Trade liberalisation under the Doha Development Agenda

Options and consequences for Africa

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This study provides a quantitative estimate of the potential economic consequences of multilateral trade reform under the WTO for Africa using a framework that explicitly incorporates issues of concern to the region, such as preference erosion, loss of tariff revenue, and trade facilitation. It also examines the impact of OECD agricultural support programmes on economic welfare and specialisation in Africa. In the static version of the GTAP model, the study finds that full liberalisation of trade would increase global welfare (income) by 0.3 per cent, but would add 0.7 per cent annually to income in the African region. Sub-Saharan Africa and, to a lesser extent, Southern Africa, are vulnerable to partial trade reforms as they incur losses from partial reform while all other regions derive positive gains from a liberalisation of minor scope.

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Preface

In recent years, multilateral trade negotiations have occupied centre stage in economic policy discussions in the African region. This reflects partly the emerging consensus that trade has an important role to play in the economic development of the region. It also reflects the understanding that African countries have to be more active in trade negotiations in order to protect their interests. Information is the key to effective participation in the Doha Development Agenda. This paper provides a quantitative estimate of the potential economic consequences of multilateral trade reform for Africa using a framework that explicitly incorporates issues of concern to the region, such as preference erosion, loss of tariff revenue, and trade facilitation. It is the result of a cooperation of staff of the Trade and Regional Integration Division, United Nations Economic Commission for Africa (ECA), Addis Ababa, and researchers of the Agricultural Economics Research Institute (LEI), The Hague, The Netherlands. The study benefited from contributions by Mr H.J. Kelholt, Dr M. Lips and Dr C. Mwalwanda. Preliminary results were presented in a seminar at the Ministry of Foreign Affairs of The Netherlands at 26 February 2004, in The Hague. The authors thank the participants for their opinions on the work.

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Summary

The key development challenge facing the African region is how to reduce poverty through sustained economic growth. There is an emerging consensus that trade, if well managed, could play an important role in confronting this challenge. This fact has been recognised by African countries as evidenced by the fact that they are beginning to show more interest in multilateral trade negotiations. They are, however, concerned that they have not been able to derive substantial benefits from trade due in part to the protective agricultural policies and trading practices of OECD countries.

This study provides a quantitative estimate of the potential economic consequences of multilateral trade reform for Africa using a framework that explicitly incorporates issues of concern to the region, such as preference erosion, loss of tariff revenue, and trade facilitation. It also examines the impact of OECD agricultural support programmes on Africa and provides an idea of the relative importance for Africa of the three pillars in the Doha round negotiations on agriculture, with a view to assisting African trade officials in ranking their priorities in the negotiations.

The study is based on the GTAP (Global Trade Policy Analysis) model, which is a multi-sector and multi-region general equilibrium model widely used by trade analysts to examine the impact of trade policies. It focuses on the impact of reforms at the sub-regional level for North Africa, sub-Saharan Africa, and Southern Africa. The focus on sub-regional, as opposed to country level, impacts can be ascribed to the fact that most African countries are not in the GTAP database and so it is not possible to conduct country level analysis. That said, to the extent that groups of countries have similar structures and trading patterns, the results could be used to draw general inferences on how the reforms might affect individual countries.

Three trade reform scenarios, capturing different degrees of trade liberalisation, are considered. These are 'little', 'modest,' and 'full' trade liberalisation scenarios. In the static version of the model, the study finds that full liberalisation of trade would increase global welfare (income) by 0.3 per cent, but would add 0.7 per cent annually to income in the African region. The gains to Africa may seem modest but is significant given the fact that the region's share of the global welfare gain is 5 per cent while its share of global output is about 2 per cent. The study also suggests that the gains from liberalisation grow with the depth of reforms. While North Africa benefits from all liberalisation scenarios, sub-Saharan Africa and Southern Africa incur losses when partial liberalisation is carried out. This is largely due to the combined impact of preference erosion and binding overhang. Several countries in the two African sub-regions are major beneficiaries of preferential trading arrangements and partial market access reforms increase the degree of competition they face in export markets. But because of binding overhangs, partial reforms do not yield any significant improvement in market access for exports of countries in the two African sub-regions.

Another interesting finding of the study is that reforms force African countries to specialise more in the production of agricultural commodities. In particular, they result in the contraction of industrial activities in the region and a shift of resources into the production of commodities such as grains, sugar, and cotton. Although this change in the pattern of specialisation is dictated by comparative advantage, it is worrisome because excessive dependence on commodities increases the degree of vulnerability faced by the region.

Regarding the three pillars of the negotiations on agriculture - market access, domestic support, and export competition - the study finds that, in terms of welfare gains, market access and domestic support are important for countries in North and Southern Africa. More specifically, under the full liberalisation scenario, North Africa derives welfare gains of USD 578 and 595 million from more market access and reductions in domestic support respectively. For Southern Africa the gains are USD 336 and 449 million. Turning to sub-Saharan Africa, market access yields the largest benefits to the sub-region. The gain from this source is three times larger than the gain from domestic support. Furthermore, North Africa incurs losses from reductions in export subsidies - because it is a net importer of subsidised commodities - while the other sub-regions do not reap any significant benefits. With respect to Non-Agricultural Market Access (NAMA), the study finds that the African region is vulnerable to partial reforms in this area due largely to the loss of tariff revenue.

On trade facilitation, the study suggests that all African regions stand to derive benefits from reforms in this area. This result should, however, be interpreted with caution because the study does not incorporate the implementation costs associated with trade facilitation. To the extent that these are large, the net benefits to African may not be positive. The results also suggest that unilateral trade facilitation by other developing countries and transition economies without any reciprocal actions by African countries will lead to welfare losses in the African region.

When the model is modified to allow for dynamic effects, the study finds that there is a substantial increase in the benefits of trade reforms to all regions of the world. For the sub-Saharan Africa region, the welfare gains from full liberalisation increases from USD 704 million in the static model to USD 4.3 billion in the dynamic model. That is, the gain to sub-Saharan Africa in the dynamic model is about six times as large as in the static model. The huge welfare gain from the dynamic model is associated with the impact of capital accumulation. The results therefore emphasise the importance of complementing trade liberalisation with investment enhancing policies.

What are the implications of our results for the current round of multilateral trade negotiations? Clearly, the most important result that has serious implications for negotiations under the Doha round is the idea that countries in sub-Saharan Africa and, to a lesser extent, Southern Africa, are vulnerable to partial trade reforms. Since other regions of the world derive positive gains from partial reforms and it is unlikely that there will be complete liberalisation in the current round of negotiations, the results underscore the need for development issues to be taken more seriously in the negotiations. Consequently, to ensure that partial reforms do not have serious adverse effects on the African region, WTO members need to find appropriate mechanisms to make special and differential treatment a more effective instrument for development in Africa and other least developed countries.

1. Introduction

The protection of agricultural markets remains a topic that seems to divide developing countries and member countries of the Organisation for Economic Cooperation and Development (OECD). Renegotiations of the Uruguay Round Agreement on Agriculture under the Doha Development Agenda (DDA) were to bring parties together, but little headway has been made so far. Between the two rounds of WTO-talks, OECD countries have been reluctant to phase out support to their farmers. For Africa, so much affected by distortions in agricultural markets, this is a major disappointment.

In response to the limited progress that has been made in the current Doha round of multilateral trade negotiations, African countries have increased their calls for fair trade practices and are beginning to show more interest in multilateral trade negotiations. Trade negotiation is a bargaining game. This has several implications. First, there is the need to bring ranked priorities to the negotiation table, preferably based on calculated gains and losses from various outcomes to the economy. Understanding the impact of various methods of trade liberalisation is important if an economy is to maximise its gains from the process. This is particularly critical in the negotiations on agriculture where the so-called 'modalities' have a large influence on the likely outcome of the process. Second, there is the need for countries with similar interests to unite and seek common positions on some of the issues in order to gain negotiating power. Since the onset of the Doha round, several developing countries have been quite effective in joining umbrella groups to defend their key interests. For example, some African countries are members of the G20+ and the Cairns group of agricultural commodity exporters pushing for more rapid reform of agricultural trade. There has also been an increase in efforts by African countries to form common positions on key issues under the DDA so as to maximise their gains from the negotiation process.

