can expect strong positive results from a successful conclusion to the Round. However, this result is driven by the large expected gains from improved trade facilitation. These gains depend on measures to be taken by developing countries themselves, and whether they will materialise must be uncertain.

The more direct impact of the removal of trade barriers is more ambiguous. One important conclusion is that the gains to developing countries from further liberalisation of industrial trade are likely to exceed those they can expect from further liberalisation of services trade and, a fortiori, from further liberalisation of agricultural trade. This also holds true even if liberalisation by industrialised countries only is considered. In the case of agricultural trade liberalisation, the Mercosur group, non-least-developed ACP countries and the Rest of the World (which includes Australia, New Zealand and South Africa) will benefit significantly. However, EBA countries and Mediterranean countries will lose because of the erosion of their benefits from preferential access to industrialised country markets. The gains from industrial trade liberalisation are more broadly based, with strong gains going to China, India, the Rest of Asia, Mediterranean countries, the Rest of the World and the more developed ACP countries. However, once again, EBA countries are likely to be hurt because of the erosion of the benefits of their current preferential access, not least in the EU market. If all developing countries are to profit from the Doha Round, the issue of preference erosion, which particularly affects the poorest and most vulnerable developing countries, will have to be addressed. Development assistance to help these countries to improve their supply-side responses may be more important than further trade liberalisation per se.

Tables

Table 1.1: Regional and Sectoral Aggregation

Label	Region	Label	Sector
IRE	Ireland	CROP	Cereals, other crops and horticulture
UK	United Kingdom	SUGA	Sugar, plants and processed
GER	Germany	CATTLE	Cattle and sheep
FRA	France	OTHLIV	Other livestock (swine, poultry...)
EU11	Rest of EU15	MILK	Raw milk
CEEC	New Members / Accession countries	BEEF	Beef & sheepmeat (+wool)
USA	USA	OTHMEAT	Other meat products
CAN	Canada	DAIRY	Dairy
CHINA	China	BEV	Beverages and tobacco
INDIA	India	PROCF	Other processed food products
EBA	Everything-But-Arms group of countries	OTHPRIM	Other primary products (extraction industries, fishing & forestry)
MERC	Mercosur	TEXT	Textiles, leather and clothing
XACP	Rest of African Caribbean Pacific countries	CHEMPET	Chemical and petroleum products
FSU	Former Soviet Union countries	MINMET	Mineral and metal products
HIAC	High Income Asian Countries	TSPEQ	Transport equipment
XEFTA	Rest of European Free Trade Area	ELEC	Electronic equipment
XASIA	Rest of Asia	OTHIND	Other industries
XLAT	Rest of Latin America	TRADE	Trade services
MED	Turkey, Middle-East and North Africa	TSPORT	Transport services
ROW	Rest of the World	BFSVC	Business and financial services
		SVCPRIV	Other private services
		UTILPUB	Utilities and public services

Table 1.2: Mapping of GTAP Sectors and Regions

GTAP Sector		GTAP Region		GTAP Region	
CROP	Paddy rice	ROW	Australia	CEEC	Cyprus
CROP	Wheat	ROW	New Zealand	CEEC	Czech Republic
CROP	Cereal grains nec	ROW	Rest of Oceania	CEEC	Hungary
CROP	Vegetables, fruit, nuts	CHINA	China	CEEC	Malta
CROP	Oil seeds	HIAC	Hong Kong	CEEC	Poland
SUGA	Sugar cane, sugar beet	HIAC	Japan	CEEC	Romania
CROP	Plant-based fibers	HIAC	Korea	CEEC	Slovakia
CROP	Crops nec	HIAC	Taiwan	CEEC	Slovenia
CATTLE	Cattle,sheep,goats,horses	XASIA	Rest of East Asia	CEEC	Estonia
OTH LIV	Animal products nec	XASIA	Indonesia	CEEC	Latvia
MILK	Raw milk	XASIA	Malaysia	CEEC	Lithuania
BEEF	Wool, silk-worm cocoons	XASIA	Philippines	FSU	Russian Federation
OTH PRIM	Forestry	HIAC	Singapore	FSU	Rest of Former Soviet Union
OTH PRIM	Fishing	XASIA	Thailand	MED	Turkey
OTH PRIM	Coal	XASIA	Vietnam	MED	Rest of Middle East
OTH PRIM	Oil	EBA	Rest of Southeast Asia	MED	Morocco
OTH PRIM	Gas	EBA	Bangladesh	MED	Tunisia
OTH PRIM	Minerals nec	INDIA	India	MED	Rest of North Africa
BEEF	Meat: cattle,sheep,goats,horse	XASIA	Sri Lanka	XACP	Botswana
OTH MEAT	Meat products nec	EBA	Rest of South Asia	ROW	South Africa
PROCF	Vegetable oils and fats	CAN	Canada	ROW	Rest of South African CU
DAIRY	Dairy products	USA	United States	EBA	Malawi
PROCF	Processed rice	XLAT	Mexico	EBA	Mozambique
SUGA	Sugar	ROW	Rest of North America	EBA	Tanzania
PROCF	Food products nec	XLAT	Colombia	EBA	Zambia
BEV	Beverages and tobacco products	XLAT	Peru	XACP	Zimbabwe
TEXT	Textiles	XLAT	Venezuela	EBA	Rest of SADC
TEXT	Wearing apparel	XLAT	Rest of Andean Pact	EBA	Madagascar
TEXT	Leather products	MERC	Argentina	EBA	Uganda
OTH IND	Wood products	MERC	Brazil	EBA	Rest of Sub-Saharan Africa
OTH IND	Paper products, publishing	XLAT	Chile		
CHEMPET	Petroleum, coal products	MERC	Uruguay		
CHEMPET	Chemical,rubber,plastic prods	XLAT	Rest of South America		
MINMET	Mineral products nec	XACP	Central America		
MINMET	Ferrous metals	XLAT	Rest of FTAA		
MINMET	Metals nec	XACP	Rest of the Caribbean		
MINMET	Metal products	EU11	Austria		
TSPEQ	Motor vehicles and parts	EU11	Belgium		
TSPEQ	Transport equipment nec	EU11	Denmark		
ELEC	Electronic equipment	EU11	Finland		
OTH IND	Machinery and equipment nec	FRA	France		
OTH IND	Manufactures nec	GER	Germany		
UTILPUB	Electricity	UK	United Kingdom		
UTILPUB	Gas manufacture, distribution	EU11	Greece		
UTILPUB	Water	IRE	Ireland		
SVCPRIV	Construction	EU11	Italy		
TRADE	Trade	EU11	Luxembourg		
TSPORT	Transport nec	EU11	Netherlands		
TSPORT	Sea transport	EU11	Portugal		
TSPORT	Air transport	EU11	Spain		
UTILPUB	Communication	EU11	Sweden		
BFSVC	Financial services nec	XEFTA	Switzerland		
BFSVC	Insurance	XEFTA	Rest of EFTA		
BFSVC	Business services nec	ROW	Rest of Europe		
SVCPRIV	Recreation and other services	ROW	Albania		
UTILPUB	PubAdmin/Defence/Health/Education	CEEC	Bulgaria		
SVCPRIV	Dwellings	ROW	Croatia		

Table 2: Macro-Projections used in the Baseline 2001-2014.
Annual Growth Rates and Total Change over the Period 2001-2014 (both in %).

	GDP		Unskilled Labour		Skilled Labour		Population		Capital	
	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total
IRE	4.61	79.57	0.77	10.51	0.51	6.80	0.77	10.50	6.86	136.88
UK	2.52	38.20	0.18	2.37	0.09	1.18	0.02	0.26	2.66	40.67
GER	2.50	37.83	-0.33	-4.23	-0.59	-7.41	-0.29	-3.76	2.25	33.62
FRA	2.43	36.60	0.28	3.64	0.01	0.13	0.28	3.69	2.07	30.54
EU11	2.79	42.97	-0.19	-2.41	-0.55	-6.91	0.00	0.06	3.14	49.43
CEEC	4.54	78.11	0.29	3.90	0.00	0.02	0.22	2.95	3.87	63.82
USA	2.66	40.76	0.54	7.25	0.56	7.47	0.81	11.03	3.13	49.27
CAN	2.68	41.10	0.75	10.22	0.45	6.07	0.80	10.88	3.66	59.61
CHINA	7.46	154.85	0.92	12.63	3.98	66.04	0.73	9.88	8.97	205.35
INDIA	4.84	84.79	1.75	25.29	4.83	84.66	1.50	21.33	5.36	97.16
EBA	4.33	73.42	2.94	45.78	3.50	56.30	2.60	39.66	3.74	61.20
MERC	3.78	61.92	3.79	62.21	3.72	60.68	1.22	17.05	3.79	62.12
XACP	3.58	57.92	2.05	30.25	3.65	59.33	1.87	27.25	3.13	49.30
FSU	4.08	68.09	0.57	7.71	0.77	10.54	0.47	6.31	2.48	37.51
HIAC	2.51	38.08	-0.24	-3.13	-0.13	-1.67	0.36	4.79	2.88	44.72
XEFTA	2.15	31.87	0.24	3.12	-0.14	-1.84	0.17	2.23	2.58	39.29
XASIA	4.74	82.52	2.19	32.48	4.46	76.28	1.83	26.62	4.86	85.42
XLAT	4.37	74.33	1.30	18.34	4.84	84.85	1.49	21.27	4.63	80.08
MED	3.68	59.89	2.56	38.84	4.73	82.47	2.39	35.91	2.48	37.54
ROW	3.97	65.80	1.91	27.95	2.74	42.08	1.41	19.99	3.61	58.49

Source: Own calculations, Brockmeier *et al.* (2003), Frandsen and Jensen (2003) and ESRI (2003).

Note: Region acronyms explained in Table 1.1

Table 3.1: Structure of the Irish Economy in 2001
(2001 US\$Millions)

2001	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	Intra-EU	Extra-EU	Intra-EU	Extra-EU			
Crops	261	40	410	285	1,069	1,462	0.73
Sugar	7	5	48	19	152	208	0.73
Cattle and sheep	93	86	110	64	1,303	1,298	1.00
Other livestock	123	22	31	9	391	287	1.36
Raw milk	0	1	0	1	1,361	1,362	1.00
Beef & sheepmeat	839	74	46	40	2,033	1,207	1.68
Other meat products	371	37	343	25	953	914	1.04
Dairy products	849	255	242	6	3,139	2,282	1.38
Beverages and tobacco	524	348	406	113	1,909	1,556	1.23
Other processed food products	1,578	981	1,222	341	4,299	3,302	1.30
Other primary products	329	39	495	614	884	1,624	0.54
Textiles, leather and clothing	824	209	1,863	659	1,490	2,978	0.50
Chemical & petroleum products	13,645	15,384	5,341	2,458	31,629	10,399	3.04
Mineral & metal products	2,029	624	2,518	490	7,006	7,362	0.95
Transport equipment	747	129	2,639	1,386	7,889	11,038	0.71
Electronic equipment	11,384	6,557	9,863	7,344	18,503	17,770	1.04
Other industries	6,947	4,481	7,231	3,974	17,140	16,916	1.01
Trade services	350	388	3,252	3,790	11,631	17,934	0.65
Transport services	870	1,320	563	872	5,432	4,677	1.16
Business & financial services	7,913	6,794	6,621	7,056	27,415	26,385	1.04
Other private services	531	538	279	279	34,030	33,519	1.02
Utilities & public services	745	919	322	633	26,242	25,532	1.03

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.
Source: GTAP Version 6.0 database.

Table 3.2: Structure of the Irish Economy in 2014
(2001 US\$Millions)

2014	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	Intra-EU	Extra-EU	Intra-EU	Extra-EU			
Crops	160	23	486	499	1,127	1,930	0.58
Sugar	1	3	73	37	152	257	0.59
Cattle and sheep	176	69	17	96	1,249	1,117	1.12
Other livestock	105	20	27	12	413	327	1.26
Raw milk	0	0	0	3	1,392	1,396	1.00
Beef & sheepmeat	425	28	61	99	1,724	1,431	1.20
Other meat products	341	35	428	60	1,017	1,130	0.90
Dairy products	519	124	263	26	3,043	2,689	1.13
Beverages and tobacco	620	440	563	166	2,526	2,194	1.15
Other processed food products	2,046	1,882	1,655	513	5,907	4,146	1.42
Other primary products	212	51	825	917	1,202	2,681	0.45
Textiles, leather and clothing	303	117	1,552	2,412	867	4,410	0.20
Chemical & petroleum products	43,540	54,388	14,130	5,880	105,027	27,108	3.87
Mineral & metal products	2,428	927	4,610	983	11,211	13,449	0.83
Transport equipment	549	95	5,305	3,221	13,085	20,967	0.62
Electronic equipment	15,275	7,910	11,266	13,550	24,481	26,112	0.94
Other industries	8,979	5,020	9,948	7,576	23,927	27,451	0.87
Trade services	410	513	5,487	8,144	21,058	33,766	0.62
Transport services	964	1,495	897	1,582	8,146	8,165	1.00
Business & financial services	7,509	6,795	12,568	14,453	37,179	49,896	0.75
Other private services	662	685	524	559	62,605	62,343	1.00
Utilities & public services	626	761	600	1,373	41,647	42,233	0.99

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.

Source: GTAP model simulation results.

Table 3.3: Change in the Irish Economy in 2001-2014 – Sectoral Changes

2001 -2014	Change in Exports		Change in Imports		Change in Output		Change in Domestic Consumption		Change in Trade Balance (\$M)	Change in Self Sufficiency
	\$M	%	\$M	%	\$M	%	\$M	%		
Crops	-118	-39	291	42	58	5	468	32	-410	-0.15
Sugar	-7	-63	42	62	0	0	50	24	-50	-0.14
Cattle and sheep	66	37	-62	-35	-54	-4	-182	-14	128	0.12
Other livestock	-20	-13	-1	-2	22	6	40	14	-19	-0.10
Raw milk	-1	0	2	0	31	2	34	2	-3	0.00
Beef & sheepmeat	-459	-50	74	86	-309	-15	224	19	-533	-0.48
Other meat products	-32	-8	119	32	64	7	216	24	-152	-0.14
Dairy products	-461	-42	41	17	-95	-3	407	18	-502	-0.24
Beverages and tobacco	188	22	210	40	617	32	638	41	-22	-0.08
Other processed food products	1,369	53	605	39	1,608	37	844	26	764	0.12
Other primary products	-105	-29	634	57	318	36	1,057	65	-739	-0.10
Textiles, leather and clothing	-613	-59	1,442	57	-623	-42	1,432	48	-2,055	-0.30
Chemical & petroleum products	68,899	237	12,210	157	73,398	232	16,709	161	56,689	0.83
Mineral & metal products	702	26	2,585	86	4,204	60	6,088	83	-1,883	-0.12
Transport equipment	-232	-26	4,501	112	5,196	66	9,929	90	-4,733	-0.09
Electronic equipment	5,244	29	7,609	44	5,978	32	8,343	47	-2,365	-0.10
Other industries	2,572	23	6,319	56	6,787	40	10,534	62	-3,748	-0.14
Trade services	185	25	6,590	94	9,427	81	15,832	88	-6,405	-0.02
Transport services	269	12	1,044	73	2,714	50	3,488	75	-774	-0.16
Business & financial services	-403	-3	13,343	98	9,764	36	23,511	89	-13,746	-0.29
Other private services	278	26	526	94	28,575	84	28,823	86	-248	-0.01
Utilities & public services	-277	-17	1,019	107	15,405	59	16,701	65	-1,296	-0.04

Source: GTAP model simulation results.

Table 3.4: Change in the Irish Economy in 2001-2014 – Aggregate Changes

	Output (\$M)			Share of GDP		Share of Value of Returns to Labour by Sector					
	2001	2014	Growth Rate	2001	2014	Unskilled Labour		Skilled Labour		Total Labour Force	
						2001	2014	2001	2014	2001	2014
Agriculture	10,402	10,118	-3%	3%	2%	5%	4%	1%	1%	3%	3%
Manufacturing	90,748	188,231	107%	47%	48%	44%	44%	32%	32%	39%	39%
Services	104,750	170,635	63%	51%	50%	51%	52%	67%	67%	58%	58%
Total	205,900	368,985	79%	100%	100%	100%	100%	100%	100%	100%	100%

Source: GTAP model simulation results.

Table 3.5: Applied Trade Protection for Ireland in 2001 and 2014
(Trade-weighted Averages in %)

2001	Extra-EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	13.0	6.0	5.3	0.8
Sugar	24.5	53.2	7.7	24.4
Cattle and sheep	1.0	0.4	0.4	0.2
Other livestock	0.8	1.2	0.2	0.3
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	99.1	10.8	46.0	1.4
Other meat products	19.6	37.1	1.4	3.6
Dairy products	28.1	9.3	0.7	2.2
Beverages and tobacco	5.1	3.5	1.1	1.8
Other processed food products	22.2	12.4	4.9	5.1
Other primary products	0.0	3.8	0.0	0.4
Textiles, leather and clothing	6.8	9.9	1.8	2.2
Chemical & petroleum products	2.1	2.9	0.7	1.5
Mineral & metal products	2.5	9.2	0.5	2.2
Transport equipment	3.2	2.9	1.1	0.4
Electronic equipment	0.1	1.1	0.0	0.4
Other industries	0.9	1.8	0.3	0.7
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.0	0.0

2014	Extra-EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	12.4	6.8	6.3	0.9
Sugar	17.9	63.6	6.0	49.4
Cattle and sheep	0.9	0.6	0.8	0.2
Other livestock	0.8	1.6	0.2	0.3
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	90.7	11.3	56.3	0.7
Other meat products	19.2	32.1	2.4	3.0
Dairy products	28.5	11.1	2.5	2.1
Beverages and tobacco	5.1	5.1	1.2	2.1
Other processed food products	22.1	12.5	5.2	6.0
Other primary products	0.0	3.9	0.0	0.8
Textiles, leather and clothing	9.1	10.9	5.5	3.1
Chemical & petroleum products	2.1	3.3	0.6	1.8
Mineral & metal products	2.4	9.5	0.4	2.6
Transport equipment	2.9	3.0	1.1	0.4
Electronic equipment	0.1	1.6	0.1	0.6
Other industries	0.9	2.2	0.4	0.8
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.0	0.0

Source: GTAP Version 6.0 database and model simulation results.

Table 4.1: Structure of the EBA Region Economy in 2001
(2001 US\$Millions)

2001	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	EU	Non-EU	EU	Non-EU			
Crops	4,020	4,202	663	4,025	69,904	66,370	1.05
Sugar	399	153	60	637	10,411	10,556	0.99
Cattle and sheep	10	84	1	89	10,288	10,284	1.00
Other livestock	112	148	42	87	6,759	6,626	1.02
Raw milk	3	5	1	2	4,447	4,441	1.00
Beef & sheepmeat	12	47	57	227	3,641	3,865	0.94
Other meat products	25	153	292	313	4,838	5,265	0.92
Dairy products	10	29	637	419	1,741	2,759	0.63
Beverages and tobacco	54	168	905	1,082	20,019	21,784	0.92
Other processed food products	2,113	1,992	1,941	5,512	41,588	44,936	0.93
Other primary products	6,998	22,207	75	1,868	63,675	36,413	1.75
Textiles, leather and clothing	7,625	12,015	1,080	9,410	49,174	40,024	1.23
Chemical & petroleum products	518	1,981	5,657	12,996	27,520	43,674	0.63
Mineral & metal products	2,259	2,209	2,993	7,458	27,571	33,554	0.82
Transport equipment	862	601	4,580	8,265	11,870	23,253	0.51
Electronic equipment	116	162	1,793	2,518	4,016	8,049	0.50
Other industries	3,475	1,823	8,847	11,600	34,414	49,563	0.69
Trade services	565	683	1,110	1,731	71,032	72,626	0.98
Transport services	1,894	3,277	1,727	2,722	48,873	48,150	1.02
Business & financial services	1,427	2,069	3,604	4,415	46,917	51,440	0.91
Other private services	248	365	578	665	90,487	91,116	0.99
Utilities & public services	807	2,838	848	2,261	72,446	71,909	1.01

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.
Source: GTAP Version 6.0 database.

Table 4.2: Structure of the EBA Region Economy in 2014
(2001 US\$Millions)

2014	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	EU	Non-EU	EU	Non-EU			
Crops	5,528	4,389	819	7,715	104,676	103,293	1.01
Sugar	3,976	217	72	1,120	21,429	18,428	1.16
Cattle and sheep	24	180	1	181	18,325	18,302	1.00
Other livestock	104	135	67	175	11,626	11,628	1.00
Raw milk	0	0	1	13	7,532	7,546	1.00
Beef & sheepmeat	44	130	34	405	6,876	7,142	0.96
Other meat products	38	213	418	985	8,570	9,721	0.88
Dairy products	25	37	817	1,325	2,943	5,023	0.59
Beverages and tobacco	68	252	1,483	1,856	34,126	37,145	0.92
Other processed food products	1,900	2,286	3,272	10,234	62,999	72,318	0.87
Other primary products	2,269	13,296	301	2,397	97,452	84,584	1.15
Textiles, leather and clothing	8,673	12,519	1,059	17,254	69,662	66,783	1.04
Chemical & petroleum products	499	2,986	13,400	20,693	46,974	77,582	0.61
Mineral & metal products	4,079	4,475	4,530	13,611	50,776	60,364	0.84
Transport equipment	2,842	1,797	5,464	13,104	26,994	40,924	0.66
Electronic equipment	431	702	1,517	4,336	9,456	14,175	0.67
Other industries	7,648	3,479	9,811	22,010	66,633	87,328	0.76
Trade services	1,016	1,547	1,496	2,606	128,538	130,077	0.99
Transport services	3,722	6,657	2,434	4,399	94,181	90,635	1.04
Business & financial services	2,690	4,304	5,078	7,114	90,656	95,854	0.95
Other private services	398	607	907	1,120	155,924	156,946	0.99
Utilities & public services	1,709	6,120	1,246	3,944	151,863	149,224	1.02

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.
Source: GTAP model simulation results.