One of the challenges facing African countries in the Doha round of negotiations is how to deal with the lack of capacity to conduct research on the impact of various proposals in the negotiations on their economies. This study is one in a series of recent efforts that have been made to identify the consequences of the DDA for African countries (see, for example, Iancovichina et al., 2001; and Kerkelä et al., 2000).[1] It has two main objectives. The first is to provide a quantitative estimate of the potential economic benefits that could accrue to Africa from multilateral trade reform using a framework that explicitly incorporates issues of concern to the region, such as preference erosion, loss of tariff revenue, and trade facilitation.[2] The second objective is to provide an idea of the relative importance for Africa of the three pillars in the agriculture negotiations so as to assist African trade officials in ranking their priorities in the negotiations. The framework used in the analysis is the Global Trade Analysis Project (GTAP) model, which is a computable

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[1] See also Francois et al. (2003a), International Monetary Fund (2002), IFPRI (2003, forthcoming) and Anderson et al. (2001) for recent applications of the GTAP model to the Doha round.
[2] See Amjadi et al. (1996) for a broad outline of trade policy issues for Africa.

general equilibrium model used by trade analysts throughout the world. It is a model of the global economy, which allows the analyst to incorporate relations between all sectors of an economy in all countries of the world.

The study makes several contributions to the existing literature. First, the model used for the analysis incorporates unemployment of unskilled labour, which is a very important feature of African countries. Throughout the analysis it is assumed that unskilled labour may enter the wage economy when this factor of production is in demand, while demand for skilled labour responds to changes in the wage rate.

Second, the study estimates trade and welfare in Africa under a mid-term baseline run that reflects the altered policy landscape in which Doha outcomes are to be implemented eventually. The baseline includes full implementation of Uruguay Round commitments and the Agenda 2000 measures of the EU Common Agricultural Policy. It also assumes the full phase-out of the Agreement on Textiles and Clothing (Multi Fibre Agreement) and the integration of China into the WTO. Trade reforms of varying degrees of comprehensiveness are simulated, and the welfare effects for Africa are measured as deviations from the baseline.

Third, substantial effort was made to incorporate preferential trade conditions in the tariff data, as well as differences between bound levels and applied rates. Many African countries are major beneficiaries of trade preferences, and the erosion of preferences under a global liberalisation of border measures is of concern to them. It is shown that this effect is intertwined with binding overhang. Both features moderate the gains from trade reform, and make beneficiaries of preferences vulnerable to partial reforms.

Finally, the policy experiments conducted in the study are based on the key interests of Africa in the Doha round. Emphasis is on the relative importance of the three pillars of the agriculture negotiations (market access, export competition and domestic support), non-agricultural market access as it relates to manufactures, and trade facilitation.

The study is organised as follows. Chapter 2 discusses the role of trade in addressing the major development challenges facing the continent while chapter 3 presents an overview of Africa's position in global trade. Chapter 4 outlines the trade policy landscape for Africa, with emphasis on the 'three pillars' in the agriculture negotiations, market access formula, and the incorporation of trade preferences. Chapter 4 also presents the views of African countries on agricultural negotiations. The data, model, and policy scenarios used in the study are presented in Chapter 5. Chapter 6 contains the results of the analysis. The concluding chapter analyses the implications of the results for Africa and the Doha round of trade negotiations.

2. Trade and African Development

2.1 The challenge of African development

When African nations gained political independence in the 1960s, they had so much promise. With abundant natural resources, fertile lands, low population density, and a growing and vibrant labour force, there was the conviction that if African leaders create a political, social and economic environment conducive to growth, and take appropriate measures to ensure that the benefits trickle down to the poor, there would be a marked improvement in living standards on the continent.

To date, however, Africa's promise has not yet been realised and this is reflected in the fact that the economic performance of the region is poor given its resource endowments and also relative to other developing countries. Table 2.1 shows that over the period 1981-90, real Gross Domestic Product (GDP) per capita fell by 1.2 per cent in Sub-Saharan Africa (SSA). In East Asia and Pacific countries it rose by 5.7 per cent while in South Asia it rose by 3.5 per cent. The only two regions that had negative growth rates as in SSA were the Middle East and North Africa, and Latin America and the Caribbean, although the decline in these regions was not as large as in SSA. The poor performance of SSA relative to the other developing countries is even more pronounced when we look at the growth rates over the 1991-2000 period when real GDP per capita fell by 0.4 per cent in SSA but rose in all other regions: in East Asia and Pacific countries the growth rate was 6.4 per cent; in Latin America and the Caribbean it was 1.6 per cent; in the Middle East and North Africa it was 1 per cent; and in South Asia it was 3.2 per cent (World Bank, 2003).

Table 2.1   Growth Rate of Real GDP per capita in Africa 1981-2000 (annual average)

	1981-1990	1991-2000
East Asia and Pacific	5.7	6.4
Latin America and Caribbean	-0.9	1.6
Middle East and North Africa	-0.6	1.0
South Asia	3.5	3.2
Sub-Saharan Africa	-1.2	-0.4

Source: World Bank (2003).

Various explanations have been adduced for this dismal economic performance ranging from poor domestic policies and geography to colonial legacy and an inhospitable

external environment.[3] However, an important fact that has emerged out of the debate on Africa's growth and development experience is that reducing poverty through sustainable growth is the primary development challenge facing the continent. African countries have recognised this challenge and are also taking measures to confront them. Since the 1990s there has been an improvement in economic policy design and implementation in the region. In addition, several countries have made significant progress toward strengthening macroeconomic stability and reinvigorating economic growth. Available data indicate that this has led to a modest improvement in economic performance. For example, in SSA average annual real GDP growth increased from 2 per cent in the period 1984-93 to 3.7 per cent over the period 1996-2001 and average annual inflation fell from 24.3 per cent to 15.9 per cent within the same period. Furthermore, overall fiscal deficits as a percentage of GDP dropped from a peak of 9 per cent in 1992 to 2 per cent in 2001.

While the recent gain in economic performance in the region is welcome, its sustainability is in doubt due largely to the adverse economic effects of the HIV/AIDS epidemic, the continued marginalisation of Africa in the global economy, and the inability to find far-reaching solutions to the problems created by political instability, brain drain, and high external debt.

HIV/AIDS is the most serious development problem facing Africa today. The relatively modest development achievements of the region in the later half of the 1990s are slowly being reversed because of the devastating economic effects of the epidemic. Studies suggest that two-third of people living with HIV are in Africa. Furthermore, in Cameroon, Kenya, Swaziland, Zambia, and the United Republic of Tanzania, it is estimated that there would be a decline in GDP of about 25 per cent over 20 years as a result of the epidemic (International Labour Office, 2000). The HIV/AIDS epidemic increases health and social security costs thereby having a negative effect on savings and growth. It also increases the cost of doing business, lowers productivity, and as a consequence reduces foreign direct investment. Given the negative impact of the disease on human capital formation, it is becoming clear that Africa's long-term growth prospects will be affected by the extent to which its leaders are able to lift the constraints imposed by the epidemic. Unless this issue is dealt with swiftly and effectively, accelerating growth in the region will remain a daunting task, and increasing the standard of living a mirage.

The marginalisation of Africa in the global economy is another problem threatening the sustainability of growth as well as poverty reduction efforts in the region. Over the last three decades, there were sharp declines in the share of the region in global trade and foreign direct investment flows. The region's share of world exports fell from 4.6 per cent in 1980 to 1.8 per cent in 2000. Its share of world imports declined from 3.6 per cent to 1.6 per cent over the same period. Furthermore, Africa's share of global inward FDI flows fell from 1.8 per cent in the period 1986-90 to 0.8 per cent over the period 1999-2000. These figures are well below the developing countries average of 17.5 per cent and 17.9 per cent over the same period. The low integration of the region into the global economy and the fact that it has not derived any significant benefits from world trade and investment has led to concerns that the region may be left behind in the globalisation process.

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[3] Despite the controversy created by attempts to provide explanations for the region's economic problems, it is clear that internal and external factors played a role. The unresolved issue is the relative importance of internal as opposed to external factors.