Table 4.3: Change in the EBA Region Economy in 2001-2014 – Sectoral Changes

2001 -2014	Change in Exports		Change in Imports		Change in Output		Change in Domestic Consumption		Change in Trade Balance (\$M)	Change in Self Sufficiency
	\$M	%	\$M	%	\$M	%	\$M	%		
Crops	1,695	21	3,847	82	34,772	50	36,923	56	-2,152	-0.04
Sugar	3,640	659	494	71	11,018	106	7,871	75	3,147	0.18
Cattle and sheep	110	118	91	101	8,037	78	8,018	78	19	0.00
Other livestock	-22	-8	113	89	4,867	72	5,002	75	-135	-0.02
Raw milk	-8	-92	12	573	3,085	69	3,105	70	-20	0.00
Beef & sheepmeat	115	194	156	55	3,235	89	3,276	85	-41	0.02
Other meat products	72	41	798	132	3,731	77	4,457	85	-725	-0.04
Dairy products	23	60	1,085	103	1,202	69	2,264	82	-1,062	-0.05
Beverages and tobacco	97	44	1,351	68	14,107	70	15,361	71	-1,253	0.00
Other processed food products	82	2	6,052	81	21,411	51	27,382	61	-5,971	-0.05
Other primary products	-13,640	-47	754	39	33,777	53	48,171	132	-14,395	-0.60
Textiles, leather and clothing	1,552	8	7,823	75	20,488	42	26,759	67	-6,271	-0.19
Chemical & petroleum products	986	39	15,441	83	19,454	71	33,908	78	-14,454	-0.02
Mineral & metal products	4,085	91	7,690	74	23,205	84	26,810	80	-3,605	0.02
Transport equipment	3,176	217	5,724	45	15,124	127	17,671	76	-2,547	0.15
Electronic equipment	854	307	1,541	36	5,440	135	6,126	76	-687	0.17
Other industries	5,829	110	11,374	56	32,219	94	37,764	76	-5,545	0.07
Trade services	1,315	105	1,261	44	57,506	81	57,452	79	55	0.01
Transport services	5,208	101	2,384	54	45,308	93	42,485	88	2,823	0.02
Business & financial services	3,498	100	4,174	52	43,739	93	44,414	86	-676	0.03
Other private services	391	64	783	63	65,438	72	65,830	72	-392	0.00
Utilities & public services	4,184	115	2,081	67	79,417	110	77,315	108	2,102	0.01

Source: GTAP model simulation results.

Table 4.4: Change in the EBA Region Economy in 2001-2014 – Aggregate Changes

	Output (\$M)			Share of GDP		Share of Value of Returns to Labour by Sector					
	2001	2014	Growth Rate	2001	2014	Unskilled Labour		Skilled Labour		Total Labour Force	
						2001	2014	2001	2014	2001	2014
Agriculture	112,029	181,977	62%	20%	21%	11%	27%	1%	1%	8%	21%
Manufacturing	279,847	465,073	66%	23%	25%	34%	18%	15%	9%	28%	16%
Services	329,754	621,162	88%	57%	54%	55%	56%	83%	90%	64%	63%
Total	721,631	1,268,212	76%	100%	100%	100%	100%	100%	100%	100%	100%

Source: GTAP model simulation results.

Table 4.5: Applied Trade Protection for EBA Region in 2001 and 2014
(Trade-weighted Averages in %)

2001	EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	17.9	3.5	9.9	8.7
Sugar	22.1	79.0	20.7	60.5
Cattle and sheep	7.8	0.4	14.1	11.3
Other livestock	25.4	0.5	15.3	1.8
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	13.6	3.1	12.7	2.8
Other meat products	29.6	6.1	22.1	40.2
Dairy products	13.6	9.4	15.0	13.2
Beverages and tobacco	47.8	2.0	44.2	19.2
Other processed food products	26.7	0.7	24.7	4.4
Other primary products	9.5	0.0	12.6	0.4
Textiles, leather and clothing	27.8	0.9	23.6	7.1
Chemical & petroleum products	16.0	0.1	13.7	6.9
Mineral & metal products	20.5	0.3	16.0	2.9
Transport equipment	15.1	1.0	17.1	2.6
Electronic equipment	12.8	0.2	11.9	2.9
Other industries	16.6	0.1	13.3	2.1
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.1	0.1

2014	EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	9.1	0.0	9.5	5.9
Sugar	21.9	0.0	20.9	0.7
Cattle and sheep	6.1	0.0	14.1	11.3
Other livestock	23.5	0.0	14.9	2.2
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	10.2	0.0	16.2	2.1
Other meat products	24.0	0.0	21.6	39.1
Dairy products	13.6	0.0	15.7	8.7
Beverages and tobacco	47.3	0.0	44.5	21.0
Other processed food products	23.0	0.0	24.6	4.9
Other primary products	7.4	0.0	11.5	1.8
Textiles, leather and clothing	24.3	0.0	24.8	6.6
Chemical & petroleum products	14.3	0.0	14.1	8.2
Mineral & metal products	18.0	0.0	16.4	3.0
Transport equipment	13.1	0.0	17.7	1.6
Electronic equipment	10.9	0.0	12.9	3.2
Other industries	13.6	0.0	13.4	2.1
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.0	0.0

Source: GTAP Version 6.0 database and model simulation results.

Table 5.1: Structure of the Rest of ACP Region Economy in 2001
(2001 US\$Millions)

2001	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	EU	Non-EU	EU	Non-EU			
Crops	2,010	2,610	136	1,544	11,565	8,626	1.34
Sugar	97	1,133	2	66	2,688	1,526	1.76
Cattle and sheep	5	44	2	47	2,224	2,223	1.00
Other livestock	21	46	6	62	1,834	1,836	1.00
Raw milk	1	1	0	1	1,293	1,292	1.00
Beef & sheepmeat	79	164	12	166	2,775	2,710	1.02
Other meat products	24	46	52	265	2,135	2,383	0.90
Dairy products	23	97	140	444	2,380	2,843	0.84
Beverages and tobacco	143	289	289	326	4,383	4,566	0.96
Other processed food products	402	1,516	285	2,241	9,793	10,402	0.94
Other primary products	82	298	26	2,509	3,439	5,594	0.61
Textiles, leather and clothing	260	7,455	349	7,368	14,535	14,538	1.00
Chemical & petroleum products	394	2,998	1,421	7,646	11,406	17,080	0.67
Mineral & metal products	368	1,671	887	3,333	8,055	10,235	0.79
Transport equipment	658	844	1,851	10,375	3,418	14,141	0.24
Electronic equipment	488	1,344	495	2,699	2,630	3,992	0.66
Other industries	2,791	2,413	2,525	7,325	13,101	17,747	0.74
Trade services	347	438	235	630	21,868	21,947	1.00
Transport services	1,680	2,511	520	927	15,550	12,806	1.21
Business & financial services	813	1,254	929	1,218	17,336	17,415	1.00
Other private services	246	346	232	276	25,231	25,148	1.00
Utilities & public services	494	903	238	876	32,992	32,710	1.01

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.

Source: GTAP Version 6.0 database.

Table 5.2: Structure of the Rest of ACP Region Economy in 2014
(2001 US\$Millions)

2014	Value of Exports		Value of Imports		Output	Domestic Consumption	Self Sufficiency ¹
	EU	Non-EU	EU	Non-EU			
Crops	3,203	3,589	127	2,259	16,759	12,353	1.36
Sugar	88	1,700	1	94	3,921	2,228	1.76
Cattle and sheep	11	73	1	73	3,086	3,076	1.00
Other livestock	30	59	7	97	2,507	2,522	0.99
Raw milk	4	1	0	1	1,834	1,829	1.00
Beef & sheepmeat	110	163	9	290	3,766	3,792	0.99
Other meat products	27	43	45	587	2,773	3,335	0.83
Dairy products	74	209	88	660	3,901	4,368	0.89
Beverages and tobacco	197	430	379	463	6,553	6,767	0.97
Other processed food products	527	1,955	358	3,347	13,645	14,868	0.92
Other primary products	32	346	42	2,176	5,020	6,860	0.73
Textiles, leather and clothing	221	7,243	332	9,656	17,449	19,974	0.87
Chemical & petroleum products	322	3,275	2,519	11,813	14,645	25,381	0.58
Mineral & metal products	615	2,893	1,304	5,129	13,521	16,446	0.82
Transport equipment	1,175	1,546	2,761	15,471	6,234	21,745	0.29
Electronic equipment	816	2,567	394	4,250	5,203	6,464	0.80
Other industries	5,961	4,375	2,846	10,932	24,152	27,593	0.88
Trade services	540	821	320	830	34,912	34,701	1.01
Transport services	3,093	4,814	645	1,328	26,712	20,778	1.29
Business & financial services	1,531	2,613	1,108	1,666	29,771	28,400	1.05
Other private services	470	688	284	362	39,100	38,588	1.01
Utilities & public services	1,209	2,199	243	1,150	55,732	53,718	1.04

Note 1: Self-sufficiency calculated as sum of value of domestic production divided by value of domestic consumption.

Source: GTAP model simulation results.

Table 5.3: Change in the Rest of ACP Region Economy in 2001-2014 – Sectoral Changes

2001 -2014	Change in Exports		Change in Imports		Change in Output		Change in Domestic Consumption		Change in Trade Balance (\$M)	Change in Self Sufficiency
	\$M	%	\$M	%	\$M	%	\$M	%		
Crops	2,173	47	706	42	5,194	45	3,727	43	1,467	0.02
Sugar	558	45	27	40	1,233	46	702	46	531	0.00
Cattle and sheep	35	70	25	51	862	39	852	38	10	0.00
Other livestock	22	34	35	52	673	37	686	37	-13	0.00
Raw milk	3	131	0	50	541	42	538	42	3	0.00
Beef & sheepmeat	30	12	121	68	990	36	1,081	40	-91	-0.03
Other meat products	0	0	314	99	638	30	952	40	-314	-0.06
Dairy products	162	136	165	28	1,522	64	1,524	54	-3	0.06
Beverages and tobacco	195	45	227	37	2,170	50	2,202	48	-32	0.01
Other processed food products	565	29	1,179	47	3,852	39	4,466	43	-614	-0.02
Other primary products	-3	-1	-318	-13	1,581	46	1,266	23	315	0.12
Textiles, leather and clothing	-251	-3	2,271	29	2,914	20	5,436	37	-2,522	-0.13
Chemical & petroleum products	204	6	5,266	58	3,240	28	8,301	49	-5,061	-0.09
Mineral & metal products	1,469	72	2,214	52	5,466	68	6,211	61	-745	0.04
Transport equipment	1,219	81	6,006	49	2,816	82	7,603	54	-4,787	0.05
Electronic equipment	1,551	85	1,449	45	2,573	98	2,471	62	101	0.15
Other industries	5,133	99	3,927	40	11,051	84	9,846	55	1,205	0.14
Trade services	576	73	286	33	13,044	60	12,754	58	290	0.01
Transport services	3,717	89	526	36	11,162	72	7,972	62	3,191	0.07
Business & financial services	2,078	101	627	29	12,435	72	10,984	63	1,451	0.05
Other private services	567	96	137	27	13,869	55	13,440	53	429	0.01
Utilities & public services	2,011	144	279	25	22,740	69	21,008	64	1,732	0.03

Source: GTAP model simulation results.

Table 5.4: Change in the Rest of ACP Region Economy in 2001-2014 – Aggregate Changes

	Output (\$M)			Share of GDP		Share of Value of Returns to Labour by Sector					
	2001	2014	Growth Rate	2001	2014	Unskilled Labour		Skilled Labour		Total Labour Force	
						2001	2014	2001	2014	2001	2014
Agriculture	26,894	38,546	43%	16%	17%	21%	21%	2%	2%	16%	16%
Manufacturing	70,758	106,422	50%	27%	27%	30%	30%	14%	14%	26%	26%
Services	112,977	186,228	65%	56%	55%	49%	49%	84%	84%	58%	59%
Total	210,629	331,196	57%	100%	100%	100%	100%	100%	100%	100%	100%

Source: GTAP model simulation results.

Table 5.5: Applied Trade Protection for Rest of ACP Region in 2001 and 2014
(Trade-weighted Averages in %)

2001	EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	49.7	19.8	6.1	10.6
Sugar	72.0	118.7	24.4	36.3
Cattle and sheep	3.6	0.0	0.5	0.9
Other livestock	24.4	0.7	3.1	1.5
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	47.2	73.4	5.5	33.1
Other meat products	48.2	6.4	13.5	6.2
Dairy products	23.4	5.8	15.7	7.7
Beverages and tobacco	27.2	8.7	19.8	8.8
Other processed food products	32.7	5.8	7.9	3.5
Other primary products	5.2	0.4	0.3	1.8
Textiles, leather and clothing	162.6	1.2	13.8	11.4
Chemical & petroleum products	11.5	0.2	4.2	2.5
Mineral & metal products	10.3	0.1	5.4	1.9
Transport equipment	9.4	1.0	10.5	2.1
Electronic equipment	9.7	0.1	4.7	1.8
Other industries	12.8	0.0	5.8	1.3
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.0	0.0

2014	EU Trade		All Trade	
	Average Import Protection	Average Export Protection	Average Import Protection	Average Export Protection
Crops	3.5	20.2	6.1	11.2
Sugar	13.1	117.1	24.6	33.5
Cattle and sheep	3.2	0.0	0.4	1.1
Other livestock	4.9	0.8	3.3	1.8
Raw milk	0.0	0.0	0.0	0.0
Beef & sheepmeat	7.3	73.9	6.1	37.9
Other meat products	14.0	6.8	14.1	6.0
Dairy products	20.3	5.7	15.3	7.3
Beverages and tobacco	25.1	8.7	19.7	9.5
Other processed food products	9.6	5.7	8.0	3.8
Other primary products	2.0	0.7	0.3	2.6
Textiles, leather and clothing	14.9	1.4	13.5	11.5
Chemical & petroleum products	5.8	0.4	4.3	2.8
Mineral & metal products	8.2	0.3	5.5	2.0
Transport equipment	7.9	1.2	10.3	2.0
Electronic equipment	6.9	0.9	6.0	2.4
Other industries	7.6	0.1	6.0	1.4
Trade services	0.0	0.0	0.0	0.0
Transport services	0.0	0.0	0.0	0.0
Business & financial services	0.0	0.0	0.0	0.0
Other private services	0.0	0.0	0.0	0.0
Utilities & public services	0.0	0.0	0.0	0.0

Source: GTAP model simulation results.

Table 6: Estimated Tariff Equivalents of Service Trade Barriers

Sector	European Union	Other Industrialised Countries	Developing Countries
Trade services	2.62	0.00	7.05
Transport services	2.57	4.15	6.16
Business and financial services	2.77	2.84	5.58
Other private services	1.92	5.19	5.78
Utilities and public services	1.92	5.19	5.78

Source: Own calculations based on Francois *et al.* (2003).

Table 7: Domestic Support in the EU in 2014 Baseline

(expressed as *ad valorem* subsidies on the use of land and capital as a percentage of value of production)

Region	Crops		Sugar		Cattle and Sheep		Other Livestock		Raw Milk	
	Land	Capital	Land	Capital	Land	Capital	Land	Capital	Land	Capital
Ireland	-69.7	0.0	-27.4	-4.9	-88.2	0.0	-27.6	-37.4	-22.3	-24.3
UK	-55.5	0.0	-8.4	-0.5	-93.8	0.0	-8.6	-18.0	-10.8	-28.5
Germany	-51.0	0.0	-3.6	-0.4	-86.3	0.0	-7.3	-19.4	-7.8	-44.2
France	-46.3	0.0	-12.9	-1.3	-83.2	0.0	-20.2	-28.6	-22.9	-55.5
Rest EU15	-35.7	0.0	-14.7	-3.4	-87.3	0.0	-8.3	-13.9	-18.6	-33.8
CEEC	-92.2	0.0	-48.6	0.0	-98.2	0.0	15.8	0.0	-65.8	0.0
EU27	-71.7	0.0	-26.2	-1.2	-92.2	0.0	0.0	-15.0	-37.5	-37.6

Source: GTAP Database and model simulation results.

Table 8.1: Total Welfare Effects of Across All Trade Liberalisation Simulations
(Measured as Equivalent Variation in 2001 US\$Millions and percentage of GDP)

Region	Total (\$M)	% of GDP	Agriculture	Industry	Service Trade	Trade Facilitation
Ireland	137	0.08	-0.03	0.05	0.12	-0.06
UK	1,644	0.09	0.10	-0.06	0.04	0.02
Germany	1,203	0.05	0.03	-0.06	0.05	0.04
France	568	0.04	0.03	-0.05	0.02	0.04
Rest EU15	5,977	0.16	0.06	-0.03	0.05	0.08
CEEC	1,744	0.30	0.01	0.13	0.02	0.14
USA	8,906	0.07	0.03	-0.04	0.03	0.06
Canada	2,073	0.25	0.10	-0.09	0.08	0.16
China	22,909	1.08	-0.03	0.54	0.05	0.52
India	6,055	0.87	0.02	0.46	0.04	0.34
EBA	1,068	0.16	-0.08	-0.08	0.02	0.30
Mercosur	6,164	0.59	0.18	0.15	0.07	0.20
Rest ACP	1,890	1.28	0.40	0.02	0.13	0.74
Former Soviet Union	2,244	0.33	0.04	0.20	0.12	-0.03
High Income Asian	24,182	0.40	0.09	0.13	0.05	0.14
Rest EFTA	6,311	1.15	0.20	0.74	0.13	0.08
Rest Asia	10,740	1.49	0.06	0.53	0.19	0.71
Rest Latin America	5,242	0.34	0.00	0.04	0.06	0.24
Mediterranean	5,193	0.31	-0.01	0.08	0.13	0.12
Rest of World	5,411	0.63	0.15	0.09	0.11	0.29
Total	119,660	0.30	0.05	0.07	0.05	0.14

Source: GTAP model simulation results.

Table 8.2: Welfare Effects of Agricultural Trade Liberalisation Simulation
(Measured as Equivalent Variation in 2001 US\$Millions)

Region	Total	% of GDP	Domestic Support Reductions (EU & USA)	Domestic Support Reductions (Rest of World)	Tariff Reduction IC	Tariff Reduction DC	Export Subsidy Abolished	EU Budgetary Effect
Ireland	-44	-0.03	2	1	90	19	34	-190
UK	1,725	0.10	29	14	1,341	54	-50	338
Germany	607	0.03	60	11	237	29	218	50
France	405	0.03	9	3	290	22	308	-227
Rest EU15	2,335	0.06	52	19	1,668	-93	841	-152
CEEC	41	0.01	-42	-3	-258	-8	170	181
USA	2,986	0.03	20	-48	1,670	1,211	133	-
Canada	818	0.10	-37	8	653	182	12	-
China	-558	-0.03	-1	18	-264	-290	-21	-
India	159	0.02	-9	1	42	111	14	-
EBA	-504	-0.08	3	3	-347	77	-239	-
Mercosur	1,816	0.18	-34	-15	1,257	501	106	-
Rest ACP	582	0.40	-5	-4	581	8	3	-
Former Soviet Union	268	0.04	56	2	271	163	-224	-
High Income Asian	5,611	0.09	149	-3	5,928	-267	-195	-
Rest EFTA	1,089	0.20	20	7	944	125	-8	-
Rest Asia	403	0.06	0	4	212	273	-87	-
Rest Latin America	-52	0.00	43	11	88	-17	-177	-
Mediterranean	-133	-0.01	70	36	221	321	-782	-
Rest of World	1,237	0.15	-85	-18	712	393	235	-
Total	18,794	0.05	303	48	15,338	2,815	291	0

Source: GTAP model simulation results.

Table 8.3: Welfare Effects of Industrial Trade Liberalisation Simulation
(Measured as Equivalent Variation in 2001 US\$Millions)

Region	Total	% of GDP	Tariff Reduction IC	Tariff Reduction DC	EU Budgetary Effect
Ireland	85	0.05	58	9	18
UK	-1,031	-0.06	-1,118	138	-52
Germany	-1,424	-0.06	-1,474	91	-42
France	-852	-0.05	-787	5	-69
Rest EU15	-1,318	-0.03	-1,803	489	-3
CEEC	753	0.13	833	-229	149
USA	-4,769	-0.04	-1,096	-3,674	-
Canada	-704	-0.09	-800	96	-
China	11,471	0.54	7,677	3,793	-
India	3,220	0.46	543	2,677	-
EBA	-524	-0.08	-660	137	-
Mercosur	1,585	0.15	702	883	-
Rest ACP	24	0.02	229	-205	-
Former Soviet Union	1,386	0.20	837	550	-
High Income Asian	7,634	0.13	4,616	3,018	-
Rest EFTA	4,058	0.74	3,816	241	-
Rest Asia	3,834	0.53	1,401	2,433	-
Rest Latin America	583	0.04	-1,087	1,669	-
Mediterranean	1,256	0.08	-1,433	2,689	-
Rest of World	799	0.09	63	737	-
Total	26,066	0.07	10,517	15,548	0

Source: GTAP model simulation results.