Political instability continues to weaken and jeopardise the prospects for sustainable economic growth in the region. In Africa political instability often takes the form of wars as well as ethnic and religious conflicts. Studies have shown that political instability has a statistically significant negative effect on growth. Political instability can affect growth through its adverse effect on savings, investment, human capital formation, and the development of infrastructure as well as institutions needed to support the development process.

Brain drain is another problem inhibiting sustainable development in the region. Human capital is vital for sustained growth. But Africa continues to loose an increasing number of its educated people to developed countries. Available data indicate that about one-third of the professionals born in Africa live abroad. Furthermore, according to the International Organisation for Migration (1999), more than 35 per cent of college graduates in 40 per cent of countries in the region reside abroad. These migrants leave in search of better pay and or living conditions but their departure results in skill shortages, as well as reductions in output and tax revenue. They therefore rob the continent of a vital and scarce resource needed for sustainable development. Proponents of migration often point to the fact that these negative effects of emigration are dampened by the inflow of remittances from migrant workers. It is true that remittances have a positive impact in the region. For example, a recent publication of the World Bank (2003) shows Sub-Saharan Africa received USD 4 billion in remittances in 2002 and this represents about 1.3 per cent of the region's GDP. However, it is not clear that these benefits offset the costs to the society arising from the fact that a significant proportion of migrants received highly subsidised technical education funded through the domestic tax system.

High external debt continues to dampen as well as constrain the prospects for economic recovery and sustained growth in the region. In 2001, total external debt of SSA was USD 203 billion (World Bank, 2003). Of this amount, USD 32.1 represented short-term debt while medium and long-term debt accounted for USD 170.9 billion. High external debt increases country risk and hence the cost of borrowing to domestic investors with adverse consequences for investment. Furthermore, the need to service debt diverts resources from important development projects thereby threatening the ability of African countries to achieve their poverty reduction goals.

It is increasingly being recognised that the problems facing the continent cannot be solved in isolation. Consequently, there is a need for the international community to be more involved and engaged in the dialogue on how to free the continent from the shackles of poverty.

2.2   Confronting Africa's development challenges through trade

In the 1960s and 1970s, African countries were very sceptical about the virtues of free trade. Since the late 1980s, they have shown more interest in multilateral trade as well as negotiations. This reflects the combined effect of three factors: dissatisfaction with the slow pace of regional integration; the belief that trade, if well managed, could play a critical role in confronting the development challenges facing the continent; and the widespread view that multilateral trade could promote as well as spur up regional

Table 2.2   Infrastructure Indicators by World Region

Country Group/ Region	Electric Power Consumption Per capita (kilowatt)	Telephone Mainline Per 1 000 people	Paved Roads (Percentage of total roads)	Population with access to save water (Per cent)	Population with access to sanitation (Per cent)
	1997	1998	1997	1995	1995
Lower middle income	1 737	115	50.7	75	
East Asia and Pacific	771	70	17.4	77	
Europe and Central Asia	2 692	200	86.5		
Latin America and Caribbean	1 402	123	26.0	75	68
South Asia	324	19	57.0	81	20
Middle East and North Africa	1 158	81	50.2		
Sub-Saharan Africa	446	14	15.0	47	47

Source: Reproduced from OECD (2002).

integration efforts in the region. By increasing competition, multilateral trade liberalisation could force African governments to intensify regional integration efforts so as to reduce transactions costs through the development of regional infrastructure. Currently, infrastructure in Africa is lagging behind other emerging regions (see Table 2.2)

Beginning in the 1980s several governments in the region engaged in domestic trade reforms in an effort to increase their participation in international trade. The impetus for these reforms came from four sources. First, African countries that sought financial assistance from the IMF/World Bank undertook some domestic trade reforms as part of the requirements of the Structural Adjustment Programmes (SAPs). Second, there were also trade reforms undertaken by African countries as a result of bilateral trade and cooperation agreements. For example, in 1999 South Africa negotiated a free trade agreement with the European Union to increase access for its products to European markets and so had to adopt certain trade reforms. Third, African countries also engaged in some trade reforms arising from their membership of different regional economic groupings. The key regional economic groups in the region are: the Economic Community of West African States (ECOWAS), Common Market for Eastern and Southern Africa (COMESA), Economic Community of Central African States (ECCAS), the Southern Africa Development Community (SADC), the Arab Maghreb Union (AMU), and the Intergovernmental Authority on Development (IGAD). Finally, African countries have also undertaken reforms as a result of their increasing participation in the multilateral trading system. Membership of the World Trade Organisation (WTO) implies that African countries have to obey the WTO rules and also honour their commitments to the organisation. African countries that are not members of the WTO have also had to adopt trade reforms as part of the requirements for accession to the WTO.

How far did these reforms go? There is some consensus that the reforms undertaken by African countries in the 1980s and 1990s have made the region relatively more open to market forces and private sector activity. Exchange and price controls as well as marketing boards have been eliminated in several countries and there has been a significant reduction in tariffs (see Hinkle et al., 2003). In several countries, average trade weighted tariffs have been reduced to 15 per cent or less (World Bank, 2000). Also, core non-tariff barriers in the twelve SSA countries included in a recent study fell from 26 per cent in 1989-94 to 10.4 per cent in 1995-98 (Martin, 2003). Despite the progress that has been made, the benefit to African countries from these reforms remains limited.

One might wonder why African countries are hesitant to fully liberalise their economies despite the conventional wisdom that free trade is good for growth and development? We see at least five reasons for this phenomenon. First, the evidence linking trade liberalisation to growth and development is not as clear as economists would like to believe. Two recent papers, Rodriguez and Rodrik (2001) and Rodrik (2001), have argued that there are fundamental and methodological problems with the series of studies suggesting that trade liberalisation enhances growth and development. They also pointed out that there is no convincing evidence that trade liberalisation is systematically associated with economic growth. The papers also suggest that the nature of domestic institutions plays a key role in determining whether or not liberalisation will have a positive outcome in an economy. Furthermore, even in countries in which liberalisation

was associated with growth, there is strong evidence that it was selective as opposed to comprehensive liberalisation that led to the observed outcome.

Second, several African countries rely on trade taxes for government revenue and so are concerned about the fiscal consequences of liberalisation for their economies. Between 1999-2001, for instance, import duties represented about 34 per cent of government revenue in the Least Developed Countries (LDCs) in Africa. In theory, trade liberalisation is unlikely to lead to any significant loss in trade tax revenue if it involves either the removal of quotas or reduction of very high tariffs and if the pre-liberalisation regime was characterised by import compression. When these conditions are absent, liberalisation is likely to have adverse consequences for trade tax revenue. That said, countries could adopt measures to ensure that liberalisation does not erode their revenue base. These include: attracting more aid flows; finding alternative sources of tax revenue; reforming domestic tax and customs administration; diversifying the economy; and reducing smuggling and corruption.

Third, in any case of liberalisation, there are bound to be winners and losers. If the losers have political clout they are likely to put pressure on domestic leaders to resist liberalisation, especially if there is no domestic mechanism in place to compensate them for the potential loss.

Fourth, there is a genuine concern among African countries that multilateral trade liberalisation and the associated rules and obligations would lead to the loss of domestic policy instruments and space needed to address pressing development problems. This is particularly important given that countries in the region are highly vulnerable to external shocks due largely to their high dependence on commodity exports (see chapter 3)

Finally, there is the widespread view that although African countries have made some progress in liberalizing their economies, they have not derived any significant benefits from the process. It is therefore understandable that they are reluctant to increase the pace of reforms. The key question then is how can African countries derive more benefits from domestic trade reforms?

African countries must learn, adapt, and incorporate the lessons of trade reforms in industrial, as well as other developing, countries into their trade reform programmes if they are to derive substantial benefits from the process. The key lessons from these experiences are that:

- Trade policy must be integrated into national development strategies in order to avoid policy incoherence and allow countries to derive more benefits from trade;
- For domestic trade reforms to enhance development, they must be carried out in such a way that they can have positive effects on sectors that generate employment and income;
- The timing and pace of reforms must be chosen carefully to ensure the sustainability of policies and avoid the risk of policy reversals;
- Trade reforms do not work in isolation. They have to be accompanied by other economic measures, such as a good macroeconomic policy environment and appropriate laws, infrastructure and institutions;
- Diversification of an economy is necessary to minimise the impact of trade shocks on an economy and increase the benefits from trade reforms; and

- Trade reforms must not focus on imports alone. There is the need to promote exports if reform is to have any substantial positive impact on an economy.

2.3 Africa and the Doha Development Agenda

African countries are interested in increasing their involvement in the multilateral trading system so as to reap the benefits of global economic integration. However, they are disappointed that the region has not benefited from the huge gains resulting from an increase in world trade and finance in the last decade. This has led to an examination of the reasons why international trade has not played its expected role in enhancing growth and reducing poverty in the region? Two key factors are responsible for this phenomenon:

(1) Lack of complementary domestic policies. For a country to take advantage of trade opportunities and reap the benefits of trade, it must put in place domestic policies that would create an incentive for the private sector to flourish. Unfortunately, up until the mid 1990s several African countries had domestic policies - for example, those affecting transport and transaction costs - that had negative effects on trade, investment, and growth in general. There was also the inability or unwillingness of African countries to put in place measures that would enable the region to lift supply constraints and to diversify so as to increase their ability to exploit the trading opportunities made available to the region. The fact that very few African countries have been able to take advantage of preferences received under the ACP-EU partnership agreements provides support for this idea.

(2) Protective domestic agricultural policies and trading practices of OECD countries have also contributed to the inability of African countries to exploit the potential gains from multilateral trade liberalisation. In 2002 governments, consumers and taxpayers in OECD countries transferred over USD 234 billion to their agricultural producers.[4] Support programmes encourage over-production and export dumping by producers in OECD countries. The support given to OECD producers allow them to sell their products on the world market at prices below production costs thereby depressing world prices and forcing competitors to struggle for survival or exit the market. Cotton presents a very interesting example of how OECD agricultural support programmes hurt African countries. Between 2001-2002, the US spent USD 3.9 billion on agricultural support to its 25,000 cotton farmers, a figure that is twice the amount it spent in 1992. This agricultural support programme has had a negative impact on world cotton prices because the US is the largest exporter of the product. Since the mid 1990s, the price of cotton has fallen by about 54 per cent with devastating effects for cotton exporting countries in Africa. Available evidence suggests that US subsidies on cotton led to a loss of about USD 300 million in potential revenue in Sub-Saharan Africa between 2001-2002. To put this figure into perspective, it is important to understand the extent of the damage caused to individual economies. For example, in Burkina Faso, it led to a loss of 1 per cent of

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[4] A preliminary measure for the Producer Support Estimate (PSE) in 2002 measured USD 234.8 million, against an average of USD 240.9 billion in the years 1986-1988 (OECD 2003).

GDP and 12 per cent of export revenue. In Mali, it led to a loss of 1.7 per cent of GDP and 8 per cent of export earnings. In Benin, the loss was about 1.4 per cent of GDP and 9 per cent of export earnings (Oxfam, 2002). The same story can be told of subsidies on other commodities exported by African countries but the experience of cotton provides a stark illustration of the adverse consequences of OECD agricultural support programmes in Africa.

In several rounds of multilateral trade negotiations, African countries expressed concerns about these external barriers inhibiting their ability to integrate into the global economy and take advantage of trading opportunities. An attempt to address this issue led to the declaration of the Doha Round of multilateral trade negotiations as a Development Round. At the fourth WTO ministerial conference in Doha in November 2001, several promises were made to African countries, and developing countries in general, in an effort to increase their ability to benefit from global trade. However, in the twenty-one months between the Ministerial conferences in Doha and Cancun, no significant progress was made in the negotiations and this has led to the widespread feeling that it is highly unlikely that the promises made to poor countries under the Doha Development Agenda (DDA) will be fulfilled before the December 2004 date set for the conclusion of the round. In the run-up to the Cancun meeting, the US tried to inject new life into the talks by issuing a joint proposal with the European Union. While African countries had reservations about the nature and scope of the proposals, they saw it as a positive development and hoped that it would increase the prospects for a successful meeting in Cancun. As we all know, the Cancun Ministerial Conference ended with no agreement by Ministers on any of the key issues on the agenda.

From an African perspective, the failure of the talks in Cancun was not surprising given the fact that there was no serious effort made by the developed countries to address the key issues of concern to African countries in the negotiations. At Cancun African countries made demands in several areas of the negotiations (agriculture, cotton, non-agricultural market access, and development issues) but the demands on cotton and agriculture attracted more attention at the meeting. On cotton, they made two requests: the first is the elimination of subsidies by developed countries within a reasonable and specified period; and the second was the payment of compensation to the affected-countries during the transition period. On agriculture, they wanted more serious commitments from the developed countries to reduce and or phase out domestic support, export subsidies, and other barriers to agricultural trade. Clearly, developed countries were reluctant to make any serious concessions on these issues in Cancun.

The failure of the Cancun meeting has added more credence to the doubts expressed by African countries about the ability of the Doha round to meet their development aspirations. Africa's concerns in the on-going round of trade talks are in three parts. The first is the relatively low bargaining power of African countries in the negotiations as reflected in their inability to influence the agenda and pace of the negotiations. The second aspect of Africa's concerns relates to the fact that the areas in which there have not been significant progress in negotiations are those of importance to African countries: namely agriculture, non-agricultural market access; and development issues and concerns. The final aspect of Africa's concerns relate to the lack of an effective mechanism to address

problems of capacity constraints in the region. Existing trade capacity building programmes tend to have a short-term focus and do not provide a coherent framework to address problems posed by supply-side constraints and the lack of competitiveness of African economies.

Since the collapse of the Cancun meeting there have been informal discussions between some of the developed countries and African countries on what needs to be done to make the Doha round contribute to African development? An important fact that is emerging from these discussions as well as from research on African economies, is that progress in the negotiations on agriculture is important for the Doha round to make any real contribution to the development efforts of the region. In several African countries, a large proportion of the population depends on the agricultural sector for their livelihood. The sector accounts for roughly two-thirds of the region's labour force and one-third of its GDP. Consequently, an increase in agricultural productivity through trade is needed to increase the prospects for poverty reduction in the region. Other measures that could enhance the contribution of the round to African development include:

- Better integration of development issues into the work programme of the WTO as well as mechanisms to make them fully effective and operational;
- More flexibility in WTO agreements to enable African countries deal effectively with poverty reduction and food security issues;
- Change of attitude by developed countries as evidenced by their willingness to honour commitments made to developing countries in previous rounds of trade negotiations;
- More sensitivity to the implementation costs of WTO agreements for poor African countries; and
- More meaningful and effective capacity building and technical assistance programmes.

3. Africa in World Trade

3.1 Trade patterns

Africa's trade potential has remained unfulfilled in the last 5 decades. While global trade volumes nearly doubled each decade, Africa's share in world trade gradually declined from over 7 per cent after World War II to just over 2 per cent in 2002 (see Figure 3.1 and Figure 3.2) (WTO, 2003).
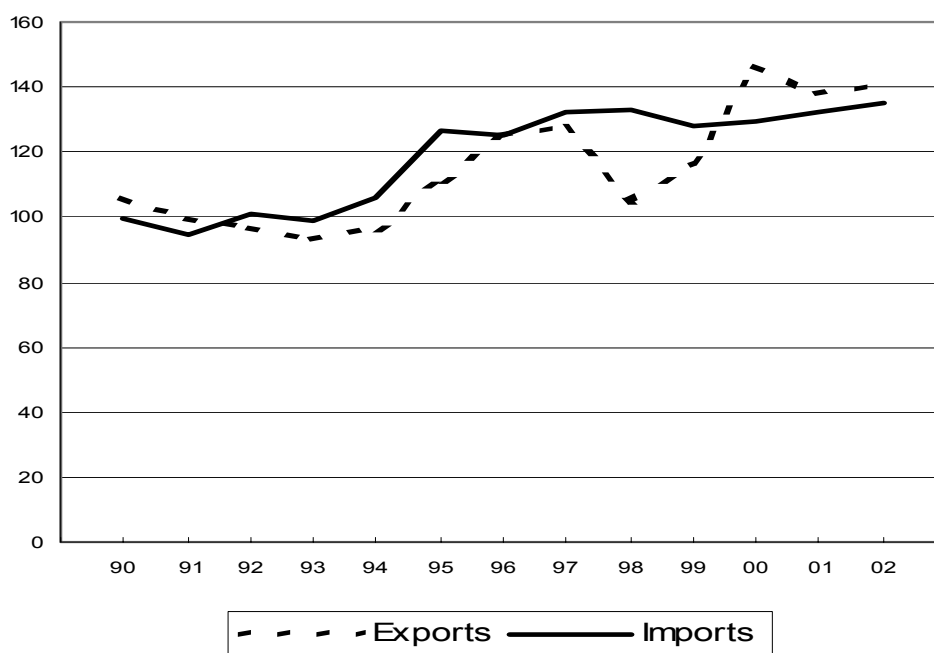
Figure 3.1   African merchandise trade volume 1990-2002 (USD billion)