Table 8.4: Welfare Effects of Service Trade Liberalisation Simulation
(Measured as Equivalent Variation in 2001 US\$Millions)

Region	Total	% of GDP	Tariff Reduction IC	Tariff Reduction DC	EU Budgetary Effect
Ireland	196	0.12	179	17	0
UK	672	0.04	596	71	5
Germany	1,036	0.05	988	40	8
France	314	0.02	280	33	1
Rest EU15	1,963	0.05	1,831	117	15
CEEC	145	0.02	165	8	-29
USA	3,349	0.03	3,123	226	-
Canada	681	0.08	634	47	-
China	1,072	0.05	158	913	-
India	309	0.04	74	235	-
EBA	119	0.02	59	60	-
Mercosur	691	0.07	68	623	-
Rest ACP	189	0.13	62	127	-
Former Soviet Union	813	0.12	730	83	-
High Income Asian	2,782	0.05	2,766	16	-
Rest EFTA	700	0.13	648	52	-
Rest Asia	1,375	0.19	174	1,201	-
Rest Latin America	953	0.06	127	825	-
Mediterranean	2,148	0.13	216	1,932	-
Rest of World	914	0.11	155	759	-
Total	20,420	0.05	13,035	7,385	0

Source: GTAP model simulation results.

Table 8.5: Welfare Effects of Trade Facilitation Simulation
(Measured as Equivalent Variation in 2001 US\$Millions)

Region	Total	% of GDP	Trade Facilitation IC	Trade Facilitation DC	EU Budgetary Effect
Ireland	-100	-0.06	23	-118	-5
UK	278	0.02	544	-274	8
Germany	985	0.04	1,173	-197	9
France	700	0.04	777	-80	3
Rest EU15	2,996	0.08	2,805	173	18
CEEC	806	0.14	679	160	-33
USA	7,340	0.06	7,250	90	-
Canada	1,278	0.16	1,471	-193	-
China	10,925	0.52	2,599	8,326	-
India	2,367	0.34	492	1,874	-
EBA	1,976	0.30	-246	2,222	-
Mercosur	2,072	0.20	178	1,894	-
Rest ACP	1,094	0.74	132	962	-
Former Soviet Union	-224	-0.03	369	-593	-
High Income Asian	8,155	0.14	7,541	614	-
Rest EFTA	464	0.08	817	-352	-
Rest Asia	5,128	0.71	418	4,709	-
Rest Latin America	3,759	0.24	96	3,663	-
Mediterranean	1,921	0.12	-1,540	3,461	-
Rest of World	2,461	0.29	-59	2,519	-
Total	54,380	0.14	25,521	28,858	0

Source: GTAP model simulation results.

Table 9: Welfare Effects of Trade Liberalisation Simulations
(per cent of total global gains)

Liberalising Region <i>Benefiting Region</i>	Agriculture		Industry	Services	Trade Facilitation	Total
	Domestic Support	Tariffs and Export Subsidies				
IC						
<i>IC</i>	0.3	11.8	2.6	10.0	19.6	44.2
<i>DC</i>	0.0	1.3	6.2	0.9	1.7	10.1
<i>Total</i>	<i>0.3</i>	<i>13.1</i>	<i>8.8</i>	<i>10.9</i>	<i>21.3</i>	<i>54.3</i>
DC						
<i>IC</i>	0.0	1.2	0.6	0.6	-0.6	1.8
<i>DC</i>	0.0	1.2	12.4	5.6	24.8	43.9
<i>Total</i>	<i>0.0</i>	<i>2.4</i>	<i>13.0</i>	<i>6.2</i>	<i>24.1</i>	<i>45.7</i>
All Regions						
<i>IC</i>	0.3	13.0	3.2	10.6	19.0	46.0
<i>DC</i>	0.0	2.4	18.6	6.5	26.5	54.0
<i>Total</i>	<i>0.3</i>	<i>15.4</i>	<i>21.8</i>	<i>17.1</i>	<i>45.4</i>	<i>100.0</i>

Source: GTAP model simulation results.

Table 10: Welfare Effects of Trade Liberalisation Simulations for Ireland
(decomposed by source of gains)

Simulation	Allocative Efficiency Effects	Endowment Effects	Technology Effects	Terms of Trade Effects	Investment and Savings Price Effect	EU Budgetary Effect	Total Welfare Gain
Agriculture	258	0	0	-128	16	-190	-44
Manufacturing	47	0	0	-57	75	18	83
Services	12	0	191	-11	4	0	196
Trade Facilitation	-10	0	169	-316	59	-5	-103
Total	306	0	360	-511	154	-177	132

Source: GTAP model simulation results.

Table 11.1: Resource Allocation Effects of Simulations for Ireland

(changes shown in percentage and value terms)

AGRICULTURAL LIBERALISATION	Market Price Relative to CPI	Value of Imports	Value of Domestic Production	Value of Exports	Quantity of Imports	Quantity of Domestic Production	Quantity of Exports	Change in Trade Balance
	%	SM	SM	SM	%	%	%	SM
Crops	-1.71	16.72	-30.96	-11.32	1.29	-1.94	-3.84	-13.11
Sugar	-0.41	6.32	-13.16	-3.07	5.64	-7.83	-74.28	-1.03
Cattle and sheep	-2.24	-32.71	-158.09	22.83	-17.23	-10.01	6.93	45.39
Other livestock	-1.35	-3.08	-21.76	-1.84	-4.79	-3.76	-0.89	-1.39
Raw milk	-12.72	-1.62	0.00	0.87	-35.81	0.00	103.38	2.29
Beef & sheepmeat	-1.67	162.38	-309.25	-139.12	97.91	-15.51	-26.21	-199.03
Other meat products	-0.71	12.68	-62.59	-38.73	2.42	-5.63	-9.71	-39.88
Dairy products	-7.08	-20.58	17.12	-34.36	-5.85	0.49	-4.41	-32.70
Beverages and tobacco	-0.54	-0.28	22.48	15.33	-0.04	1.00	1.67	8.51
Other processed food products	-0.57	-2.44	72.34	74.78	-0.12	1.30	2.21	50.53
Other primary products	0.48	8.74	0.30	-1.86	0.18	0.01	-0.20	-11.68
Textiles, leather and clothing	0.02	4.19	8.88	5.85	0.13	1.14	1.59	6.77
Chemical & petroleum products	0.34	37.15	194.82	191.79	0.19	0.22	0.23	109.51
Mineral & metal products	0.31	4.03	30.92	17.88	0.08	0.31	0.62	13.41
Transport equipment	0.32	-11.13	11.64	2.40	-0.15	0.09	0.40	11.86
Electronic equipment	0.38	48.68	70.45	68.94	0.23	0.35	0.36	14.63
Other industries	0.33	20.90	77.06	62.71	0.14	0.38	0.53	35.70
Trade services	0.33	3.32	-3.02	0.61	0.03	-0.02	0.08	4.65
Transport services	0.30	-2.08	17.38	12.96	-0.10	0.24	0.48	11.93
Business & financial services	0.34	-9.56	54.53	35.94	-0.04	0.17	0.28	37.85
Other private services	0.34	-1.16	11.92	3.30	-0.13	0.02	0.28	3.58
Utilities & public services	0.32	-2.99	13.75	5.94	-0.18	0.03	0.44	7.11

INDUSTRIAL LIBERALISATION	Market Price Relative to CPI	Value of Imports	Value of Domestic Production	Value of Exports	Quantity of Imports	Quantity of Domestic Production	Quantity of Exports	Change in Trade Balance
	%	SM	SM	SM	%	%	%	SM
Crops	0.10	-7.36	1.20	2.06	-0.57	0.08	0.70	7.37
Sugar	-0.03	-0.29	-0.50	0.04	-0.26	-0.30	0.97	0.70
Cattle and sheep	-0.02	-0.69	0.59	1.28	-0.36	0.04	0.39	1.23
Other livestock	0.01	-0.32	-0.17	1.01	-0.50	-0.03	0.49	0.86
Raw milk	-0.12	0.01	0.00	0.00	0.18	0.00	0.58	0.01
Beef & sheepmeat	0.00	0.10	-1.96	-0.11	0.06	-0.10	-0.02	-1.20
Other meat products	0.02	1.19	-4.03	-1.57	0.23	-0.36	-0.39	-2.34
Dairy products	-0.07	0.44	0.51	1.62	0.13	0.01	0.21	-0.05
Beverages and tobacco	0.00	3.27	-12.97	-11.02	0.51	-0.57	-1.20	-13.57
Other processed food products	-0.15	58.11	-30.56	9.50	2.87	-0.55	0.28	-22.32
Other primary products	-0.16	20.00	-0.26	2.06	0.42	-0.01	0.22	0.87
Textiles, leather and clothing	-0.66	34.36	-35.07	-18.46	1.04	-4.49	-5.02	-47.57
Chemical & petroleum products	-0.05	145.78	492.27	537.21	0.75	0.56	0.65	250.11
Mineral & metal products	-0.02	34.04	13.98	54.32	0.68	0.14	1.89	37.76
Transport equipment	-0.02	77.27	-144.68	-22.95	1.04	-1.16	-3.80	-55.34
Electronic equipment	-0.03	-179.78	-298.19	-292.71	-0.85	-1.48	-1.51	-99.90
Other industries	-0.09	-36.30	-176.49	-126.96	-0.24	-0.86	-1.07	-78.67
Trade services	0.08	-83.97	53.64	10.54	-0.76	0.31	1.33	45.63
Transport services	-0.08	1.07	28.56	21.85	0.05	0.39	0.81	16.42
Business & financial services	0.08	-6.02	38.53	17.47	-0.03	0.12	0.14	30.98
Other private services	0.06	1.60	-48.55	-4.36	0.18	-0.09	-0.38	-5.26
Utilities & public services	0.05	1.35	-18.54	-4.91	0.08	-0.05	-0.36	-4.49

Source: GTAP model simulation results.

Table 11.2: Resource Allocation Effects of Simulations for Ireland - Continued

(changes shown in percentage and value terms)

SERVICE LIBERALISATION	Market Price Relative to CPI	Value of Imports	Value of Domestic Production	Value of Exports	Quantity of Imports	Quantity of Domestic Production	Quantity of Exports	Change in Trade Balance
	%	SM	SM	SM	%	%	%	SM
Crops	0.19	1.03	0.50	0.04	0.08	0.03	0.01	-1.03
Sugar	0.10	0.07	0.21	0.02	0.07	0.12	0.40	0.00
Cattle and sheep	0.17	0.03	0.60	0.17	0.02	0.04	0.05	0.10
Other livestock	0.17	0.07	0.35	0.02	0.11	0.06	0.01	-0.05
Raw milk	0.25	0.01	0.00	0.00	0.25	0.00	-0.32	-0.01
Beef & sheepmeat	0.14	0.02	0.64	0.07	0.01	0.03	0.01	-0.18
Other meat products	0.12	0.21	1.05	0.57	0.04	0.09	0.14	0.35
Dairy products	0.18	0.29	-0.21	-0.62	0.08	-0.01	-0.08	-0.86
Beverages and tobacco	0.12	0.34	0.60	0.24	0.05	0.03	0.03	-0.18
Other processed food products	0.11	1.05	7.06	5.76	0.05	0.13	0.17	3.47
Other primary products	0.22	5.44	0.08	-0.04	0.11	0.00	0.00	-6.36
Textiles, leather and clothing	0.13	1.35	0.70	0.41	0.04	0.09	0.11	0.16
Chemical & petroleum products	0.13	21.54	122.17	116.62	0.11	0.14	0.14	58.79
Mineral & metal products	0.13	4.16	1.28	0.38	0.08	0.01	0.01	-1.60
Transport equipment	0.14	7.82	5.21	-0.85	0.11	0.04	-0.14	-4.17
Electronic equipment	0.13	12.53	14.47	13.98	0.06	0.07	0.07	2.86
Other industries	0.12	10.63	20.63	15.30	0.07	0.10	0.13	6.04
Trade services	0.12	71.91	-25.77	1.45	0.65	-0.15	0.18	-11.86
Transport services	0.03	13.70	-13.61	-1.75	0.65	-0.19	-0.07	-1.00
Business & financial services	0.10	126.89	-101.20	-39.52	0.57	-0.31	-0.31	-54.06
Other private services	0.13	7.66	7.55	-0.97	0.84	0.01	-0.08	-4.78
Utilities & public services	0.14	15.52	1.27	0.81	0.91	0.00	0.06	-5.24

TRADE FACILITATION	Market Price Relative to CPI	Value of Imports	Value of Domestic Production	Value of Exports	Quantity of Imports	Quantity of Domestic Production	Quantity of Exports	Change in Trade Balance
	%	SM	SM	SM	%	%	%	SM
Crops	0.22	3.79	3.16	0.05	0.29	0.20	0.02	-0.63
Sugar	0.07	0.48	0.69	0.11	0.42	0.41	2.63	0.10
Cattle and sheep	0.16	0.91	4.67	1.48	0.48	0.30	0.45	0.38
Other livestock	0.21	0.25	2.03	0.46	0.39	0.35	0.22	-0.15
Raw milk	0.64	0.08	0.00	-0.01	1.77	0.00	-1.43	-0.07
Beef & sheepmeat	0.14	0.39	5.92	4.59	0.23	0.30	0.86	3.41
Other meat products	0.17	-0.06	4.89	3.63	-0.01	0.44	0.91	3.93
Dairy products	0.41	1.07	-1.04	-0.88	0.31	-0.03	-0.11	-1.70
Beverages and tobacco	0.12	-0.29	3.26	3.34	-0.04	0.14	0.36	2.38
Other processed food products	0.08	1.69	37.24	34.03	0.08	0.67	1.01	26.80
Other primary products	-1.02	-14.48	-1.33	-3.59	-0.30	-0.06	-0.39	66.69
Textiles, leather and clothing	0.13	-2.23	5.75	5.10	-0.07	0.74	1.39	13.67
Chemical & petroleum products	-0.02	-41.55	-397.83	-361.50	-0.21	-0.45	-0.44	-584.22
Mineral & metal products	0.06	-3.33	-1.47	9.43	-0.07	-0.01	0.33	21.43
Transport equipment	0.09	-18.79	-66.80	1.18	-0.25	-0.54	0.20	50.87
Electronic equipment	-0.01	55.80	88.94	92.36	0.26	0.44	0.48	60.16
Other industries	0.04	32.51	127.92	144.40	0.21	0.62	1.21	128.67
Trade services	0.08	-82.85	40.02	15.09	-0.75	0.23	1.91	73.90
Transport services	0.06	-2.67	36.21	30.58	-0.13	0.50	1.14	23.74
Business & financial services	0.12	-91.33	221.85	178.51	-0.41	0.68	1.40	221.16
Other private services	0.06	-6.33	-72.43	14.97	-0.70	-0.14	1.29	17.40
Utilities & public services	0.08	-8.91	30.24	18.90	-0.52	0.07	1.40	23.30

Source: GTAP model simulation results.

Table 11.3: Resource Allocation Effects of Simulations for Ireland**Summary Results for Simulations 1 - 3****(changes shown in percentage and value terms)**

	CPI Adjusted Market Price	Value of Imports	Value of Domestic Production	Value of Exports	Quantity of Imports	Quantity of Domestic Production	Quantity of Exports	Change in Trade Balance
	%	SM	SM	SM	%	%	%	SM
Crops	-1.44	10.39	-29.26	-9.23	0.80	-1.84	-3.13	-6.78
Sugar	-0.36	6.10	-13.45	-3.01	5.44	-8.01	-72.90	-0.34
Cattle and sheep	-2.11	-33.36	-156.90	24.28	-17.57	-9.94	7.37	46.72
Other livestock	-1.19	-3.33	-21.58	-0.81	-5.18	-3.73	-0.39	-0.59
Raw milk	-12.60	-1.60	0.00	0.87	-35.38	0.00	103.64	2.28
Beef & sheepmeat	-1.55	162.50	-310.57	-139.17	97.99	-15.58	-26.22	-200.41
Other meat products	-0.60	14.08	-65.58	-39.73	2.68	-5.90	-9.96	-41.86
Dairy products	-7.00	-19.85	17.42	-33.36	-5.64	0.50	-4.28	-33.60
Beverages and tobacco	-0.43	3.33	10.11	4.55	0.52	0.45	0.50	-5.24
Other processed food products	-0.63	56.73	48.84	90.03	2.80	0.88	2.67	31.68
Other primary products	0.52	34.18	0.12	0.16	0.72	0.01	0.02	-17.18
Textiles, leather and clothing	-0.53	39.89	-25.49	-12.19	1.20	-3.27	-3.32	-40.64
Chemical & petroleum products	0.40	204.46	809.27	845.62	1.05	0.91	1.02	418.41
Mineral & metal products	0.39	42.23	46.19	72.58	0.85	0.46	2.52	49.57
Transport equipment	0.42	73.97	-127.82	-21.40	0.99	-1.03	-3.54	-47.65
Electronic equipment	0.45	-118.57	-213.27	-209.79	-0.56	-1.06	-1.08	-82.41
Other industries	0.34	-4.77	-78.79	-48.95	-0.03	-0.38	-0.41	-36.93
Trade services	0.51	-8.74	24.85	12.59	-0.08	0.14	1.59	38.42
Transport services	0.24	12.69	32.33	33.05	0.60	0.45	1.23	27.35
Business & financial services	0.49	111.30	-8.15	13.89	0.50	-0.03	0.11	14.77
Other private services	0.52	8.09	-29.07	-2.03	0.89	-0.06	-0.18	-6.46
Utilities & public services	0.49	13.88	-3.52	1.84	0.82	-0.01	0.14	-2.62

Source: GTAP model simulation results.

Table 12: Changes in Exports for EBA Region and Rest of ACP Region**Summary Results for Simulations 1 - 3****(changes shown in percentage and value terms)**

	EBA		Rest of ACP	
	%	\$m	%	\$m
Crops	0.0	5	4.2	361
Sugar	-29.6	-1135	21.6	351
Cattle and sheep	6.3	14	-3.8	-4
Other livestock	-1.4	-5	-7.1	-8
Raw milk	-28.7	-1	-42.6	-3
Beef & sheepmeat	-5.3	-9	98.2	277
Other meat products	10.0	28	-16.8	-13
Dairy products	5.4	4	-3.0	-8
Beverages and tobacco	0.2	1	0.0	0
Other processed food products	-2.9	-125	-5.6	-132
Other primary products	0.3	241	4.7	74
Textiles, leather and clothing	0.6	101	17.2	1,066
Chemical & petroleum products	2.5	92	-0.5	-18
Mineral & metal products	1.3	99	-3.0	-91
Transport equipment	-2.3	-87	4.5	104
Electronic equipment	3.9	35	2.8	85
Other industries	2.0	185	-4.6	-400
Trade services	3.9	82	-1.3	-15
Transport services	2.8	296	-0.3	-21
Business & financial services	3.4	189	-2.3	-78
Other private services	3.2	27	-1.6	-15
Utilities & public services	3.6	232	-1.3	-34

Source: GTAP model simulation results.

Table 13: Changes in Consumer Price Index (CPI) in Simulations 1 – 4
(percentage change)

Region / Simulation	Agricultural Liberalisation	Industrial Liberalisation	Service Liberalisation	Trade Facilitation	Simulations 1-3
Ireland	-0.41	-0.31	-0.20	-0.26	-0.90
UK	-0.30	-0.54	-0.12	-0.28	-0.95
Germany	-0.28	-0.52	-0.10	-0.27	-0.89
France	-0.36	-0.55	-0.09	-0.30	-0.98
Rest EU15	-0.32	-0.46	-0.08	-0.23	-0.85
CEEC	-0.46	-0.42	-0.10	-0.18	-0.96
USA	0.10	-0.61	-0.03	-0.22	-0.54
Canada	0.04	-0.78	-0.02	0.05	-0.77
China	-0.14	1.14	-0.07	0.09	0.90
India	-0.35	-0.18	0.03	0.23	-0.51
EBA	-0.25	-0.27	0.03	-0.34	-0.47
Mercosur	0.88	-0.09	-0.08	0.10	0.66
Rest ACP	0.63	-0.46	-0.03	0.09	0.11
Former Soviet Union	-0.29	-1.61	-0.15	-0.15	-2.01
High Income Asian	-0.49	0.37	-0.04	-0.04	-0.16
Rest EFTA	-0.50	-0.32	-0.04	-0.17	-0.85
Rest Asia	-0.11	0.34	-0.05	0.11	0.17
Rest Latin America	0.10	-0.59	-0.05	-0.01	-0.53
Mediterranean	-0.12	-1.01	-0.14	-0.34	-1.25
Rest of World	0.40	-0.36	-0.10	0.05	-0.07

CPI = price index for private consumption expenditure in region (variable *ppriv*)

Source: GTAP model simulation results.