Clearly, an important way for African countries to increase their share of world trade is through an increase in intra-African trade. In 2002, intra-African trade represented only 8 per cent of total African trade. When we consider manufactures and agricultural exports alone, however, the share of intra-African trade is about 15 per cent (USD 8.5 billion). History has shown that the largest share of world trade occurs within geographical regions that have reached a certain level of political and economic integration such as EU, NAFTA and ASEAN. There are several regional trading arrangements on the African continent (SADC, ECOWAS, ECCAS, AMU, and COMESA etc) but they have not been very

successful in increasing trade among countries in the region. The reasons for this include: poor and inadequate infrastructure which limits the potential for cross-border movement of goods and persons; structural constraints associated with the fact that most countries in the region produce similar goods and so pay more attention to trade with countries outside the region; and the high incidence of conflicts in the region which breeds mistrust among members thereby creating an environment that is not supportive of integration.
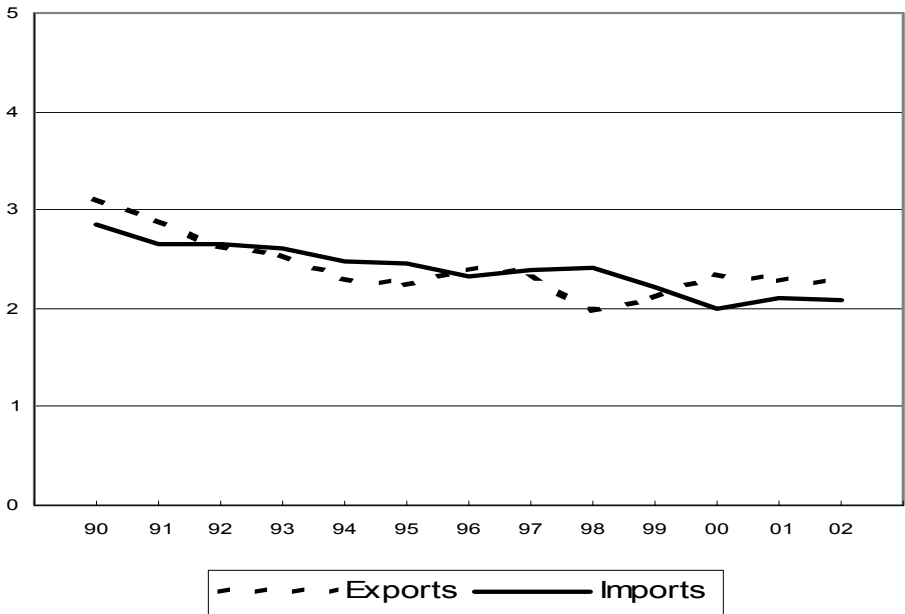
Figure 3.2   African share in world merchandise trade, 1990-2002 (%)

This study attempts to estimate the economic benefits for Africa resulting from multilateral trade liberalisation. However, since the analysis is done at the sub-regional level, the results can only give a general indication of the impact of liberalisation on individual countries. For individual countries, an important factor is the net trade position in certain products. The reason is that trade reform affects world markets prices. More specifically, for many agricultural products trade liberalisation results in an increase in prices on world markets, which results in gains to exporters to the world and losses to importers from world markets. African countries are, at least in the short term, likely to be affected most by reforms in the field of agriculture and trade policy. This makes it useful to classify African countries according to their trade position in primary agriculture and processed agriculture products (Table 3.1).

Exports of agricultural products accounted for USD 22 billion in 2002, or 16 per cent of total African merchandise exports. Fuel exports account for half of total exports, or a flow of USD 67 billion. The remainder is accounted for by manufactures. In 2002, Africa's exports of clothing (USD 7.4 billion), machinery and transport equipment (USD 7 billion)

and iron and steel (USD 2.9 billion) expanded faster than world trade in these categories (WTO, 2003).

Sub-Sahara Africa accounts for approximately 40 per cent of total exports from Africa, and for over half of agricultural exports. Table 3.2 gives trade volumes and trade shares for the group of 45 countries in Sub-Sahara Africa. Nigeria and Angola are main exporters in the region, a reflection of large oil and diamond resources. Main agricultural exporters are Côte d'Ivoire, Kenya, Zimbabwe and Cameroon. A large set of countries records very small export levels.

3.2   Revealed comparative advantage

There is a range of export products from Sub-Sahara Africa that successfully participate in the world trading system. Identifying those products that perform well in international markets can give some indication as to which products and sectors might gain from a multilateral lowering of trade barriers. On the other hand, identifying products in which Africa does not have a comparative advantage will give an indication of sectors that may be adversely affected by increased competition due to a reduction in trade barriers. This is useful for the interpretation of the simulations, which are performed at a much higher level of aggregation.

One measure that helps to identify the competitive strength of a country is the so-called 'Revealed Comparative Advantage Index' (RCA) (Balassa, 1965). Based on the index, if an export product from an African country has a large world market share - adjusted for the total participation of African exports in world trade - then the index exceeds the level 100, and the country is said to have a revealed comparative advantage in that product.[5]

The RCA index can be criticised on various grounds. For example, it does not take product differentiation and intra-industry trade into account. Another disadvantage of this indicator is that it only takes exports into consideration and does not account for import penetration. In the context of African trade, with few imports re-exported, this flaw can be overcome. The data analysed represent averages for the period 1993 to 2001 and use the full list of 261 products from the UNCTAD trade statistics. African exports are proxied by total imports of African products into the countries that report to UNCTAD, which gives about 90 per cent accuracy on the export data.

One advantage of the RCA index is that it ensures that export volume alone does not determine which products perform well on international markets. For instance, at 350 million dollar, export volume of copper (SITC 682) is approximately equal to that of spices. Yet the index of copper stands at 135, while spices are at 1,422. This shows that the region Sub-Sahara Africa has a far greater share of world trade in spices than copper. The implication is that the export potential for spices is much larger than for copper.

Table 3.3 reports the 30 highest RCA indices calculated from all Sub-Sahara African exports at the SITC-3 level. The product list is, as expected, mostly made up of primary

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[5] The revealed comparative advantage for good i from Africa is defined as:
[(export good i, Africa)/(world exports good i)]/ [total exports Africa/ (world exports)] * 100

products, mining products and fuels. Traditional commodities cocoa, tea, and tobacco are at the top of the list. The eleventh rank for coffee on the 2001 RCA index confirms the depression in the coffee markets. Spice trade is clearly on the rise in the last decade. The indices for wood and cotton have declined somewhat from their peak in the later half of the 1990s.

The two columns on the right reveal that a big score on the RCA index need not imply a large trade volume, although it often does. With a total of 45 billion dollar, these Top-30 products account for over 80 per cent of total exports in 2001. Crude petroleum oils is the product group with the largest volume by far in the list. Some products for which an African comparative advantage is often claimed do not appear in the list of table 2, groundnuts for example. Vegetables, the typical categories of 'non-traditional' export growth, rank around the 100 average. Ranked equally modest are leather and apparel products. These sectors, then, will likely contract under tougher international competition after trade reform.

This method allows a powerful demonstration of the effect of tariff escalation, i.e. the phenomenon of tariffs levied on products rising with the degree of processing required. Compare an index of over 5,000 for cocoa with a meagre 12 for chocolate, or a high of 394 for sugars and molasses with a mere 31 for sugar confectionaries. A similar pattern shows in fruit trade, with fruit and nuts at 258, preserved fruit at 81, and fruit juices at 24. Clearly, there remains a traditional pattern in food trade of importing raw agricultural product from Africa, adding value through processing elsewhere.

Table 3.1   Country classification

Trade position processed food	Trade position primary products	Trade position primary products
	Net primary exporter	Net primary importer
Net processed exporter	Low Income countries: Ethiopia Togo Mauritania Mali Chad Uganda Sudan Madagascar Kenya Ghana Cote d'Ivoire Cameroon Zimbabwe Middle Income Countries: Morocco RSA Equatorial Guinea	Low Income countries: Senegal Mozambique Burkina Faso Benin Middle Income countries: Swaziland Mauritius
Net processed importer	Low Income countries: Somalia Sao Tome and Principe Rwanda Niger Malawi Guinea Congo Dem Rep Central African Republic Burundi Guinea-Bissau Comoros Tanzania	Low income countries: Zambia Sierra Leone Nigeria =low inc? Liberia Gambia Congo Rep Angola Eritrea Lesotho Middle income countries: Egypt Botswana Tunisia Seychelles Libya Algeria

Source: OECD (2001).

Table 3.2   Sub-Sahara Africa exports by country, 2001

	Total Trade (USD mln)	Trade Share (%)	Total Agriculture (USD mln)	Trade Share (%)
Nigeria	19,224	34	444	4
Angola	6,317	11	45	0
Côte d'Ivoire	3,258	6	2,684	22
Gabon	3,009	5	479	4
Cameroon	2,009	4	983	8
Equatorial Guinea	1,787	3	119	1
Sudan	1,728	3	272	2
Zimbabwe	1,694	3	1,038	8
Botswana	1,692	3	64	1
Congo	1,672	3	112	1
Kenya	1,638	3	1,123	9
Mauritius	1,607	3	416	3
Ghana	1,327	2	778	6
Madagascar	1,112	2	552	4
Liberia	1,088	2	187	2
Guinea	870	2	58	0
Mozambique	711	1	155	1
Senegal	543	1	368	3
Zambia	536	1	81	1
Tanzania, UR	470	1	333	3
Mauritania	464	1	224	2
Congo, D.R.	434	1	32	0
Malawi	429	1	383	3
Ethiopia	312	1	227	2
Uganda	304	1	289	2
Seychelles	258	0	230	2
Niger	249	0	23	0
Togo	204	0	87	1
Mali	189	0	104	1
Burkina Faso	175	0	108	1
Benin	128	0	106	1
Other Sub-Sahara Africa a)	552	0	270	0
Total	55,988	100	12,374	100

a) This group consists of countries with trade shares lower than 1 per cent, both in total trade and agricultural trade. These countries are Sierra Leone, Rwanda, Central African Republic, Guinea, Chad, Comoros, Burundi, Somalia, Gambia, Eritrea, Djibouti, Sao Tome and Principe and Cape Verde.
Source: ITC/WTO data.

Table 3.3   *Revealed Comparative Advantage in Sub-Sahara Africa: Top 30 at SITC-3 level*

SITC code	Product group	RCA	Export volume (2001, USD mln)
072	Cocoa	5247	2,430
074	Tea and mate	2007	481
121	Tobacco, unmanufactured	1597	987
075	Spices	1422	327
247	Wood rough,rough squared	1157	902
263	Cotton	1127	698
333	Petroleum oils, crude	995	29,865
287	Ore,concentr.base metals	934	542
285	Aluminium ore,conctr.etc	887	578
071	Coffee,coffee substitute	848	731
667	Pearls,precious stones	664	2,568
231	Natural rubber, etc.	591	226
793	Ship,boat,float.structrs	565	893
037	Fish etc.prepd,prsvd.nes	537	493
245	Fuel wood, wood charcoal	426	14
272	Fertilisers, crude	423	54
061	Sugars,molasses,honey	394	423
265	Vegetable textile fibres	365	18
036	Crustaceans,molluscs etc	364	625
689	Misc.non ferro base metals	359	129
223	Oilseed (oth.fix.veg.oil)	353	23
284	Nickel ores,conctr,matte	341	71
292	Crude veg.materials, nes	326	469
248	Wood, simply worked	318	769
342	Liquefied propane,butane	299	380
344	Petroleum gases, nes	287	98
057	Fruit,nuts excl.oil nuts	258	746

4. Trade Policy Landscape

This chapter provides background information on selected issues in the current round of negotiations that are useful in understanding the results of the simulations. It provides an analysis of the three pillars in the negotiations on agriculture as well as the implications of differences between bound and applied tariffs. It also looks at the different approaches to trade liberalisation, examines the issue of trading costs and preferences, and presents an assessment of the degree of protection of OECD trade policies. The chapter concludes with an overview of the African position on the negotiations on agriculture in the WTO.

4.1 Agriculture negotiations

The Uruguay Round Agreement on Agriculture (URAA) set the stage for the negotiations on agriculture under the Doha Development Agenda. It was also the first time that disciplines on agricultural trade and production were set in the multilateral trading system. Despite this achievement, the URAA had several shortcomings among which is the fact that it could not deal effectively with the issue of tariff peaks and escalation. Furthermore, it imposed implementation costs on poor countries and negotiating parties gave themselves considerable leeway in the selection of the appropriate reference period from which to measure reductions in agricultural support. Negotiations under the DDA are expected to address these limitations of the URAA.

The Doha Declaration suggested guidelines for agricultural negotiations in this Round of multilateral trade negotiations. It specified that this Round should aim to obtain 'substantial improvement of market access, reduction of all export subsidies, in view of their progressive withdrawal, and substantial reduction of domestic support having effects on trade distortion21'. These are the three 'pillars' in the agriculture negotiations under the Doha Development Agenda: market access concerns reductions in tariffs and tariff rate quotas; domestic support concerns commitments to reduce trade-distorting farm income policies; export competition concerns the promotion of agricultural exports through subsidies and export credits.

4.1.1 Market access in agriculture

One key difference between agricultural and industrial products is that essentially all agricultural tariffs are bound. However, in both industrial and developing countries, there is a large degree of binding overhang (See Table 4.1). Commitments not to erode current market access were meant to limit the scope for increased protection through 'dirty tariffication' or the use of 'ceiling bindings' (Hathaway and Ingco, 1996). As the name implies, dirty tariffication involved violations of the spirit, if not the letter, of the URAA text. It involved setting tariff bindings at rates far above the current effective protection

rates. The practice of setting high bindings complicated the problem of measuring the impact of further commitments to reduce bindings. Basically, in agriculture, we are in a world that allows scope for great policy discretion and uncertainty as a result of the loose nature of the commitments made. In addition, the setting of high bound rates made possible the conversion of non-tariff barriers (quotas and tariff rate quotas) into even more restrictive import tariffs. This in turn made quantity disciplines necessary to avoid backsliding.

Table 4.1   Applied tariffs on agricultural imports in selected regions (% ad valorem)

	Simple average	Standard deviation	Maximum tariff	Binding overhang
European Union	5.9	7.5	74.9	0.3
Japan	6.2	8.1	43.3	1.2
United States	3.5	7.4	90.0	0.5
Brazil	12.9	5.1	27.0	22.6
India	31.0	20.8	150.0	90.7
Thailand	26.5	14.4	65.0	7.1

Source: Francois and Martin (2003).

4.1.2 Export subsidies & domestic support

Under the Uruguay round negotiations, domestic support programmes were classified into three categories. The first category is the 'Amber Box,' which captures all domestic support measures that are considered to distort production or trade. Subsidies under this category are to be reduced or kept within defined limits. The second category, the Blue Box, covers payments aimed at limiting production. The final category, the Green Box, includes payments that do not distort trade or are considered to cause minimal distortion. Green box payments are allowed within limits. They include payments associated with environmental protection and those associated with regional development programmes.

The Aggregate Measure of Support (AMS) is widely used to measure the extent of protection, particularly domestic support, in the agricultural sector. Although it is a price-based measure, it includes only those forms of support that are agreed to be most trade distorting and so is not comprehensive.[6] A major issue in the discussions on domestic support is how to reduce the scope and incentive for members to reallocate expenditures from categories that are considered trade distorting to those that are not considered trade distorting.[7] This is of concern because although expenditures in the Amber Box are declining, there has been an increase in the use of Blue Box support.