Table 14.1: Price Changes in Ireland in Simulations 1 & 2
(percentage change)

Agricultural Liberalisation	piw	pim	pm	pxw	pp
Crops	0.07	-2.80	-2.12	-1.36	-2.53
Sugar	-1.72	-4.69	-0.82	27.24	-2.72
Cattle and sheep	0.35	-0.03	-2.65	-2.65	-1.73
Other livestock	-1.26	-1.37	-1.76	-1.65	-1.58
Raw milk	-0.97	-0.97	-13.13	-13.13	-12.98
Beef & sheepmeat	-0.01	-19.80	-2.08	-1.20	-5.17
Other meat products	-1.01	-2.41	-1.12	-0.73	-1.74
Dairy products	-4.36	-5.27	-7.49	-4.51	-7.26
Beverages and tobacco	-0.29	-0.28	-0.95	-0.95	-0.73
Other processed food products	-0.58	-0.53	-0.98	-0.98	-0.72
Other primary products	0.04	0.04	0.07	0.07	0.05
Textiles, leather and clothing	-0.19	-0.20	-0.39	-0.39	-0.23
Chemical & petroleum products	-0.05	-0.05	-0.07	-0.07	-0.06
Mineral & metal products	-0.05	-0.05	-0.10	-0.10	-0.08
Transport equipment	0.01	0.01	-0.09	-0.09	-0.02
Electronic equipment	0.00	0.00	-0.03	-0.03	-0.01
Other industries	-0.02	-0.02	-0.08	-0.08	-0.04
Trade services	-0.07	-0.07	-0.08	-0.08	-0.08
Transport services	0.01	0.01	-0.11	-0.11	-0.10
Business & financial services	0.00	0.00	-0.07	-0.07	-0.02
Other private services	0.01	0.01	-0.07	-0.07	-0.07
Utilities & public services	0.04	0.04	-0.09	-0.09	-0.08

Industrial Liberalisation	piw	pim	pm	pxw	pp
Crops	0.02	0.03	-0.14	-0.14	-0.04
Sugar	-0.35	-0.35	-0.27	-0.27	-0.31
Cattle and sheep	-0.08	-0.08	-0.26	-0.26	-0.20
Other livestock	-0.01	-0.01	-0.23	-0.23	-0.13
Raw milk	-0.42	-0.42	-0.36	-0.36	-0.36
Beef & sheepmeat	-0.26	-0.26	-0.24	-0.24	-0.24
Other meat products	-0.35	-0.34	-0.22	-0.22	-0.28
Dairy products	-0.36	-0.36	-0.31	-0.31	-0.32
Beverages and tobacco	-0.40	-0.95	-0.24	-0.24	-0.47
Other processed food products	-0.41	-2.86	-0.39	-0.39	-1.82
Other primary products	-0.47	-0.47	-0.40	-0.40	-0.43
Textiles, leather and clothing	0.15	-2.45	-0.90	-0.90	-2.20
Chemical & petroleum products	-0.48	-0.79	-0.29	-0.29	-0.59
Mineral & metal products	-0.47	-0.69	-0.26	-0.26	-0.42
Transport equipment	-0.51	-1.06	-0.26	-0.26	-0.82
Electronic equipment	-0.31	-0.34	-0.27	-0.27	-0.34
Other industries	-0.34	-0.53	-0.33	-0.33	-0.46
Trade services	0.43	0.43	-0.16	-0.16	0.16
Transport services	-0.21	-0.21	-0.32	-0.32	-0.31
Business & financial services	-0.13	-0.13	-0.16	-0.16	-0.14
Other private services	-0.31	-0.31	-0.18	-0.18	-0.18
Utilities & public services	-0.25	-0.25	-0.19	-0.19	-0.19

piw = world price of composite import in Ireland.

pim = market price of composite import in Ireland.

pm = market price in Ireland.

pxw = aggregate price of exports from Ireland.

pp = private consumption price for commodity in Ireland.

Source: GTAP model simulation results.

Table 14.2: Price Changes in Ireland in Simulations 3 & 4**(percentage change)**

Service Liberalisation	piw	pim	pm	pxw	pp
Crops	0.00	0.00	0.01	0.01	0.01
Sugar	-0.05	-0.05	-0.08	-0.08	-0.06
Cattle and sheep	0.00	0.00	-0.01	-0.01	-0.01
Other livestock	-0.03	-0.03	-0.01	-0.01	-0.02
Raw milk	0.01	0.01	0.07	0.07	0.07
Beef & sheepmeat	-0.04	-0.04	-0.04	-0.04	-0.04
Other meat products	-0.06	-0.06	-0.06	-0.06	-0.06
Dairy products	-0.03	-0.03	0.00	0.00	-0.01
Beverages and tobacco	-0.07	-0.07	-0.06	-0.06	-0.06
Other processed food products	-0.06	-0.06	-0.07	-0.07	-0.06
Other primary products	0.03	0.03	0.04	0.04	0.03
Textiles, leather and clothing	-0.05	-0.05	-0.05	-0.05	-0.05
Chemical & petroleum products	-0.05	-0.05	-0.05	-0.05	-0.05
Mineral & metal products	-0.08	-0.08	-0.05	-0.05	-0.06
Transport equipment	-0.07	-0.07	-0.04	-0.04	-0.06
Electronic equipment	-0.06	-0.06	-0.05	-0.05	-0.06
Other industries	-0.06	-0.06	-0.06	-0.06	-0.06
Trade services	-0.05	-0.53	-0.06	-0.06	-0.32
Transport services	-0.09	-0.87	-0.15	-0.15	-0.20
Business & financial services	-0.07	-0.55	-0.08	-0.08	-0.42
Other private services	-0.04	-0.48	-0.05	-0.05	-0.06
Utilities & public services	-0.03	-0.59	-0.04	-0.04	-0.07

Trade Facilitation	piw	pim	pm	pxw	pp
Crops	-0.05	-0.29	-0.25	-0.25	-0.27
Sugar	-0.22	-0.39	-0.40	-0.40	-0.39
Cattle and sheep	-0.01	-0.44	-0.31	-0.31	-0.35
Other livestock	-0.11	-0.26	-0.26	-0.26	-0.26
Raw milk	0.10	-0.36	0.17	0.17	0.17
Beef & sheepmeat	-0.10	-0.39	-0.33	-0.33	-0.34
Other meat products	-0.21	-0.27	-0.30	-0.30	-0.28
Dairy products	-0.11	-0.16	-0.06	-0.06	-0.07
Beverages and tobacco	-0.20	-0.31	-0.35	-0.35	-0.34
Other processed food products	-0.27	-0.38	-0.39	-0.39	-0.38
Other primary products	-1.20	-1.46	-1.49	-1.49	-1.48
Textiles, leather and clothing	0.02	-0.27	-0.34	-0.34	-0.28
Chemical & petroleum products	-0.56	-0.71	-0.49	-0.49	-0.62
Mineral & metal products	-0.31	-0.40	-0.41	-0.41	-0.41
Transport equipment	-0.26	-0.44	-0.38	-0.38	-0.43
Electronic equipment	-0.28	-0.55	-0.48	-0.48	-0.54
Other industries	-0.23	-0.45	-0.43	-0.43	-0.44
Trade services	0.19	0.19	-0.39	-0.39	-0.07
Transport services	-0.08	-0.08	-0.41	-0.41	-0.39
Business & financial services	0.02	0.02	-0.35	-0.35	-0.09
Other private services	-0.10	-0.10	-0.41	-0.41	-0.40
Utilities & public services	-0.05	-0.05	-0.39	-0.39	-0.38

piw = world price of composite import in Ireland.

pim = market price of composite import in Ireland.

pm = market price in Ireland.

pxw = aggregate price of exports from Ireland.

pp = private consumption price for commodity in Ireland.

Source: GTAP model simulation results.

Table 15: Changes in Wages in Simulations 1 – 4
(percentage change)

	Agricultural Liberalisation		Industrial Liberalisation		Service Trade Liberalisation		Trade Facilitation	
	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled
Ireland	0.28	0.41	0.10	0.14	0.20	0.17	-0.13	-0.07
UK	0.21	0.23	0.08	0.08	0.05	0.03	0.06	0.07
Germany	0.22	0.24	0.11	0.07	0.08	0.07	0.05	0.05
France	0.29	0.34	0.10	0.06	0.04	0.03	0.08	0.08
Rest EU15	0.23	0.29	0.12	0.11	0.07	0.05	0.15	0.16
CEEC	0.68	0.83	0.52	0.66	0.01	-0.01	0.27	0.34
USA	0.02	-0.01	0.05	0.07	0.03	0.03	0.08	0.08
Canada	0.10	0.09	0.08	0.11	0.10	0.11	0.43	0.41
China	0.25	0.26	2.74	2.92	0.03	0.04	1.57	1.87
India	0.40	0.42	2.00	2.02	0.04	0.06	0.62	0.68
EBA	-0.20	-0.09	-0.08	-0.13	0.03	0.08	0.67	0.75
Mercosur	-0.23	-0.24	0.39	0.36	0.06	0.05	0.33	0.36
Rest ACP	-0.03	-0.11	1.24	1.05	0.15	0.17	1.05	1.15
Former Soviet Union	0.14	0.16	0.12	0.06	-0.02	-0.04	1.25	1.30
High Income Asian	0.48	0.57	0.45	0.43	0.06	0.06	0.20	0.20
Rest EFTA	0.48	0.53	0.73	0.71	0.16	0.16	0.26	0.26
Rest Asia	0.29	0.25	2.42	1.97	0.22	0.23	1.50	1.47
Rest Latin America	-0.02	-0.08	0.41	0.39	0.07	0.06	0.48	0.52
Mediterranean	0.11	0.11	0.65	0.58	0.07	0.01	0.46	0.48
Rest of World	0.14	0.10	0.60	0.56	0.11	0.10	0.58	0.63

Note: Change in wages measured as the change in ratio of return of skilled or unskilled labour to CPI in each region (variable *pfactreal*).

Source: GTAP model simulation results.

**Table 16.1: Alternative Decomposition of Welfare Effects on Ireland of
Agricultural Trade Liberalisation (Simulation 1) – Tariff Liberalisation Only
(Measured as Equivalent Variation in 2001 US\$Millions)**

Breakdown of Tariff Reductions	
Reduction of tariffs on agricultural goods from Rest of EU to Ireland	0
Reduction of tariffs on agricultural goods from Third Countries to Ireland	143
Reduction of tariffs on agricultural goods from Ireland to Rest of EU	0
Reduction of tariffs on agricultural goods from Ireland to Third Countries	1
Reduction of tariffs on agricultural goods from Rest of EU to Third Countries	12
Reduction of tariffs on agricultural goods from Third Countries to Rest of EU	-54
Reduction of tariffs on agricultural goods from Third Countries to Third Countries	7
Total	109

Source: GTAP model simulation results.

The numbers are interpreted as the gain to Ireland on the assumption that agricultural imports and exports to non-EU countries are traded at world prices. In practice, they are traded at EU prices due to the operation of the common financing of the CAP. To obtain the overall impact of tariff liberalisation the change in net transfers from the EU budget must also be taken into account.

**Table 16.2: Alternative Decomposition of Welfare Effects on Ireland of Industrial
Trade Liberalisation (Simulation 2)
(Measured as Equivalent Variation in 2001 US\$Millions)**

Breakdown of Tariff Reductions	
Reduction of tariffs on industrial goods from Rest of EU to Ireland	0
Reduction of tariffs on industrial goods from Third Countries to Ireland	88
Reduction of tariffs on industrial goods from Ireland to Rest of EU	0
Reduction of tariffs on industrial goods from Ireland to Third Countries	676
Reduction of tariffs on industrial goods from Rest of EU to Third Countries	-269
Reduction of tariffs on industrial goods from Third Countries to Rest of EU	-138
Reduction of tariffs on industrial goods from Third Countries to Third Countries	-290
Total	67

Source: GTAP model simulation results.

Table 17.1: Alternative Decomposition of Welfare Effects on EBA Region of Agricultural Trade Liberalisation (Simulation 1) – Tariff Liberalisation Only
(Measured as Equivalent Variation in 2001 US\$Millions)

Breakdown of Tariff Reductions	
Reduction of tariffs on agricultural goods from EU to EBA Countries	0
Reduction of tariffs on agricultural goods from Third Countries to EBA Countries	0
Reduction of tariffs on agricultural goods from EBA Countries to EU	0
Reduction of tariffs on agricultural goods from EBA Countries to Third Countries	228
Reduction of tariffs on agricultural goods from EBA Countries to EBA Countries	0
Reduction of tariffs on agricultural goods from EU to Third Countries	-442
Reduction of tariffs on agricultural goods from Third Countries to EU	22
Reduction of tariffs on agricultural goods from Third Countries to Third Countries	-78
Total	-270

Source: GTAP model simulation results.

Table 17.2: Alternative Decomposition of Welfare Effects on EBA Region of Industrial Trade Liberalisation (Simulation 2)
(Measured as Equivalent Variation in 2001 US\$Millions)

Breakdown of Tariff Reductions	
Reduction of tariffs on industrial goods from EU to EBA Countries	0
Reduction of tariffs on industrial goods from Third Countries to EBA Countries	0
Reduction of tariffs on industrial goods from EBA Countries to EU	0
Reduction of tariffs on industrial goods from EBA Countries to Third Countries	1629
Reduction of tariffs on industrial goods from EBA Countries to EBA Countries	0
Reduction of tariffs on industrial goods from EU to Third Countries	-428
Reduction of tariffs on industrial goods from Third Countries to EU	-436
Reduction of tariffs on industrial goods from Third Countries to Third Countries	-1288
Total	-524

Source: GTAP model simulation results.

Table 18.1: Alternative Decomposition of Welfare Effects on Rest of ACP Region of Agricultural Trade Liberalisation (Simulation 1) – Tariff Liberalisation Only
(Measured as Equivalent Variation in 2001 US\$Millions)

Breakdown of Tariff Reductions	
Reduction of tariffs on agricultural goods from EU to Rest of ACP	0
Reduction of tariffs on agricultural goods from Third Countries to Rest of ACP	-33
Reduction of tariffs on agricultural goods from Rest of ACP to EU	727
Reduction of tariffs on agricultural goods from Rest of ACP to Third Countries	305
Reduction of tariffs on agricultural goods from Rest of ACP to Rest of ACP	11
Reduction of tariffs on agricultural goods from EU to Third Countries	-142
Reduction of tariffs on agricultural goods from Third Countries to EU	-16
Reduction of tariffs on agricultural goods from Third Countries to Third Countries	-264
Total	588

Source: GTAP model simulation results.

Table 18.2: Alternative Decomposition of Welfare Effects on Rest of ACP Region of Industrial Trade Liberalisation (Simulation 2)
(Measured as Equivalent Variation in 2001 US\$Millions)

Breakdown of Tariff Reductions	
Reduction of tariffs on industrial goods from EU to Rest of ACP	-49
Reduction of tariffs on industrial goods from Third Countries to Rest of ACP	-212
Reduction of tariffs on industrial goods from Rest of ACP to EU	52
Reduction of tariffs on industrial goods from Rest of ACP to Third Countries	957
Reduction of tariffs on industrial goods from Rest of ACP to Rest of ACP	36
Reduction of tariffs on industrial goods from EU to Third Countries	-100
Reduction of tariffs on industrial goods from Third Countries to EU	70
Reduction of tariffs on industrial goods from Third Countries to Third Countries	-730
Total	24

Source: GTAP model simulation results.

**Table 19: Overall of EU Budgetary Effect on Ireland of Agricultural Trade
Liberalisation (Simulation 1)**

(2001 US\$Millions)

	2001	2014 Pre-Simulation	2014 Post-Simulation
Net contribution¹	-718	-474	-284
Decomposition of net contribution			
GDP tax	298	204	169
Revenues and subsidies	-1,016	-678	-453
Decomposition of revenues and subsidies			
<i>Exports subsidies</i>			
Crops	-3	-3	0
Sugar	-3	-2	0
Cattle and sheep	0	0	0
Other livestock	0	0	0
Raw milk	0	0	0
Beef & sheepmeat	-62	-21	0
Other meat products	-2	-2	0
Dairy products	-80	-42	0
	-150	-70	0
<i>Tariff revenues collected and domestic support</i>			
Crops	-449	-442	-387
Sugar	0	28	26
Cattle and sheep	-675	-711	-632
Other livestock	-19	-22	-16
Raw milk	-7	-12	-7
	-1,151	-1,158	-1,016
<i>Tariff duties on other products</i>			
	286	550	563

Note 1: a positive figure represents a net contribution from Ireland to the EU; a negative figure a net transfer from the EU to Ireland.

Source: GTAP model simulation results.

Table 20: Armington Elasticities assumed in this Report.

Sector	ESUBD	ESUBM
Crops	2.66	5.17
Sugar	2.7	5.4
Cattle and sheep	2	4
Other livestock	1.3	2.6
Raw milk	3.65	7.3
Beef & sheepmeat	4.01	8.23
Other meat products	4.4	8.8
Dairy products	3.65	7.3
Beverages and tobacco	1.15	2.3
Other processed food products	2.18	4.34
Other primary products	4.47	12.22
Textiles, leather and clothing	3.78	7.58
Chemical & petroleum products	2.96	6.05
Mineral & metal products	3.39	6.94
Transport equipment	3.15	6.43
Electronic equipment	4.4	8.8
Other industries	3.67	7.69
Trade services	1.9	3.8
Transport services	1.9	3.8
Business & financial services	1.9	3.8
Other private services	1.9	3.8
Utilities & public services	2.03	4.08

Note for an explanation of ESUBM and ESUBD – see Appendix 2.1.4

Source: GTAP Database

Table 21: Sensitivity Analysis of ESUBD in Simulation 4
(expressed in \$Millions)

Region	Welfare	Mean	Standard Deviation	95% Confidence Interval	
				lower	upper
Ireland	-95	-98	16.5	-172	-25
UK	270	242	127.4	-327	811
Germany	976	947	139.9	322	1573
France	697	681	113.2	175	1187
Rest EU15	2,978	2,956	178.0	2160	3751
CEEC	839	849	5.8	823	874
USA	7,340	7,239	432.4	5306	9171
Canada	1,278	1,286	27.4	1164	1408
China	10,925	10,990	26.7	10870	11109
India	2,367	2,379	54.8	2135	2624
EBA	1,976	1,986	69.8	1674	2298
Mercosur	2,072	2,098	37.3	1931	2264
Rest ACP	1,094	1,113	56.0	863	1363
Former Soviet Union	-224	-221	34.1	-374	-69
High Income Asian	8,155	8,134	149.0	7468	8800
Rest EFTA	464	461	22.6	360	561
Rest Asia	5,128	5,149	24.3	5040	5257
Rest Latin America	3,759	3,780	26.9	3659	3900
Mediterranean	1,921	1,920	119.6	1385	2454
Rest of World	2,461	2,493	66.7	2195	2791

Source: GTAP model simulation results.

Table 22: Sensitivity Analysis of Simulation 1
Armington Elasticities for Agricultural Commodities Doubled
(Measured as Equivalent Variation in \$Millions)

Region	Total	Domestic Support Reductions (EU & USA)	Domestic Support Reductions (Rest of World)	Tariff Reduction IC	Tariff Reduction DC	Export Subsidy Abolished	EU Budgetary Effect
Ireland	62	-6	1	210	5	94	-243
UK	3,901	-24	20	3,297	77	-2	533
Germany	1,868	2	15	1,255	78	464	54
France	113	-20	-1	804	82	217	-969
Rest EU15	5,967	-3	21	5,286	181	996	-515
CEEC	1,599	1	1	334	6	117	1,140
USA	2,821	158	-56	2,169	613	-61	-
Canada	1,815	-39	10	1,851	88	-94	-
China	514	5	8	151	456	-106	-
India	334	-3	-1	88	249	0	-
EBA	-305	-4	1	-266	56	-93	-
Mercosur	3,356	-48	7	3,073	203	122	-
Rest ACP	744	-12	-3	726	42	-9	-
Former Soviet Union	246	32	7	438	31	-263	-
High Income Asian	13,771	197	-7	14,260	38	-717	-
Rest EFTA	2,428	8	5	2,359	119	-63	-
Rest Asia	836	-19	-4	225	662	-28	-
Rest Latin America	503	0	0	359	230	-87	-
Mediterranean	193	1	30	471	306	-615	-
Rest of World	1,417	-67	-15	889	380	230	-
Total	42,184	158	38	37,981	3,902	104	0

Source: GTAP model simulation results.

Table 23: Sensitivity of the Baseline.