As the AMS approach reflects available data, it is employed in this study as well. Table 4.2 provides data on the subsidies from farm-income policies and export competition for the EU, North America and high-income Asia. A negative number refers to a net tax on

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[6] See OECD (2003) for methodology and measurements.
[7] Tangermann (1998) provides a discussion on these issues.

producers in that sector. Note that the accuracy with which these data reflect current subsidies in these regions varies. These are 1997 data from the GTAP database, which have been updated for cotton only. The GTAP database does not include domestic protection measurement for cotton. We include average domestic support levels in the European Union and the United States in the late 1990s.[8] Both export subsidies and domestic support vary largely from year to year due to variations in world prices, the size of harvests and other factors. So the numbers in the table provide an indication of support rather than a true reflection of the current state. They are used, nevertheless, as inputs in the simulation of policy changes in the model.

Table 4.2   Agricultural subsidies in Quad countries (1997, USD million)

	Domestic support			Export subsidies		
	European Union	North America	High income Asia	European Union	North America	High income Asia
1 Cereals	22,374	21,767	1,576	517	-7	-1
2 Vegetable	-1,074	-100	-350	25	-2	-3
3 Oilseeds	6,029	2,606	-4	5	-5	-2
4 Sugar	72	169	-8	865	0	0
5 Cotton a)	1,276	1,392	0	0	0	0
6 Other Crops	-801	-5	-281	9	-1	-5
7 Animal	14,650	4,240	1,200	0	-4	-2
8 ProFOOD	-17,455	-194	-49,463	2,939	118	-86

a) Cotton support levels are updated with data from WTO notifications for European Union and United States only. See footnote 8.
Source: GTAP database version 5.

4.2   Analysis of Market Access Modalities

There are various approaches to tariff reduction. Under the GATT negotiations on tariff reduction was initially based on a request-and-offer procedure. Under this approach members negotiate bilateral market access concessions, and subsequently extend them to other members. With a relatively small number of negotiating parties and the focus on a limited number of industrial products, members were able to substantially reduce average tariffs. However, the approach was abandoned in favour of a comprehensive formula approach in the Kennedy Round (1964-7). The next round, the Tokyo Round (1973-9) introduced the so-called Swiss formula. This approach was however abandoned during the Uruguay Round (1986-94) and a more flexible approach was adopted. This new approach required that, on average, tariffs were to be cut by a certain amount (e.g., 36% in

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[8] Reported data are domestic support commitments notified to the WTO secretariat for the two regions with the largest levels of support: US and EU. The levels of subsidies for cotton farmers are extremely volatile between years; here we use averages of 1999-2000 for US, of 1997-1998 for EU.

agriculture). The distribution of the cut across sectors was left for negotiations between trading partners. While achieving substantial tariff reductions, the Uruguay round allowed members to protect strategic sectors, and failed to achieve significant reductions in tariff escalation.

How to assess the effects?
To derive more benefits from trade negotiations, countries' have to assess the merits of the various proposals or modalities for market access, but it is not evident which criteria should be used for the assessment. For example, if an average cut in tariffs is the objective, it is not clear whether this should be a weighted or a simple average. If a weighted average is chosen and import weights are used, it may result in the underestimation of high prohibitive tariffs, because in such cases little trade occurs. There is also a complication introduced by the fact that bound rates for most countries are different from applied rates. This implies that reductions in bound rates do not always lead to reductions in applied rates and so it is important whether the reduction commitments are based on bound or applied rates. Other issues that arise in assessing the merits of different negotiating proposals include the effects of the proposals on:
- *Tariff peaks*
  As the most severe impediments to trade occur if very high tariffs are in place, the effects on peaks deserve separate attention;
- *Import prices*
  Ultimately, this is what affects domestic markets. Consumers will enjoy lower prices, while domestic producers might fear competitive pressure from cheaper imports. For a small importing country the direct effect on domestic prices equals the change in the power of the tariff $T=t/(1+t)$, and can be readily calculated. For a large country, the effects on world markets need also to be taken into account;
- *Tariff revenues*
  This concerns especially those countries which use tariff revenues as a prime source for generating government revenues, and which have little alternative means to levy domestic taxes. Evaluation of tax revenue effects is not straightforward, as it requires taking into account direct tariff revenue effects as well as indirect spending effects and supply response by domestic industries;
- *Preferential market access*
  Tariff reduction erodes preferential trade conditions to the loss of currently preferred suppliers, and to the benefit of competing producers.

Introducing formulae for agricultural market access
The DDA negotiations on agriculture have introduced several approaches to tariff reform. The European Union prefers a Uruguay Round (UR) approach, which defines as the goal an *average cut* in tariffs. The Uruguay Round has in practice led to the outcome that larger cuts were applied to tariffs that were already relatively low, while applying only modest reductions to high tariffs. A minimum cut per tariff line, an additional requirement currently proposed, will prevent this, so the EU claims. In fact, this depends largely on the modalities for the minimum cut.

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The USA and the CAIRNS group have proposed a formula approach. In contrast to the UR approach, a formula approach sets out rules to cut tariffs on each tariff-line. Specifically, these countries would like to apply a Swiss formula approach because it achieves higher proportional cuts in higher tariff rates and results in a maximum ceiling tariff per tariff line. The Swiss formula is the most appropriate modality for addressing the issue of tariff escalation. The so-called Derbez text that emerged during the Cancun ministerial conference proposed a 'blended' formula that combines a UR and a Swiss formula approaches. To give readers an idea of the implications of the formula approaches discussed in the current round of negotiations, we provide illustrations with a proportional cut, a Swiss formula, and a blended formula.

The proportional cut determines the new tariff t_1 as a simple percentage of the original tariff t_0:

$$t_1 = c\ t_0$$

For example, if a 30% reduction were desired, c would be 0.7. The Swiss formula determines the new tariff as:

$$t_1 = a\ t_0/(a + t_0)$$

The parameter a is to be determined as part of the negotiations. It determines the maximum tariff that remains after the implementation of commitments. For example, if $a = 25$, then the maximum tariff will be 25%. Besides defining effectively ceiling tariff, the Swiss formula has the feature of yielding sharper reductions in high tariffs, as can be seen from a comparison with the Linear 36 approach in Figure 4.1
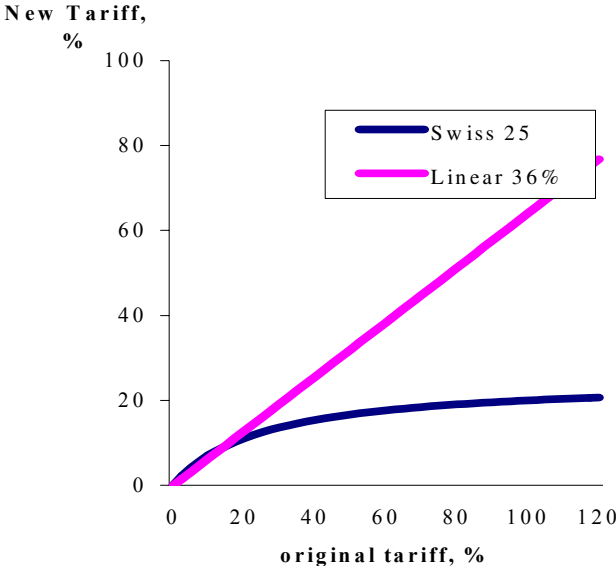
Figure 4.1   Linear 36 versus Swiss formula

By contrast, the UR approach sets the average reduction as a negotiation parameter, while it leaves open the exact way in which such an average is to be achieved. In fact, the UR approach allows the setting of an individual per cent reduction c^i for each tariff line. This becomes evident from the following equation, where we introduce a superscript i to distinguish tariff lines, where t_0 and t_1 are tariff rates before and after reform, and α denotes the simple average reduction:

$$\alpha = \frac{1}{n}\sum_i (t_0^i - t_1^i)/t_0^i = \frac{1}{n}\sum_i (t_0^i - c^i t_0^i)/t_0^i = \frac{1}{n}\sum_i (1 - c^i)$$

The following example is meant to illustrate the effects of different modalities. We show the effect of various modalities on a set of five initial tariffs that range from a high *ad valorem* tariff of 250% to a low one of just 10%. This reflects the variety of tariff lines for agricultural products in the world.