Region	Baseline 1	Baseline 2	Variation (%)
Ireland	347	345	0.5
UK	1,532	1,532	0.0
Germany	2,220	2,230	-0.4
France	980	992	-1.2
Rest EU15	3,764	3,774	-0.2
CEEC	676	682	-1.0
USA	-3,126	-3,002	4.1
Canada	57	59	-4.0
China	5,719	5,455	4.8
India	1,970	1,962	0.4
EBA	124	130	-5.2
Mercosur	4,136	4,127	0.2
Rest ACP	180	182	-1.1
Former Soviet Union	1,333	1,339	-0.4
High Income Asian	16,971	16,986	-0.1
Rest EFTA	1,089	1,081	0.7
Rest Asia	4,671	4,660	0.2
Rest Latin America	4,026	4,030	-0.1
Mediterranean	255	254	0.3
Rest of World	3,583	3,579	0.1
Total	50,507	50,397	0.2

Source: GTAP model simulation results

Figures

Figure 1: Baseline Structure

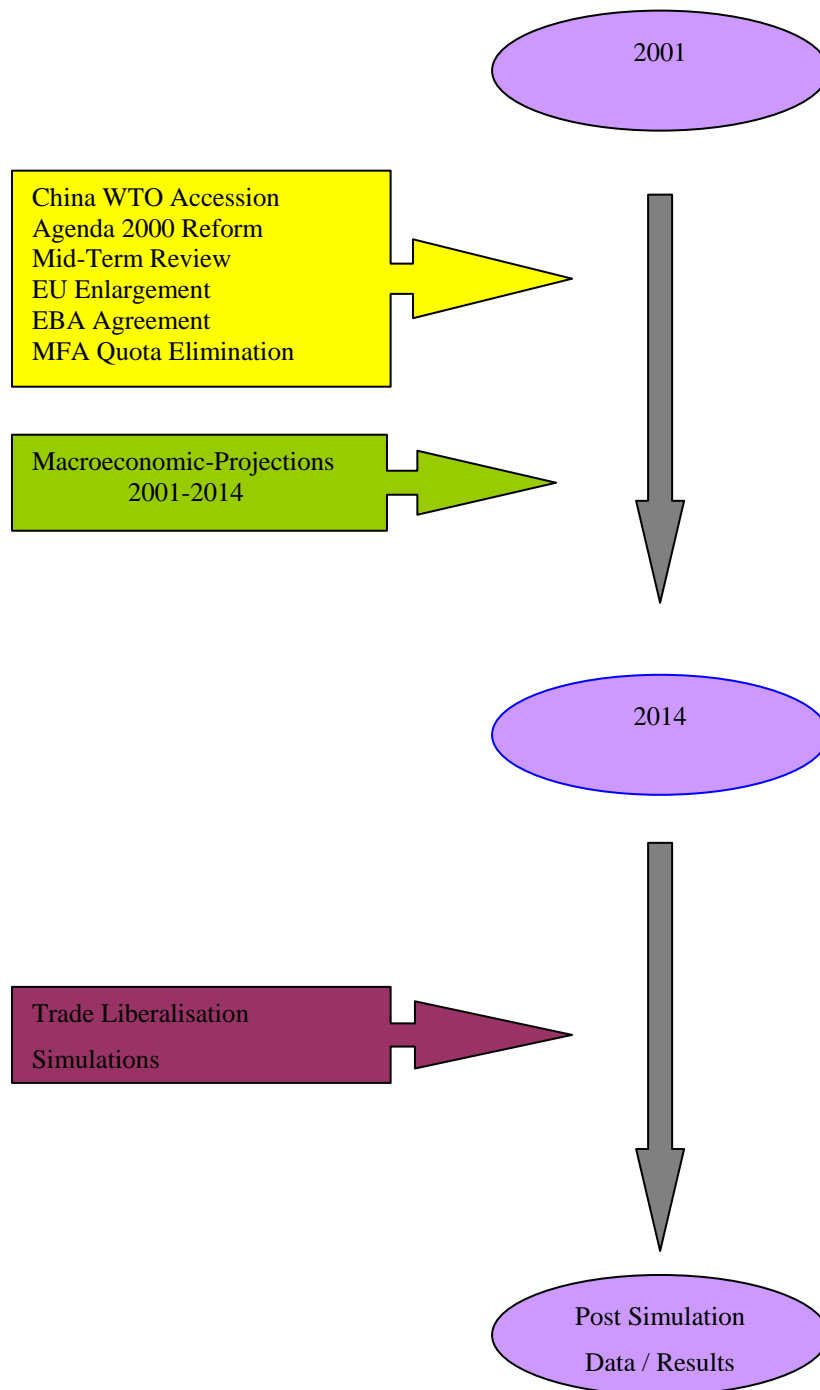
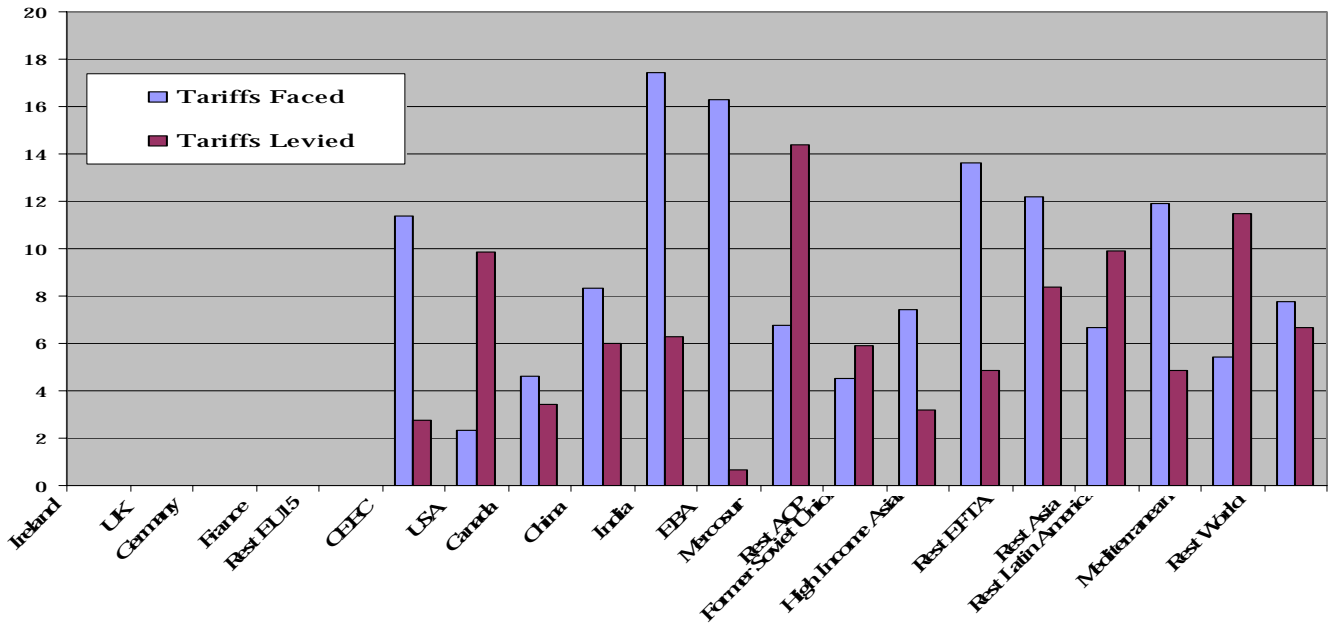
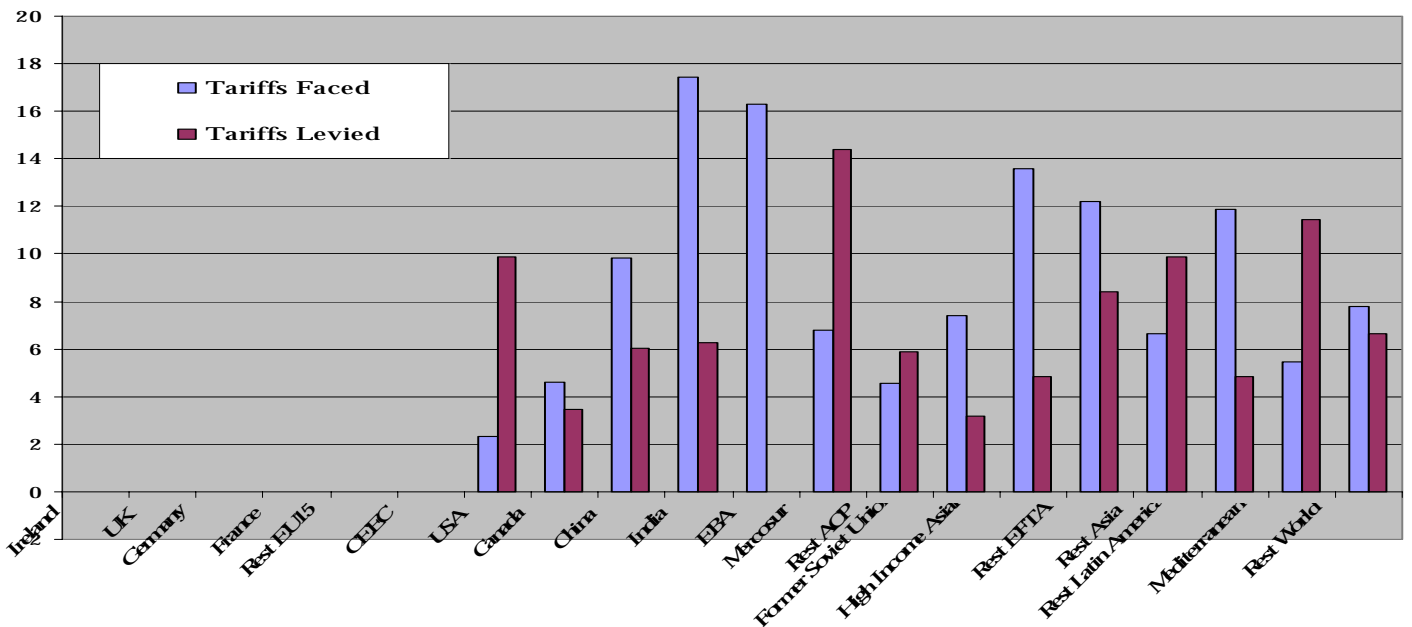


Figure 2.1: Applied Trade Protection for Irish Exports and Imports in 2001



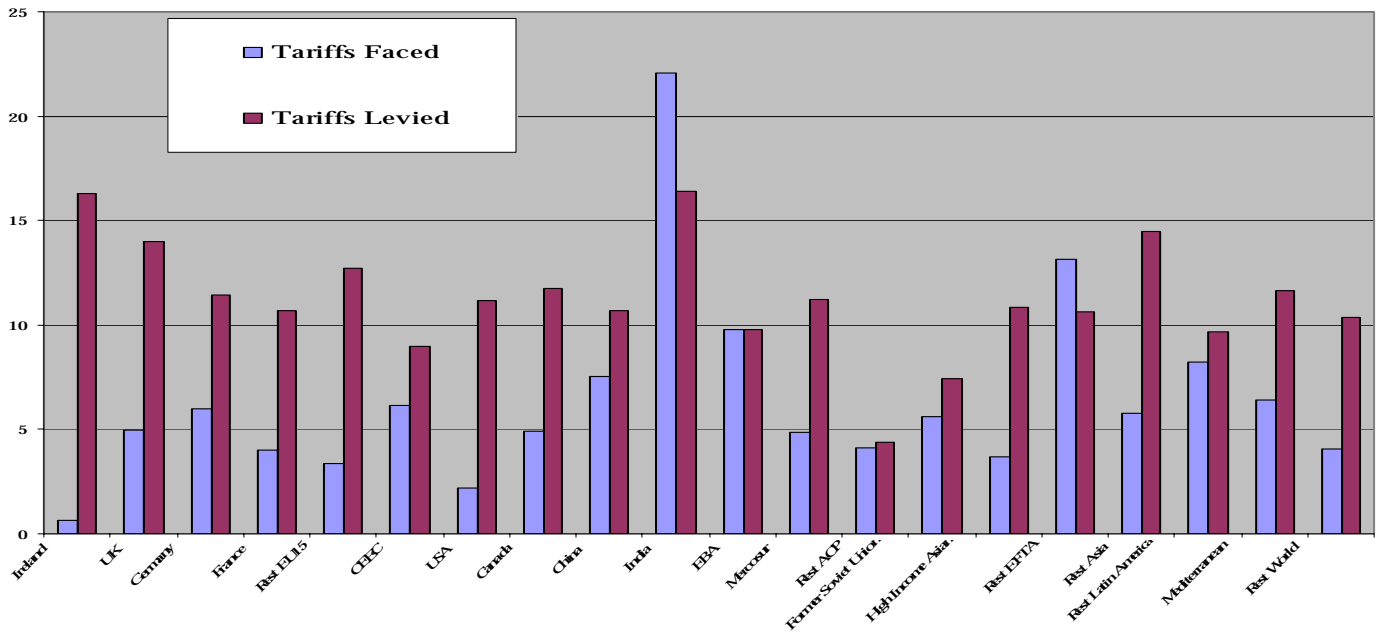
Source: GTAP model simulation results.

Figure 2.2: Applied Trade Protection for Irish Exports and Imports in 2014



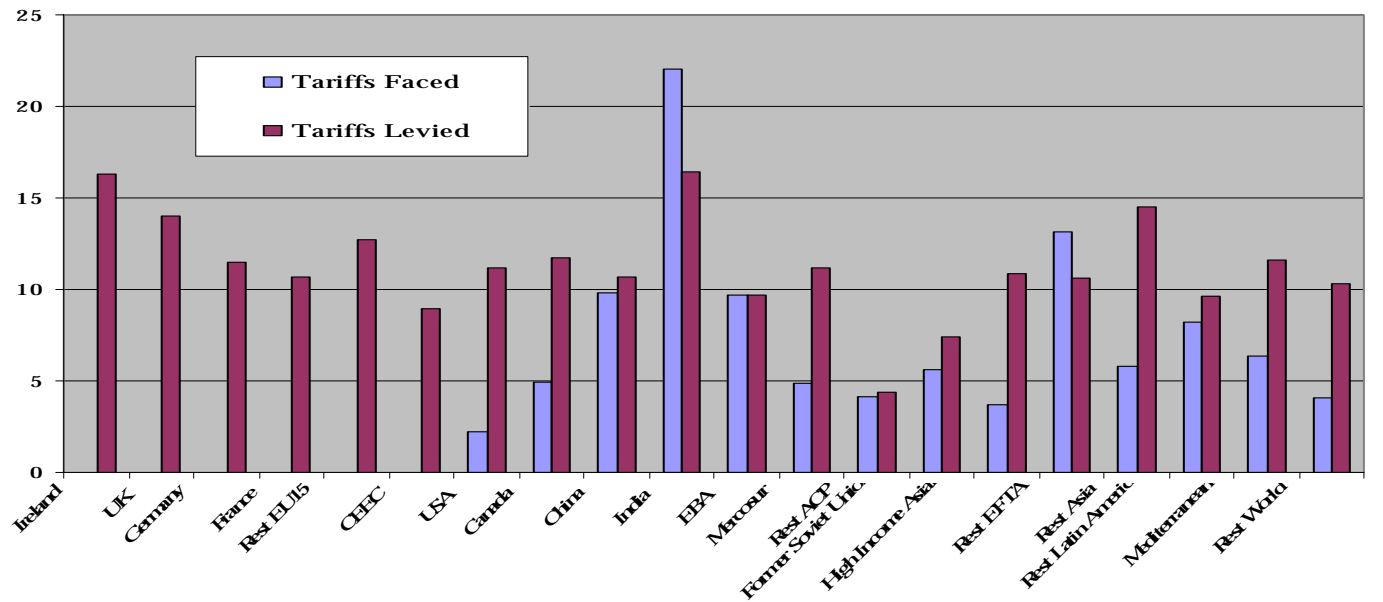
Source: GTAP model simulation results.

Figure 2.3: Applied Trade Protection for EBA Exports and Imports in 2001



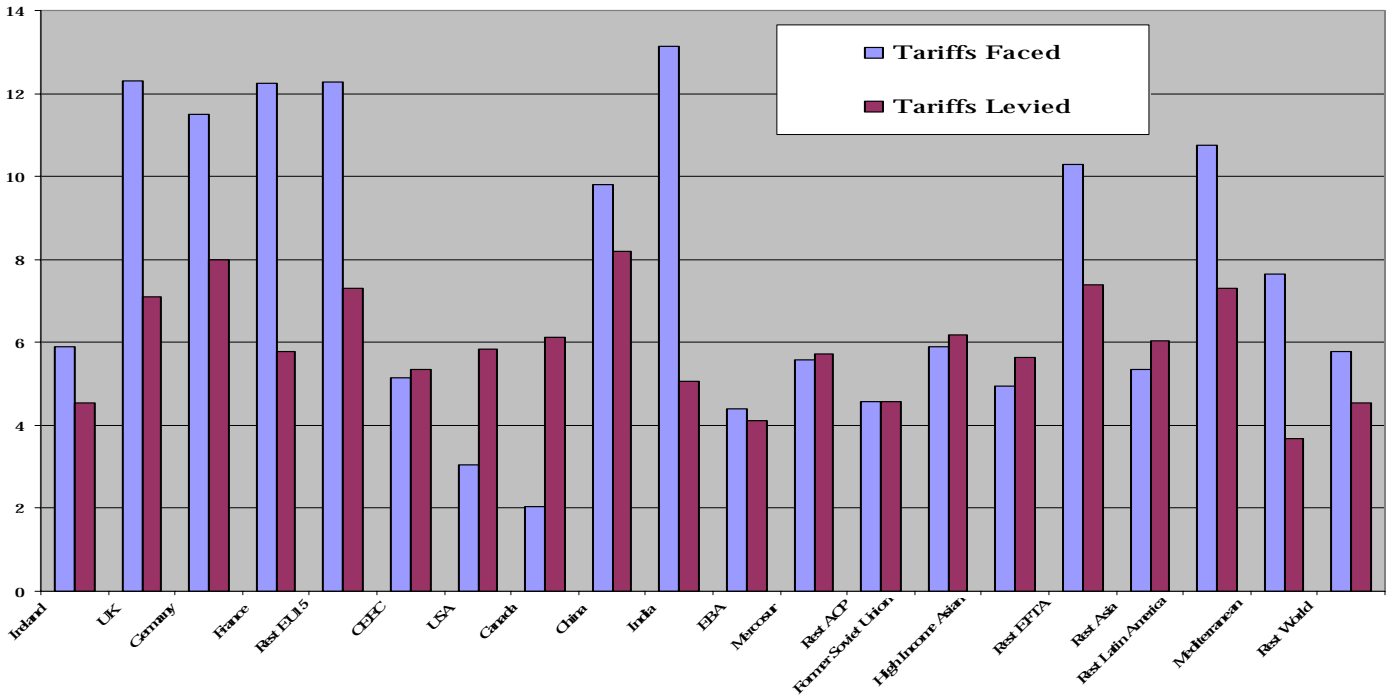
Source: GTAP model simulation results.

Figure 2.4: Applied Trade Protection for EBA Exports and Imports in 2014



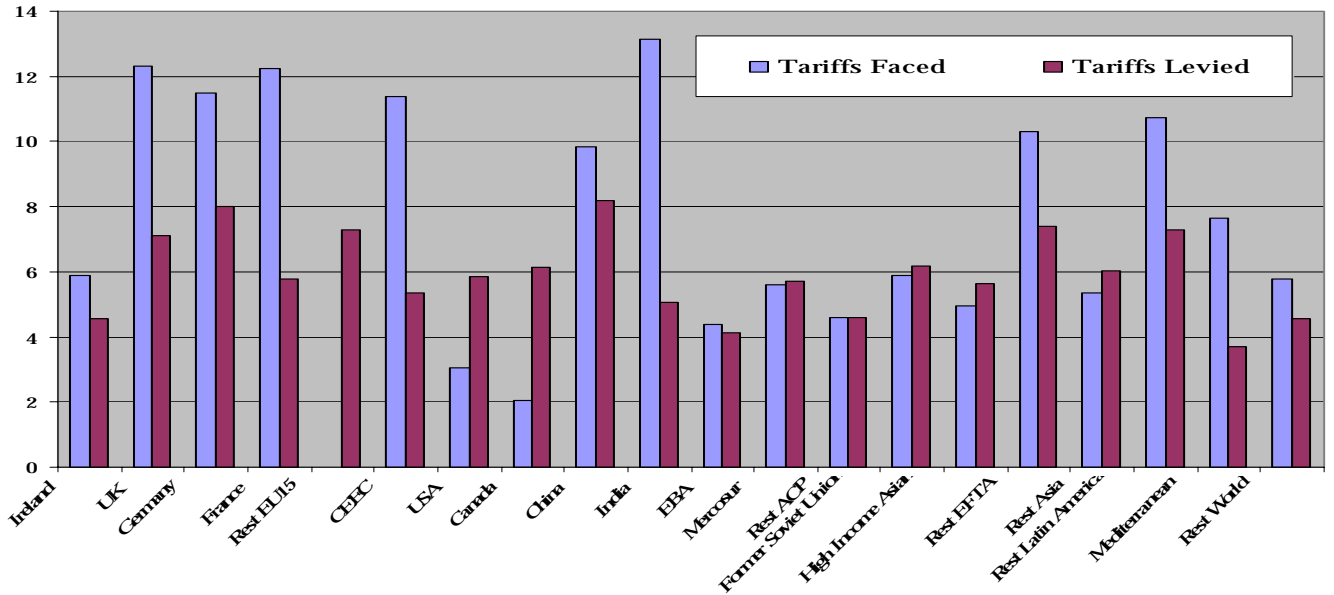
Source: GTAP model simulation results.

Figure 2.5: Applied Trade Protection for Rest ACP Exports and Imports in 2001



Source: GTAP model simulation results.

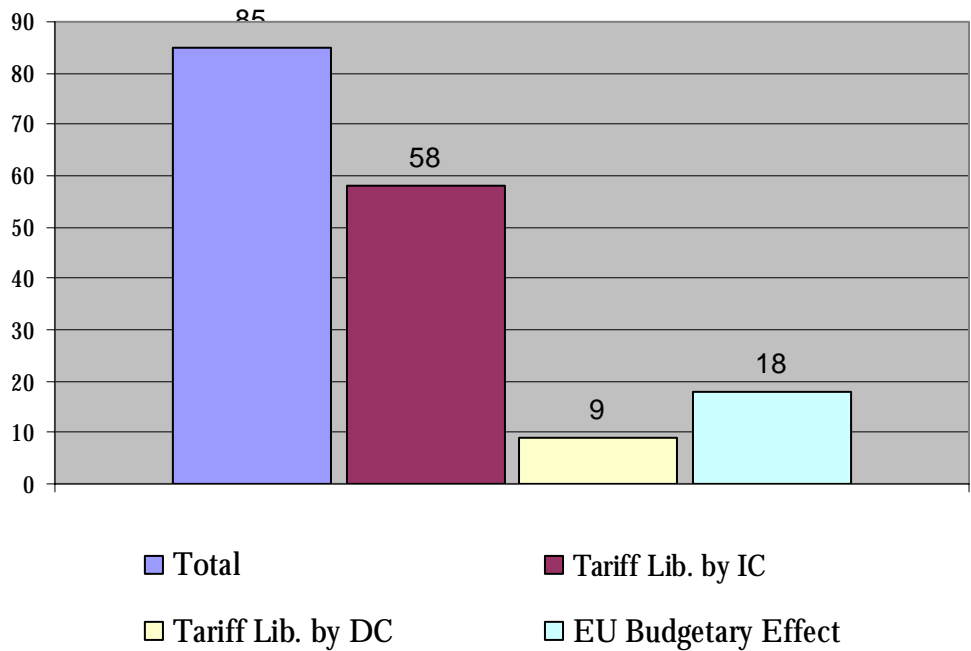
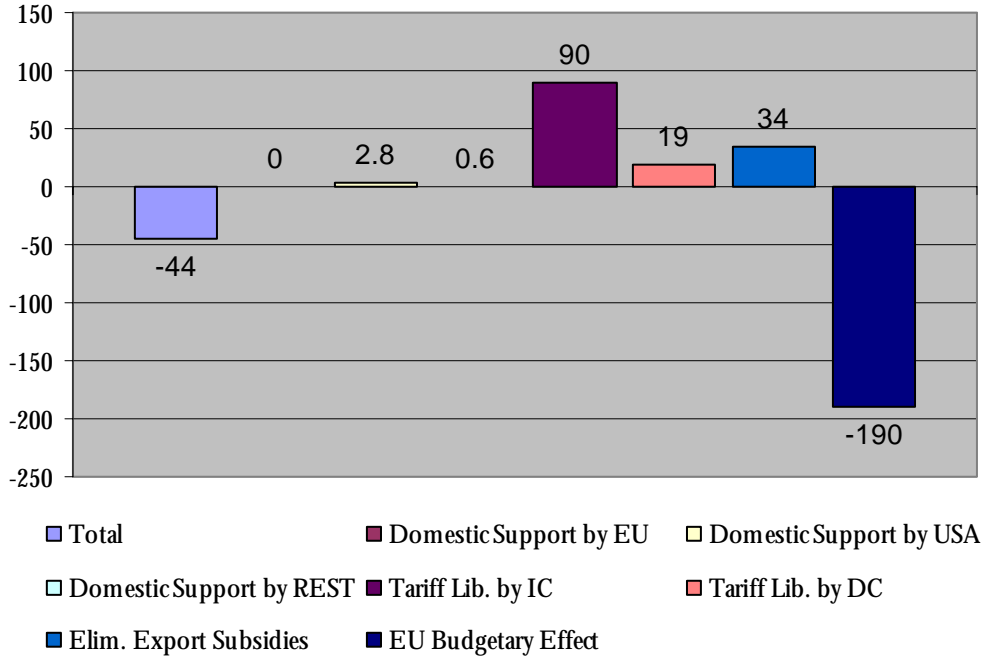
Figure 2.6: Applied Trade Protection for Rest ACP Exports and Imports in 2014



Source: GTAP model simulation results.

Figure 3: Welfare Decomposition by Subtotal for Ireland - Simulations 1 and 2

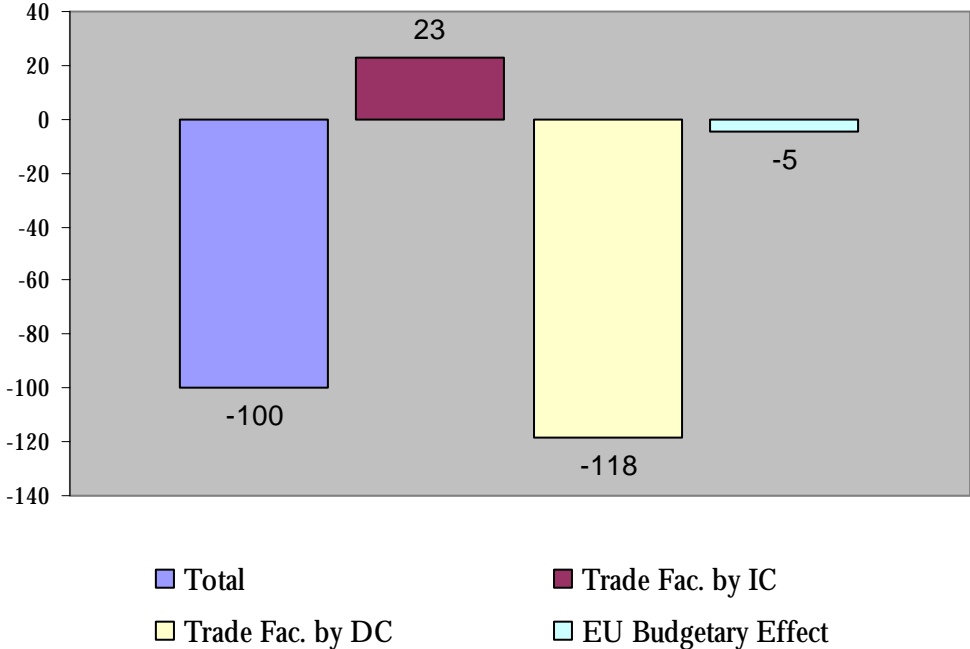
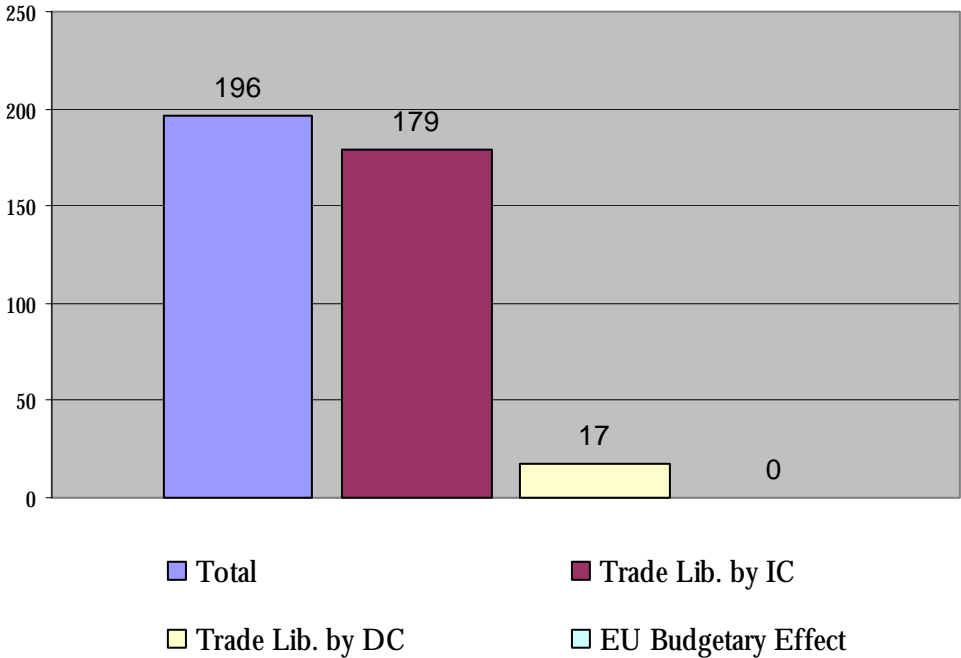
(\$US Millions)



Source: GTAP model simulation results.

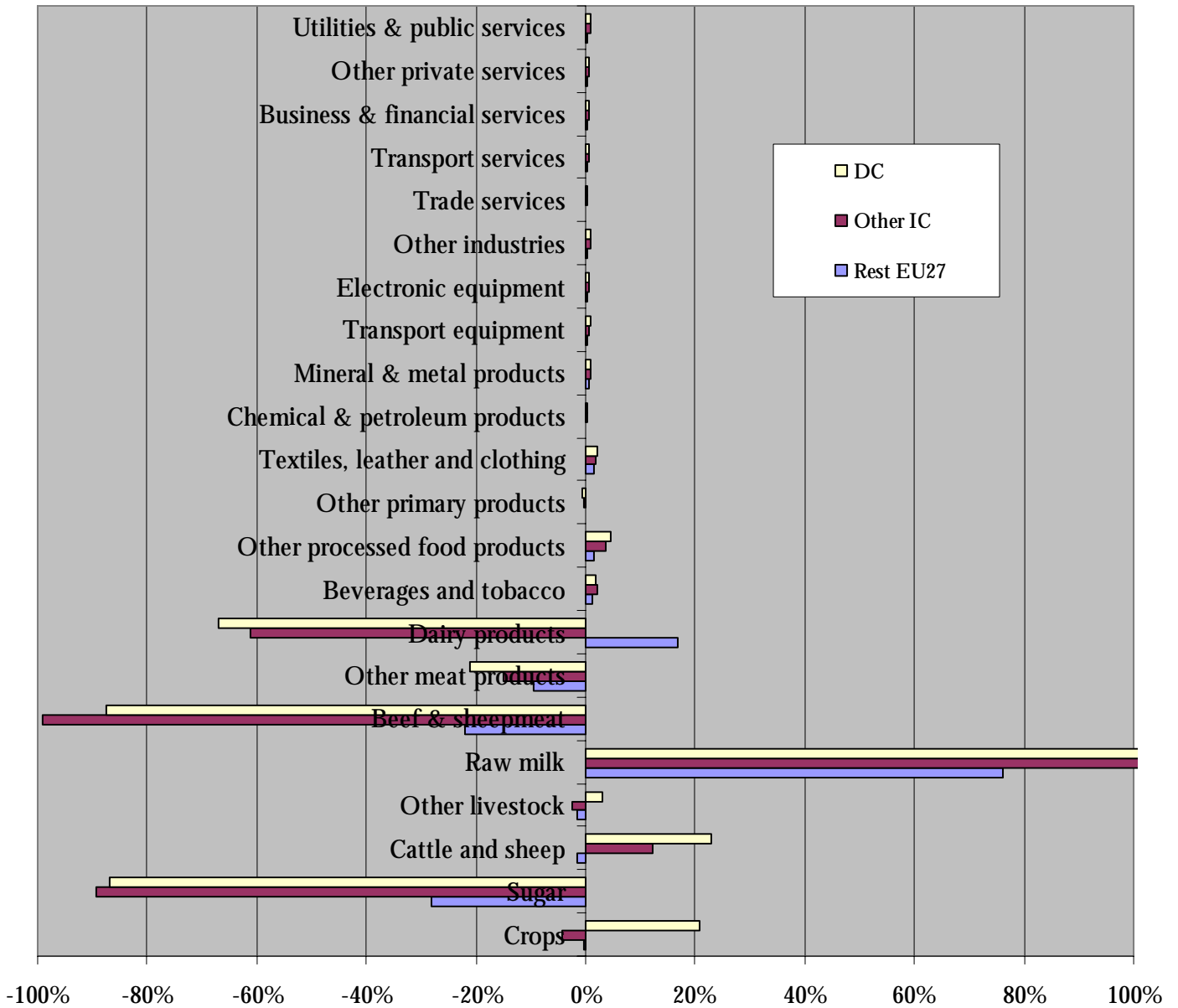
Figure 3: Welfare Decomposition by Subtotal for Ireland – Simulations 3 and 4

(\$US Millions)



Source: GTAP model simulation results.

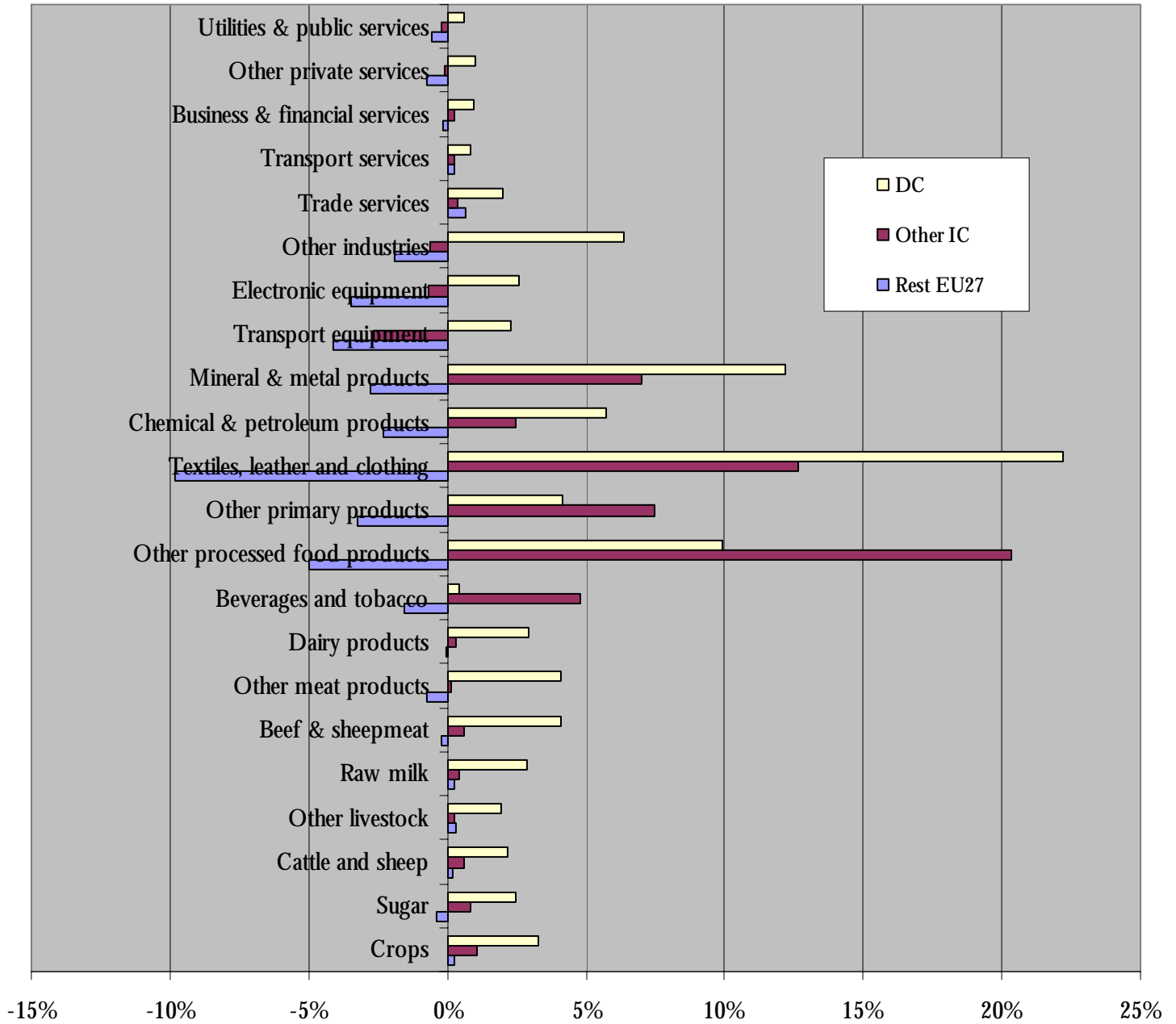
Figure 4.1: Change in Irish Exports by Destination – Simulation 1
(in percentage change)



Note: axis is truncated at 100 per cent to better illustrate the changes in the majority of the sectors. Some sectors (e.g. raw milk) experience considerable percentage changes but their initial export values are low.

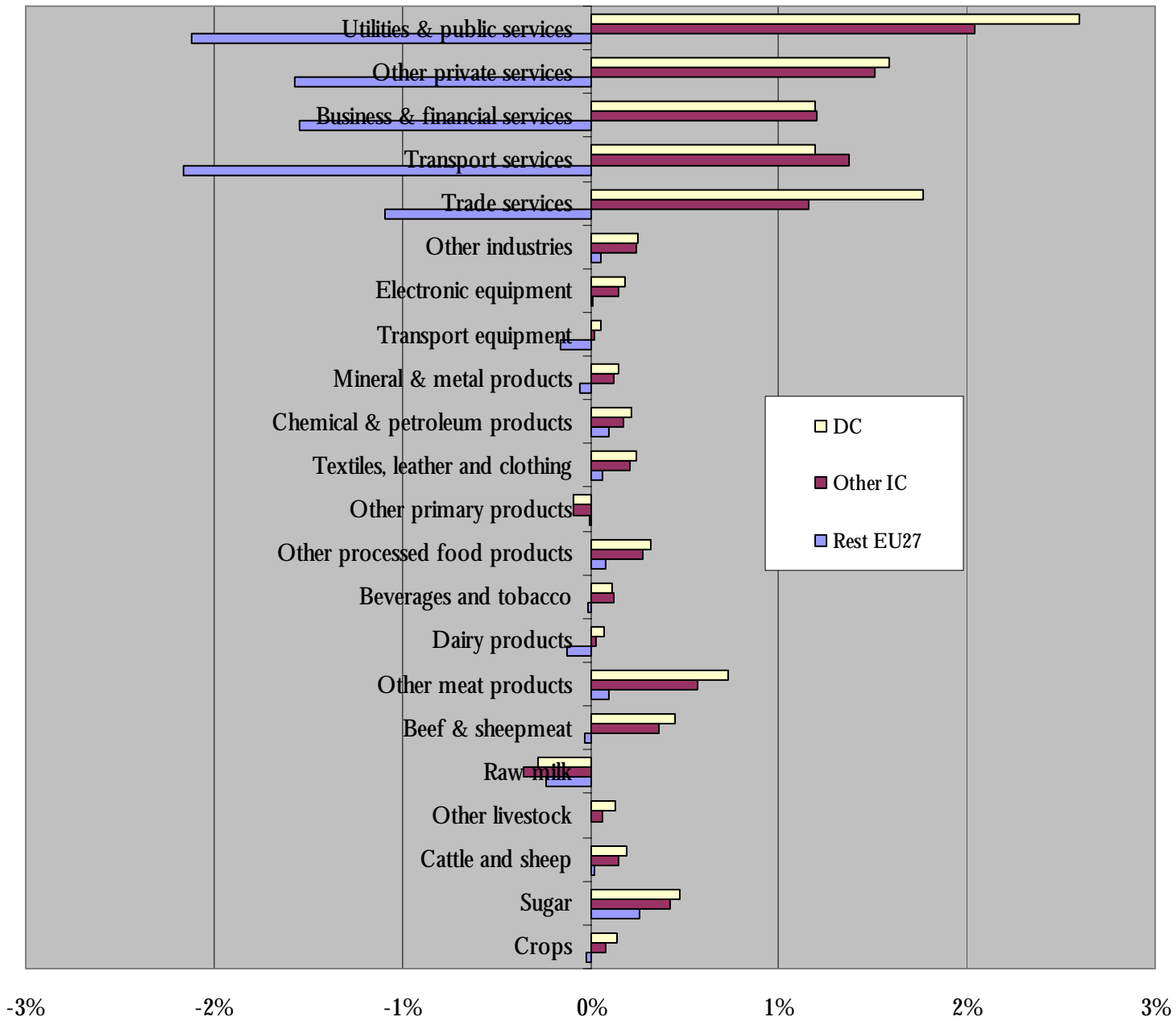
Source: GTAP model simulation results.

Figure 4.2: Change in Irish Exports by Destination – Simulation 2
(in percentage change)



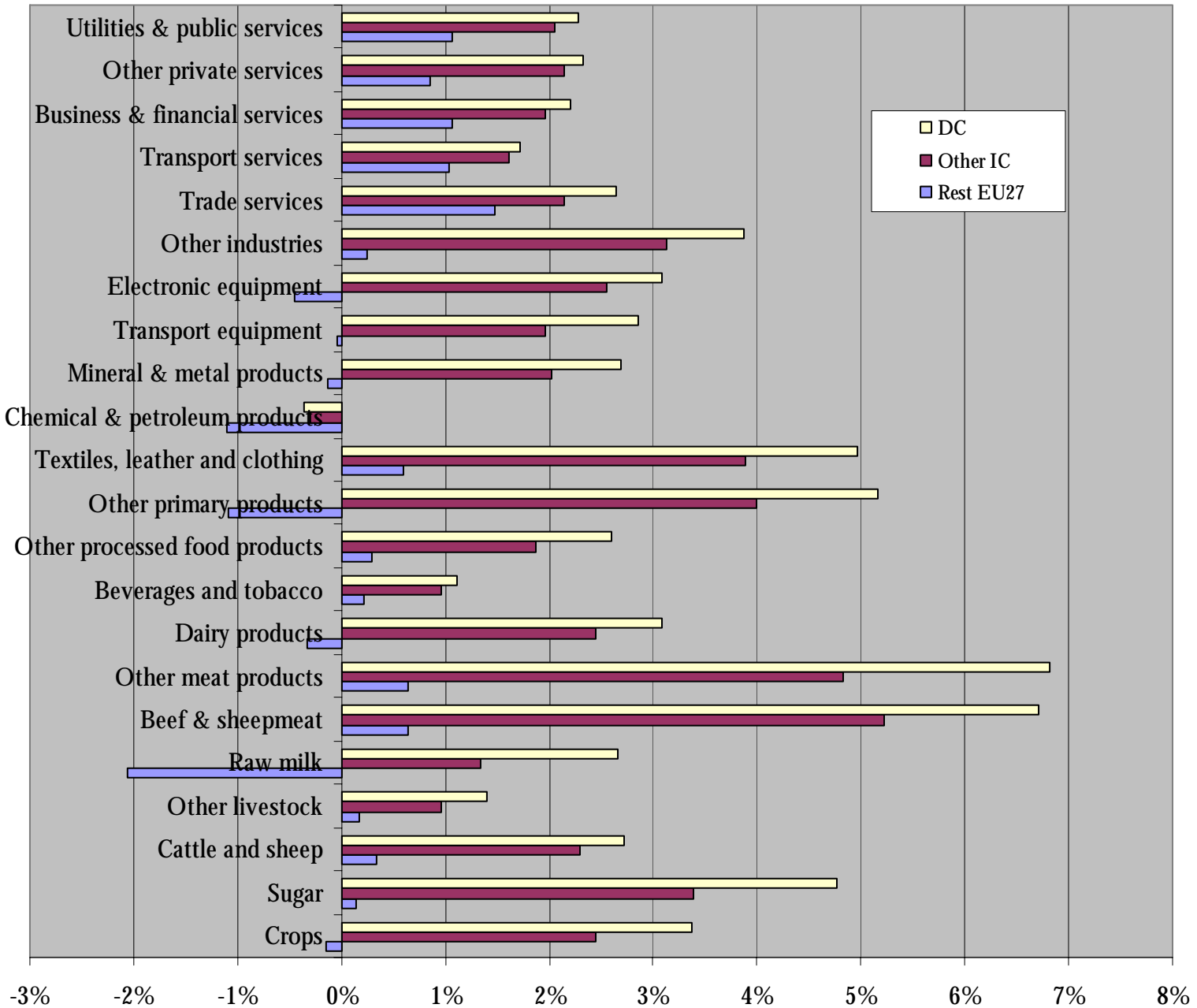
Source: GTAP model simulation results.

Figure 4.3: Change in Irish Exports by Destination – Simulation 3
(in percentage change)



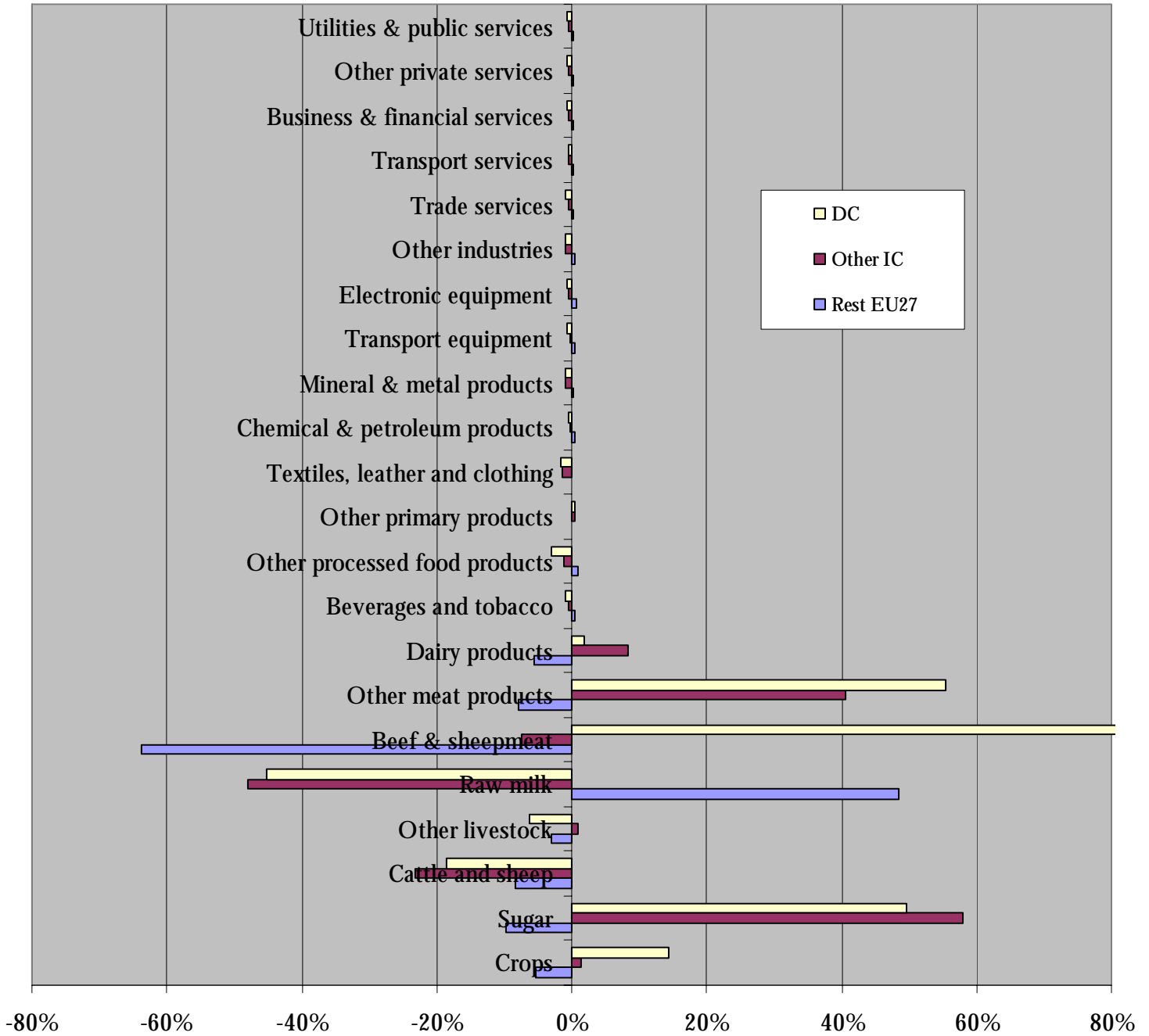
Source: GTAP model simulation results.

Figure 4.4: Change in Irish Exports by Destination – Simulation 4
(in percentage change)



Source: GTAP model simulation results.

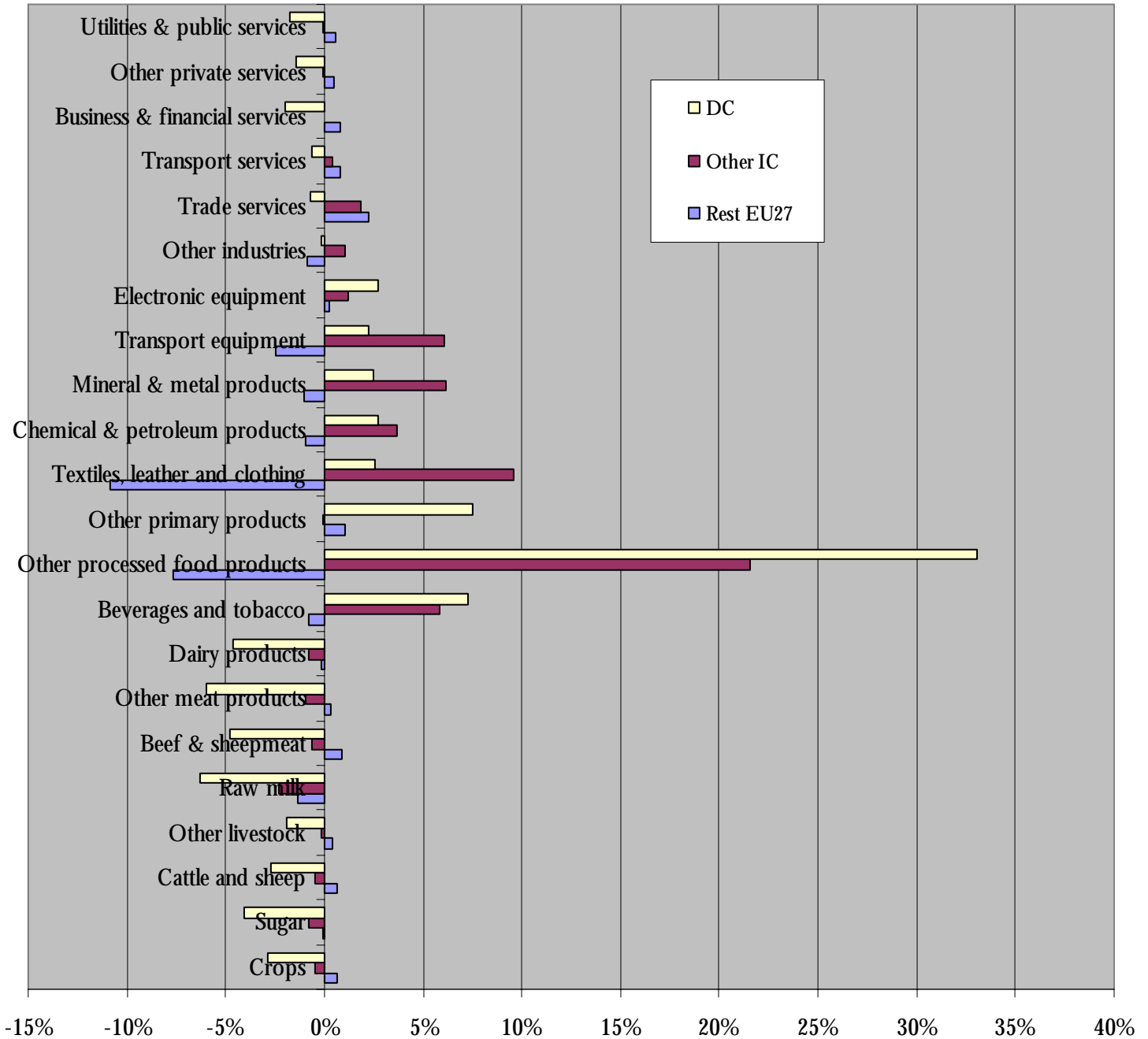
Figure 4.5: Change in Irish Imports by Source – Simulation 1
(in percentage change)



Note: axis is truncated at 80 per cent to better illustrate the changes in the majority of the sectors. Some sectors (e.g. raw milk) experience considerable percentage changes as their initial import values are low.

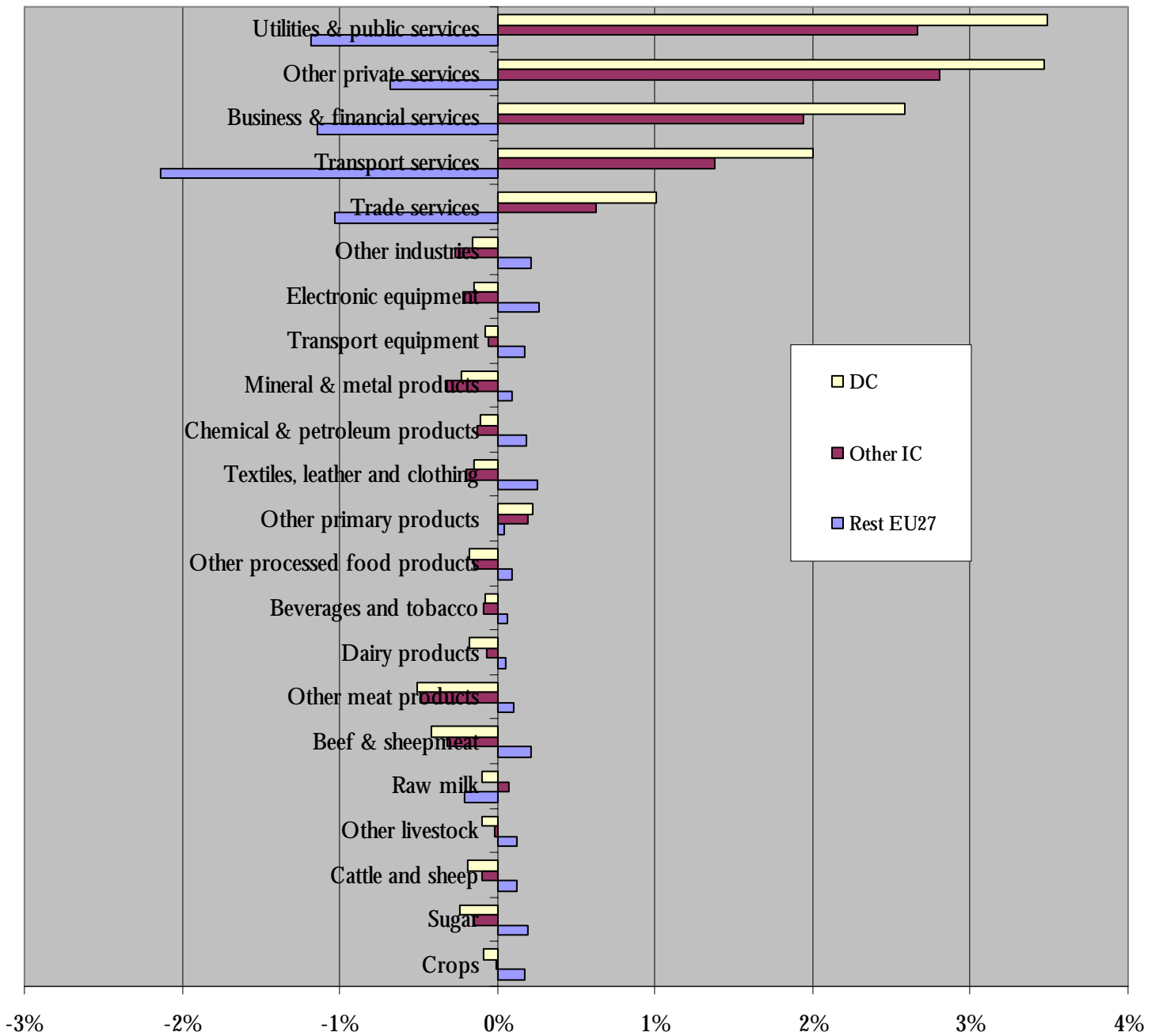
Source: GTAP model simulation results.

Figure 4.6: Change in Irish Imports by Source – Simulation 2
(in percentage change)



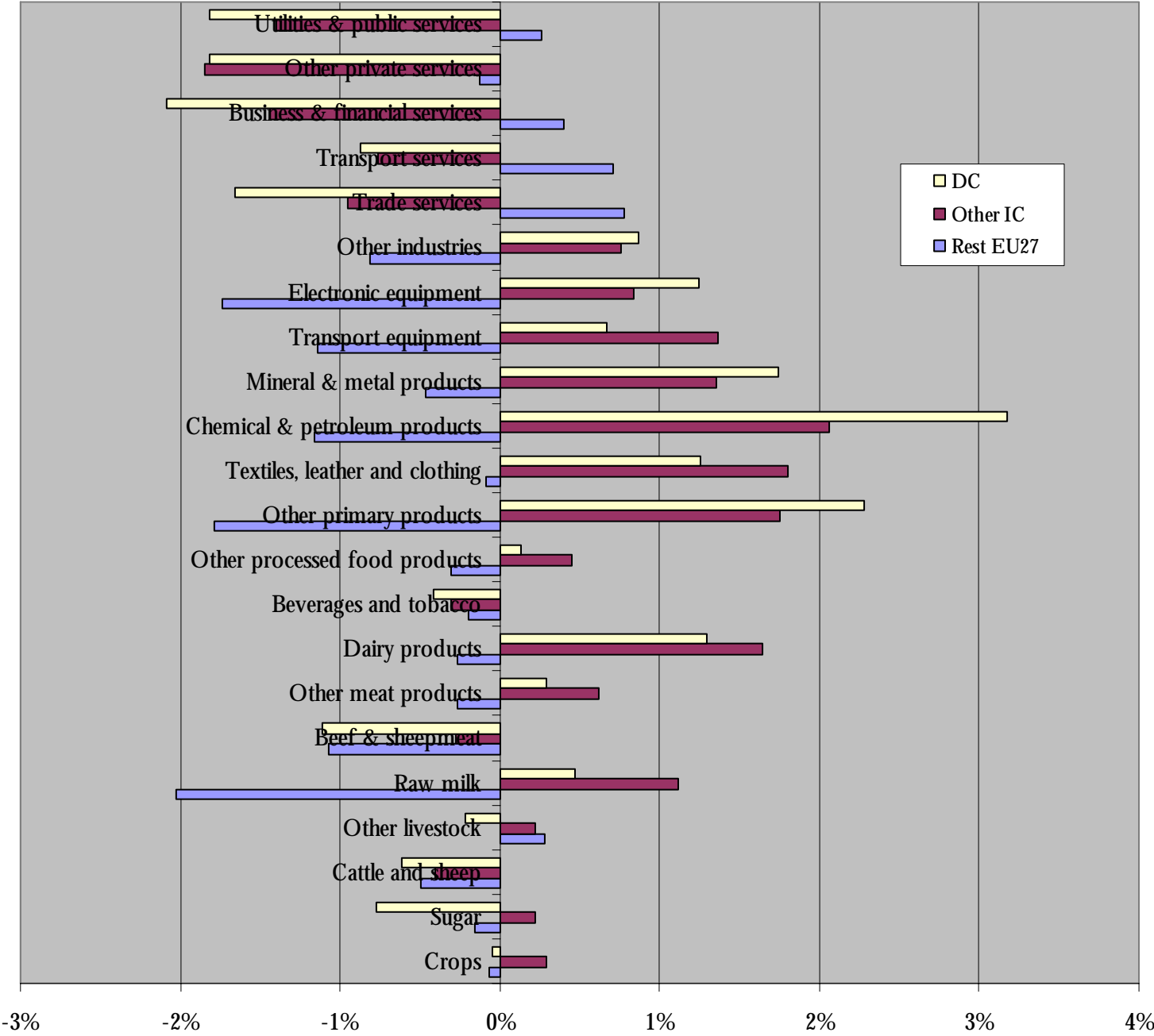
Source: GTAP model simulation results.

Figure 4.7: Change in Irish Imports by Source – Simulation 3
(in percentage change)



Source: GTAP model simulation results.

Figure 4.8: Change in Irish Imports by Source – Simulation 4
(in percentage change)



Source: GTAP model simulation results.

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Appendix The GTAP Model and Database

1 Introduction

The empirical work undertaken in this paper employs a computable general equilibrium (CGE) model known as GTAP, the Global Trade Analysis Project model. This type of model is a powerful tool enabling quantitative analysis of trade issues. GTAP in particular, with its wide country coverage and extensive database, is designed for precisely this task.

As described by Greenaway *et al.* (1993), the theory of CGE modelling is simple: an analytically consistent, mathematical model of an economy is combined with the data on the required variables in this economy at a point in time allowing the model to be solved numerically. The theory of general equilibrium, implying demand equalling supply across all markets, and the concept of modelling an economy as a system of simultaneous equations, can be traced back to Walras in the 19th century. However, it was not until relatively recently that the computational power to run such models efficiently became widely available.

The Centre for Global Trade Analysis, based in the Department of Agricultural Economics at Purdue University, is the home of the GTAP. Begun in 1992 with the objective of lowering the cost of entry to CGE modelling (Hertel, 1997), GTAP has become more than a model and database. The Centre coordinates an international consortium of agencies working to maintain and develop the model and the software required for its operation, whilst providing a focal point for a worldwide network of researchers working on international economic issues.

2 An Overview of the Standard GTAP Model and Database

GTAP is a one period model, multi-regional, CGE model. All markets in the model are perfectly competitive and exhibit constant returns to scale. This paper employs the standard model, however it can be extensively modified to suit more particular modelling requirements.

The world economy consists of many economies (referred to in the model as “regions”) interlinked by bilateral trade flows. The structure of these regions is the same, each provides an elaborate representation of the economy including the interactions between the agents in the model (private households, government and firms) and linkages between all of world production and trade. The number of sectors is the same in each region and all commodities are produced in every region.

The functioning of the model economy, including the actions of the represented agents and the sectoral and regional linkages, is determined by the behavioural and accounting equations specified in the model files. These equations in turn draw upon the database. Fully disaggregated there are five factor endowments (land, skilled and unskilled labour, capital and natural resources), eighty-seven regions and fifty-seven sectors /

commodities. The primary reference for information on the model and its database is Hertel (1997) and the GTAP website.³¹

Although GTAP is a non-linear model and is solved in a non-linear way, the equations in the main model file (the GTAP Tab file) are written in linearised form. The Tab file is written in a programming language known as TABLO code, allowing the model code to be read and implemented using a software package known as General Equilibrium Modelling Package (GEMPACK) developed by the Centre for Policy Studies (CoPS) in Monash University.³²

2.1 Model Structure³³

2.1.1 *The Regional Household*

The agents in the model are private households, government and firms. These are brought together within in each represented region in the model by a regional household, as shown in Figure A1. This diagram demonstrates the relationship of the agents within a region and also the links between of each region in the model with the rest of the world.³⁴ All revenues within a region accrue to the regional household. These revenues come from payments by firms on factor endowments owned by private households and from the assorted net taxes³⁵ in the model. All factors are assumed to be fully-employed.

The regional household distributes this income among private households, government and savings that together sum up to equal final demand in the model, as shown in Figure A2. This distribution is by a Cobb-Douglas utility function, this does not necessarily imply constant shares to private, public and savings demands as might be expected. This irregularity is due to the fact that, while savings and government expenditures are homothetic in real income, private consumption is not, it is modelled using a Constant Difference of Elasticity (CDE) function. For example, as regional income increases, there will be shift towards public and future consumption (if we think of savings as being intended for consumption in future periods), away from private consumption. The reason for this characteristic is to better model private household behaviour as is explained in the next section.

2.1.2 *Measurement of Welfare Change in GTAP*

There are some disadvantages to this structure, however it does offer some major advantages, including enforcing the condition that the regional household may not spend more than it receives, removing the need for detailed tax account data in the construction of the data, and, in particular it allows for the computation of a measure of regional welfare and its decomposition.

³¹ GTAP website: www.gtap.org.

³² For more information on GEMPACK, see Harrison and Pearson (1994) and www.monash.edu.au/policy/gempack.htm.

³³ The main source for this model description is Hertel (1997), unless other references are indicated. Much of the material also draws upon the 12th Annual GTAP Short Course, 2004, Purdue (see www.gtap.org).

³⁴ As it is impossible to show a diagram with all 87 GTAP regions and all the linkages between them, for simplicity only one illustrative region is displayed, the Rest of World in this diagram represents the other 86.

³⁵ Taxes are applied to private expenditure, government expenditure, intermediate inputs of firms and imports and exports. Some taxes are negative, i.e., are subsidies.

In GTAP, the change in a region's welfare as the result of a shock is measured as the equivalent variation in income – the amount of money that the consumer would be willing to pay to avoid a price change. It measures the change in consumers' utility expressed in monetary terms (2001 US dollars in version 6). The GTAP model features an add-on module that decomposes these welfare changes in elaborate detail (Hertel and Huff, 2000). The EV is broken down into allocative efficiency effects, terms of trade effects, technology effects and endowment effects³⁶, each of which can be further decomposed into its component parts.

2.1.3 Production Structure in GTAP

Production in GTAP is based on the nested structure shown in Figure A3.³⁷ Firms' output is produced from a combination of primary factors and intermediate inputs purchased from other sectors. The optimal mix is determined by a Constant Elasticity of Substitution (CES) function.³⁸ Whilst in theory this implies there can be substitution between intermediate inputs and value-added factors in production (at a constant rate), this is not the case in the standard model. The calibration of the model parameters is such that this becomes a Leontief function, although users may specify other parameter values if they prefer. The Leontief functional form is a special case of the CES that enforces a zero elasticity of substitution and so fixes the mix of value added and intermediates. In a Leontief function, quantity shares are fixed, as opposed to a Cobb-Douglas which implies fixed budget shares.

Within the sub-nests in the production tree, the functional form used in GTAP is also a CES function, however at this level substitution is permitted within in both nests. Firms substitute between factors of production and among intermediates. Firms are assumed to select their optimal mix of endowments based on relative prices of the different factors and independently of the price of intermediates. The elasticity parameter (ESUBVA in Figure A3) that determines this substitution. Its values are shown in Table A2.

The two subnests are said to be separable, the elasticity of substitution between any one factor and intermediates is equal (i.e., it is the same between labour and food as between labour and manufacturing), as is the elasticity between any particular intermediate input and different factors. Within the intermediate input nest, the Armington assumption is used to differentiate between domestically produced and imported commodities.

2.1.4 The Armington Assumption

The purchase of commodities by agents takes into account their origin. The price of a commodity purchased by an agent is a composite of the weighted prices of domestic and foreign produced goods. Substitution between domestic and imported goods in consumption (Figure A2) and in production tree nest (Figure A3) is determined by a Constant Elasticity of Substitution (CES) function. In turn, imports are a mix of imports

³⁶ The last two are exogenous and will be zero unless technology or factor supply has been shocked respectively.

³⁷ This diagram illustrates a production tree, convenient for representing separable, constant returns to scale technologies. Each level is referred to as 'nest' (Hertel, 1997). The term within each nest is the elasticity of substitution.

³⁸ In the case of the production structure, this is sometimes referred to as a constant elasticity of transformation function (CET). This is the elasticity named *ESUBT* in Figure 2.4.

from other regions also based on a CES function. These two CES parameters are known as Armington elasticities (*ESUBM* and *ESUBD* in Figures A2 and A3).

GTAP follows the approach of Armington (1969) to determine the sourcing of imports in the model. Known as the ‘Armington Assumption’, national varieties of a homogenous commodity are differentiated by source. By treating them as imperfect substitutes, this introduces separability between homogenous products from different sources. Consumers of commodities (whether it be public or private consumption or for use as intermediate inputs by firms) follow the same approach. First the sourcing of imports is determined, based on the Armington elasticity parameter (*ESUBM*³⁹ in Figures A2 and A3) A composite import price is calculated based on this and combined with another Armington elasticity (*ESUBD*), determines firms’ optimal mix of domestically and foreign produced inputs. (utility maximising in case of private and public consumers or cost minimising in the case of firms).

Therefore, in the consumption and production trees there are two Armington elasticities. There is separability between domestic and imported inputs. *ESUBM* and *ESUBD* are the same for all regions but vary between sectors. As Table 2.5 shows, *ESUBM* elasticities are approximately double the values of *ESUBD*.

2.1.5 Prices in GTAP

Policy interventions (tax and subsidies) are modelled as price wedges. GTAP does not track individual taxes and subsidies. The value of an intervention is calculated by comparing values of transactions at agent and market prices or market and world prices. Any difference between them is due to a policy intervention. Whether this intervention has a positive or negative impact on prices depends on the net effect of the taxes and subsidies. If taxes on a particular commodity are greater than the subsidies, then the market price will be above the agent price for that commodity.

All prices in GTAP are relative rather than absolute prices. The GTAP model is essentially a large system of simultaneous equations, with the endogenous variables representing the unknown variables. Making use of Walras’ Law, if all other markets clear then it must be the case that the final one clears too. In GTAP it is not imposed that the equation setting global savings equal to global investment must hold, but all other markets are fixed (i.e., supply must equal demand). If the model is valid, this market must clear to satisfy Walras’ Law. This approach allows for a powerful check of model valid but also means that, as the model is not solved for all markets, it cannot be solved for all prices. One price must be set exogenously. This price is known as the numeraire and provides a point of reference against which the changes in all others prices are compared.

2.2 The GTAP Database

The construction and calibration of the database is documented in Dimaranan and McDougall, 2005.⁴⁰ The database is composed of three broad parts - national input-

³⁹ Both the *ESUBM* and *ESUBD* parameters are the same as used in private and government consumption.

⁴⁰ Dimaranan and McDougall (2002) documents version 5 of the database, relevant differences in the current version (v6) are highlighted.

output tables, international trade data and protection data. The base year of the current version is 2001 and all data is represented in 2001 US dollars.

2.2.1 Input-Output Data

Every region in the GTAP database is represented by an input-output (IO) table. Each IO table is an input matrix showing employment of factor endowments and use of intermediates in production for each sector per region (fifty-seven industries each producing a single commodity). IO tables represent only domestically produced commodities and the allocation of the regional factor endowments between sectors, however the intermediate inputs in any sector can be sourced from abroad. Also included is final demand for domestic and imported goods by private households and governments, and for gross capital formation. Finally, tax and subsidy data is added.

2.2.2 Bilateral Trade Data

The main source for the international trade data is the United Nations COMTRADE (Commodity Trade) database and GTIS (Global Trade Information Services). However, due the number of countries involved and the large amount of data required, it is often the case that there are gaps. Methodology developed by the US Department of Agriculture's Economic Research Service (ERS) is used to calculate estimates of missing values. These estimates are made at the 4-digit level (following the Standard International Trade Classification system) and then aggregated up to the relevant sectors used in the GTAP database.

For international trade in services, COMTRADE data is supplemented with IMF Balance of Trade Statistics. Following the GATS classification, services can be broken down into four categories: margin, non-margin, travellers and commercial presence.

To illustrate the representation of margin commodities in GTAP, Dimaranan and McDougall (2002) uses the example of a Norwegian cargo ship being used to export cars to Canada from Germany. The value of water transport services supplied by Norway and the value of transport services used in exporting cars from Germany to Canada are specified. The margin services are considered exports of the country that supplies them and imports of the country that receives the merchandise (the cars in this example). In this way trade in margin services are specified by supply and usage. The margin service sectors in GTAP are air, water and other transport.

Travellers' expenditure is considered as consumption abroad, whilst trade in non-margin services is treated as cross-border supply and temporary presence of persons. Non-margin services are traded in all GTAP service sectors except for electricity, gas, water and dwellings. The only sector in which travellers' expenditure is not traded is dwellings. The fourth category, commercial presence is not modelled.

Foreign direct investment (FDI) is not modelled in the standard GTAP model.⁴¹ All factors including capital are region specific and hence cannot flow between regions. Whilst this presents a limitation for modellers, it does reduce greatly the data requirements.

⁴¹ There are modified versions of the model that attempt to incorporate FDI (e.g., Dee and Hanslow, 2000).

2.2.3 Protection Data

A wide range of measures are covered, with data from a variety of sources (Dimaranan and McDougall, 2005). Table A1 provides a summary of the protection measures represented in the standard version of the database and the sources of the data used.

Whereas in previous versions of the database, different resources were used for agricultural and non-agricultural tariff data, both are now derived from the same source. The Market Access Map (MAcMAP) database, developed by CEPII and ITC,⁴² is used to generate applied tariff rates for 2001 for all regions in the GTAP. Export subsidies are calculated based on countries' submissions on export subsidy expenditures to the WTO and export values from the UNCTAD trade database.

For all service sectors both import tariffs and export subsidies are set to zero. Generally restrictions to trade in services are qualitative rather than quantitative. The difficulties in accurately estimating tariff equivalents to these barriers are well documented (see Francois *et al.*, 2003 for example) and as yet not sufficiently overcome for any such estimates to be considered sufficiently precise to be included in the database.

The main source of the domestic agricultural support data in current version of the database is the Producer Subsidy Estimates (PSE) produced by the Organisation for Economic Cooperation and Development (OECD) for 2001. PSE as measured and reported by the OECD has two constituent parts: market price support (the gap between domestic market prices and world prices) and direct domestic supports (OECD, 2001).

The representation of this data in GTAP was substantially improved in the construction of version 5 of the database. In earlier versions of the database, only market price support was explicitly modelled. The remaining domestic support was modelled as subsidies on output. The PSE database was used for both market price support and domestic support data. Agricultural support in versions 5 and later is structured differently. As a result of work by researchers at the Danish Institute of Agricultural and Fisheries Economics (FOI) to make GTAP more suitable for modelling scenarios concerning EU agricultural reform, domestic support in the PSE database has been broken down into four categories: output subsidies, intermediate input subsidies, land-based payments and capital-based payments.

A number of free trade areas (FTAs) are represented in the database, Table A1 gives the complete list. This has been facilitated by the use of MAcMaps to generate import tariff data, as many more FTAs and other preferential trading agreements are taken into account compared to the previous data sources.

⁴² Centre d'Etudes Prospectives et d'Informations Internationales (Paris) and the International Trade Centre (Geneva) respectively.

Appendix Tables

Table A1: Protection Instruments in the Standard GTAP Database

Protection Mechanism	Data Sources
<i>Import Tariffs</i>	MAcMAPS (CEPII) – Applied tariff rates.
<i>Export Subsidies</i>	Based on country submissions to the WTO. Any missing data is extracted from the input-output tables.
<i>Domestic Support</i>	OECD Producer subsidy equivalents (PSE) data for 2001 supplemented with EAGGF Guarantee expenditures for the same year.
<i>Agreement on Textiles and Clothing (ATC)</i>	Data on export tax equivalents of the quotas allowed under the ATC are based on estimates by Francois and Spinanger (2001).
<i>Other Protection Measures</i> <ul style="list-style-type: none"> ▪ Anti-dumping duties ▪ Price undertakings ▪ Voluntary Export Restraints 	Due to lack of available data, these have been reported as zero values in this version of the database.
<i>Free Trade Areas</i>	The following FTAs are recognised in the database: <ul style="list-style-type: none"> ▪ North American Free Trade Agreement (NAFTA) ▪ Australia-New Zealand Closer Economic Relations Trade Agreement (ANZCERTA) ▪ European Union (15 members) ▪ European Free Trade Association (EFTA) ▪ Southern Africa Customs Union (SACU)

Source: Dimaranan and McDougall (2002).

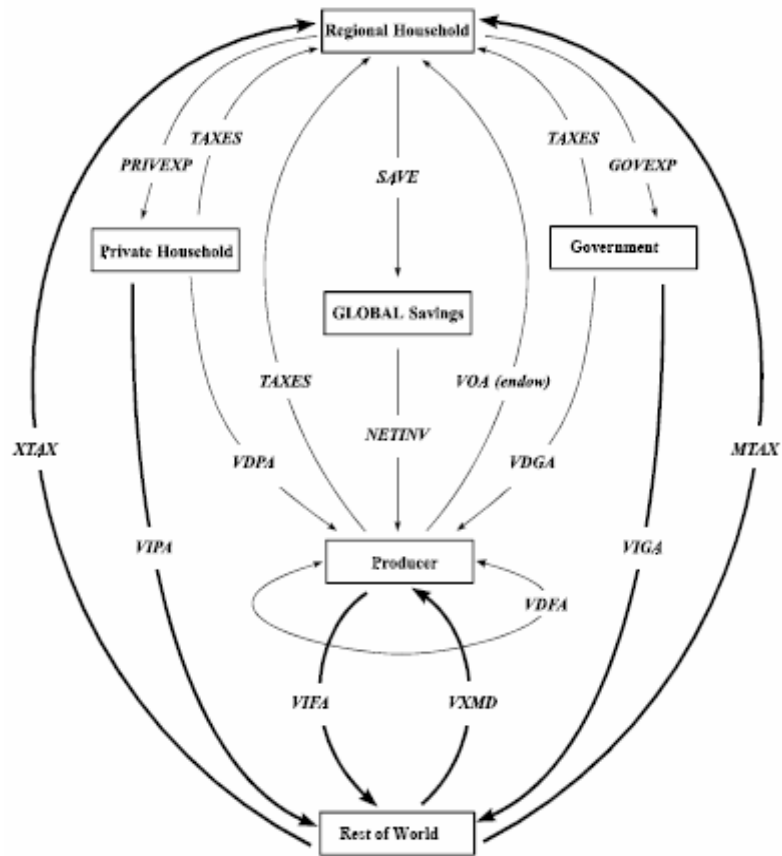
Table A2: Elasticities in GTAP Database version 5

Sector	<i>ESUBVA</i>	<i>ESUBD</i>	<i>ESUBM</i>	Sector	<i>ESUBVA</i>	<i>ESUBD</i>	<i>ESUBM</i>
Paddy rice	0.2	2.2	4.4	Wood products	1.3	2.8	5.6
Wheat	0.2	2.2	4.4	Paper products & publishing	1.3	1.8	3.6
Other cereal grains	0.2	2.2	4.4	Petroleum & coal products	1.3	1.9	3.8
Vegetables, fruit & nuts	0.2	2.2	4.4	Chemical, rubber & plastic products	1.3	1.9	3.8
Oil seeds	0.2	2.2	4.4	Other mineral products	1.3	2.8	5.6
Sugar cane & sugar beet	0.2	2.2	4.4	Ferrous metals	1.3	2.8	5.6
Plant-based fibres	0.2	2.2	4.4	Other metal	1.3	2.8	5.6
Other crops	0.2	2.2	4.4	Metal products	1.3	2.8	5.6
Cattle, sheep, goats & horses	0.2	2.8	5.6	Motor vehicles & parts	1.3	5.2	10.4
Other animal products	0.2	2.8	5.6	Other transport equipment	1.3	5.2	10.4
Raw milk	0.2	2.2	4.4	Electronic equipment	1.3	2.8	5.6
Wool & silk-worm cocoons	0.2	2.2	4.4	Other machinery & equipment	1.3	2.8	5.6
Forestry	0.2	2.8	5.6	Other manufactures	1.3	2.8	5.6
Fishing	0.2	2.8	5.6	Electricity	1.3	2.8	5.6
Coal	0.2	2.8	5.6	Gas manufacture & distribution	1.3	2.8	5.6
Oil	0.2	2.8	5.6	Water	1.3	2.8	5.6
Gas	0.2	2.8	5.6	Construction	1.4	1.9	3.8
Other minerals	0.2	2.8	5.6	Trade	1.7	1.9	3.8
Meat: cattle, sheep, goats & horses	1.1	2.2	4.4	Other transport	1.7	1.9	3.8
Other meat products	1.1	2.2	4.4	Sea transport	1.7	1.9	3.8
Vegetable oils and fats	1.1	2.2	4.4	Air transport	1.7	1.9	3.8
Dairy products	1.1	2.2	4.4	Communication	1.3	1.9	3.8
Processed rice	1.1	2.2	4.4	Other financial services	1.3	1.9	3.8
Sugar	1.1	2.2	4.4	Insurance	1.3	1.9	3.8
Other food products	1.1	2.2	4.4	Other business services	1.3	1.9	3.8
Beverages & tobacco products	1.1	3.1	6.2	Recreation and other services	1.3	1.9	3.8
Textiles	1.3	2.2	4.4	Public administration, defence, health &	1.3	1.9	3.8
Wearing apparel	1.3	4.4	8.8	Dwellings	1.3	1.9	3.8
Leather products	1.3	4.4	8.8				

Source: GTAP Database

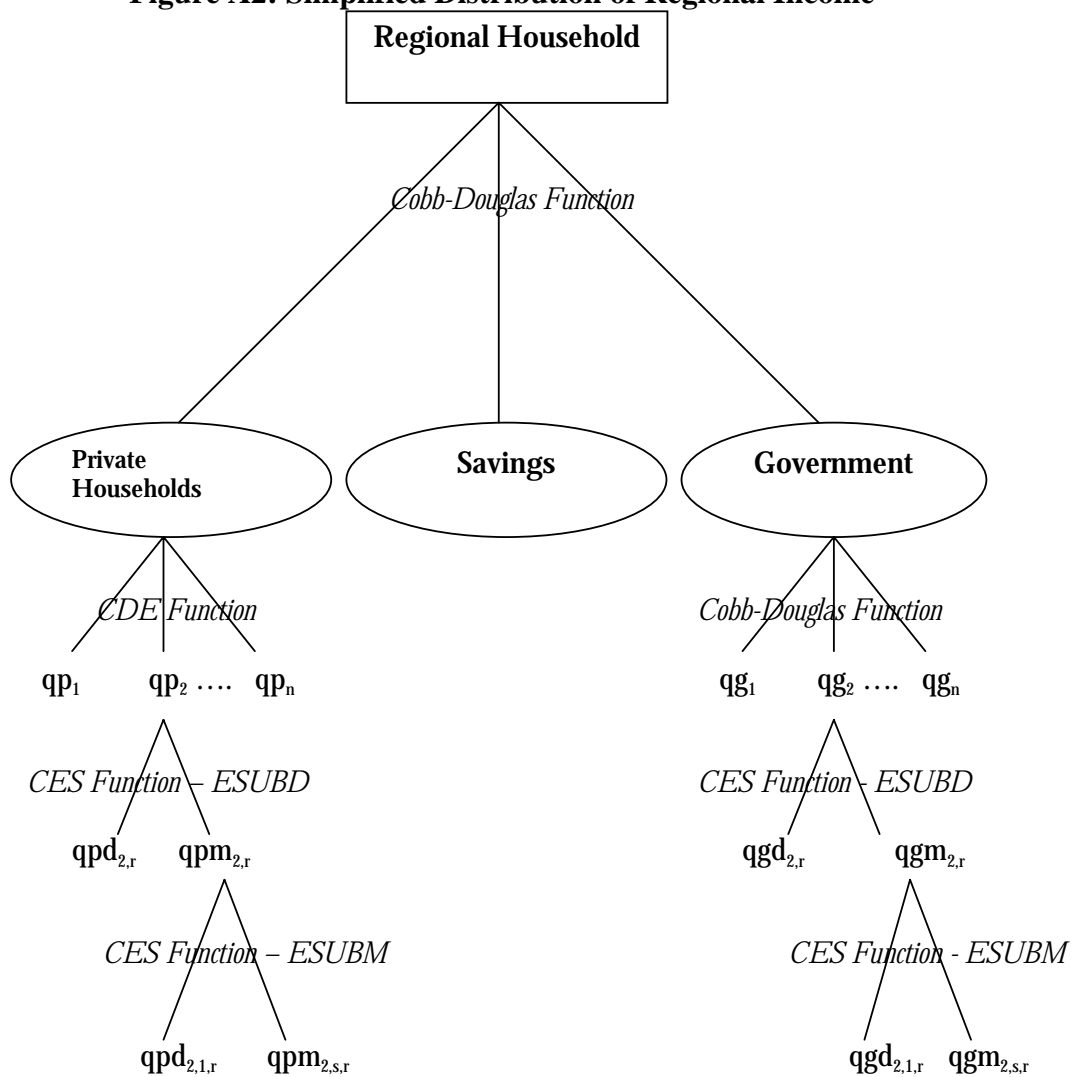
Appendix Figures

Figure A1: Structure of an Economic Region in GTAP



Source: Brockmeier, 2001 (Figure 6, p16)

Figure A2: Simplified Distribution of Regional Income

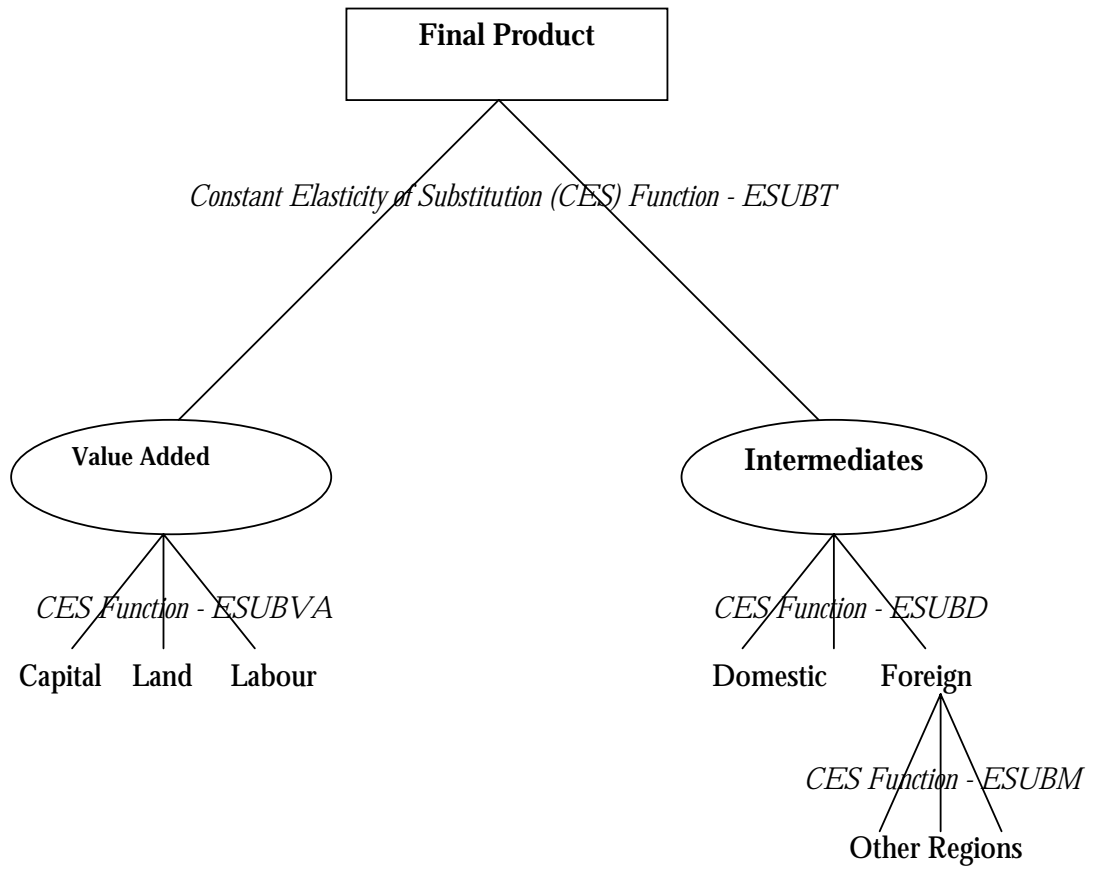


Source: Based on Hertel (1997).

Where:

- qp_i and qg_i represent individual quantities consumed by private households and government.
- qpm and qpd indicate that commodity is produced domestically or imported respectively.
- $qpd_{2,s,r}$ = quantity of commodity i imported from s into r .
- $ESUBM$ and $ESUBD$ are the Armington elasticities.

Figure A3: Production Structure



Source: Based on Hertel (1997).