Figure 4.2 illustrates the effects of different modalities on the initial tariffs. Table 4.3 shows the per cent cuts per tariff line. The linear proportional cut simply reduces each tariff by 36%, resulting in more favourable access conditions for the products subject to high tariffs, while the low tariff lines see relatively modest improvements. The UR approach shown in the figure assumes a minimum cut of 15% for each tariff line and an average reduction percentage of 36%. This is achieved in the example by reducing high tariffs by just 15% while reducing the Medium1 tariff by 25%, the Medium2 tariff by 36% and the Low tariff by as much as 90%. The incentive of this approach is clear: very modest reductions in the high tariff range and large reduction in the low range. This contrasts sharply with the Swiss formula approach, where we assume the parameter *a* to equal 25, as proposed by the USA ('Swiss 25'). This brings down sharply the high tariffs, and results in an average reduction percentage of 61%. See Table 4.4 for summary statistics on tariff dispersion, and Table 4.5 for the direct effects of the tariff reforms on domestic prices.

Table 4.3   Per cent cuts per tariff line, %

	Per cent cuts Linear 36%	UR 36%	Swiss 25	Blended
High1	-36	-15	-91	-18
High2	-36	-15	-76	-40
Medium1	-36	-25	-67	-50
Medium2	-36	-36	-44	-44
Low	-36	-90	-29	-100

Table 4.4   *Summary statistics, %*

	Linear 36%	UR 36%	Swiss 25	Blended	Total
Average	82	52	66	15	58
Max	250	160	213	23	205
Min	10	6	1	7	0
Average cut	-36	-36	-61	-50	

Table 4.5   *Effects on domestic prices, % a)*

	Linear 36%	UR 36%	Swiss 25	Blended
High1	-25.7	-10.7	-64.9	-12.9
High2	-16.0	-6.7	-33.9	-17.8
Medium1	-12.0	-8.3	-22.2	-16.7
Medium2	-6.0	-6.0	-7.4	-7.4
Low	-3.3	-8.2	-2.6	-9.1

a) Calculated as per cent change in the power of the tariff.

The blended formula approach proposed in the 'Derbez text' combines the UR approach with the Swiss formula and adds the requirement that at least one tariff line has to be reduced to zero. Given the features of the UR and the Swiss formula, we implement the blended formula by: applying the UR formula to the high and medium1 tariffs; reducing the low (nuisance) tariffs to zero; and applying the Swiss formula to the medium range. The UR component of the cocktail is constructed such that the average reduction within this component equals 36%. Such a behaviour can be expected to occur if countries want to avoid granting improved market access in products that are considered to be of 'strategic' value. Hence, blending allows members still a considerable leeway in designing their tariff landscape.

	High1	High2	Medium1	Medium2	Low
Original tariff	250	80	50	20	10
Linear 36%	160	51	32	13	6
UR 36%	213	68	38	13	1
Swiss 25	23	19	17	11	7
Blended	205	48	25	11	0
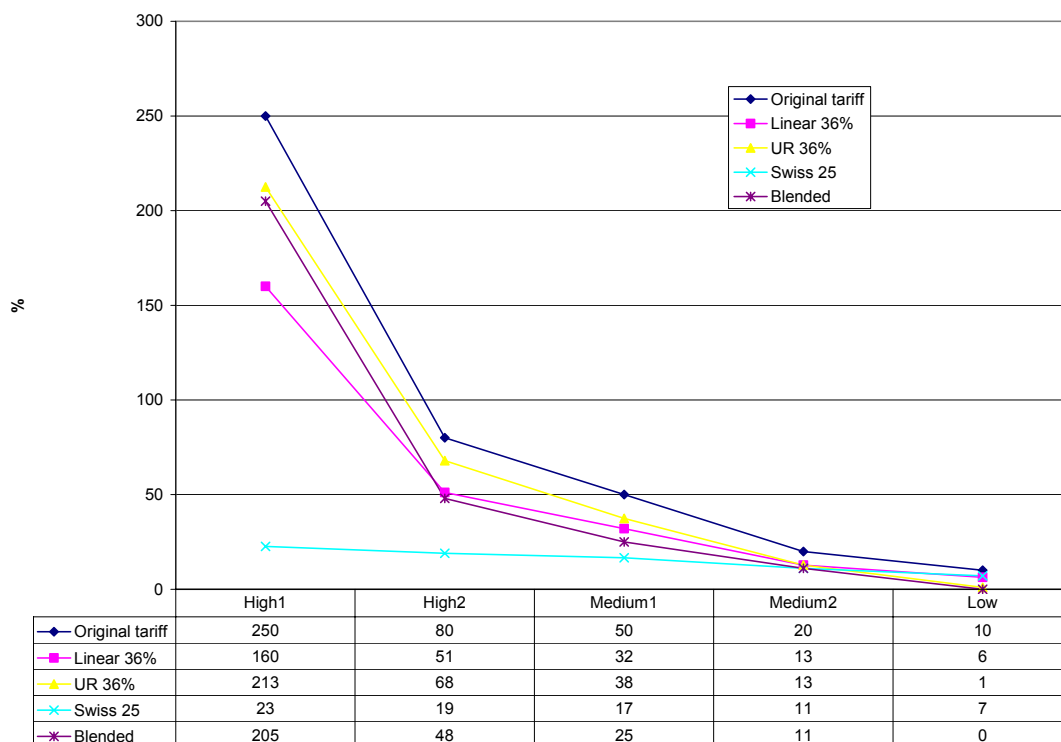
Figure 4.2   The impact of various modalities on tariffs

It is important to find the interest of the negotiating parties in specific modalities. The examples given can be roughly interpreted as follows. The EU proposal of a UR approach points to a strong interest in keeping market access restricted for program commodities as long as domestic support policies are in the process of reform. The EU, as well as Japan and Korea, have large tariff peaks in agriculture. It is in the interest of agricultural exporters to reduce these peaks. The use of a Swiss formula approach is in the interest of these countries because they have open markets in general (Australia and New Zealand) or have tariff peaks in non-agricultural sectors (US and Canada).

4.3   Non-agricultural market access

Tariff negotiations in the GATT/WTO have generally been based on tariff bindings, or schedules of concessions tabled under GATT rules, and the coverage and level of these bindings are important elements of the negotiations. While tariffs in the OECD (and Latin America) are generally bound, many Asian and African economy tariffs remain unbound despite more than a four-fold increase in the coverage of developing-country tariff bindings in the Uruguay Round (Abreu, 1996). For almost all developing countries, existing bindings are, on average, well above applied rates, reflecting a combination of

relatively high initial bindings, and the subsequent wave of reductions in applied rates. (See Blackhurst et al., 1996; Francois, 2001).

In addition to the general Uruguay Round commitments, there have also been efforts for sector-based commitments to implement zero tariffs (called 'zero-for-zero'). As a result of zero-for-zero efforts, OECD economies have between roughly 10% and 30% of tariff lines bound at zero per cent. Most developing countries have opted out of this process. Zero-for-zero increased developed country duty-free imports to 43% of total imports (Laird 1998). The process itself ground to a halt after the initial Information Technology Agreement (ITA). This seems to have been for two reasons: (i) the sectors in which OECD economies could easily reach agreement had already been included, and (ii) those sectors remaining involve North-South issues not susceptible to this approach.

With the implementation of Uruguay Round commitments, average ad valorem tariffs in the industrial countries generally are around 3 per cent, as is reflected in Table 4.6. However, there are important exceptions. One of these is textiles and clothing, where the average rate is roughly three times this average. This is reflected in the standard deviation and maximum tariff columns. With full implementation of current commitments, we estimate a simple average industrial tariff in the United States of 3.2 per cent, a standard deviation of 4.3, and a maximum tariff of 37.5 per cent. The European Union has a higher average, but less dispersion: the EU has an average of 3.7 per cent, a standard deviation of 3.6 per cent, and a maximum tariff of 17 per cent.

Table 4.6 also presents detailed data for three developing countries: Brazil, India, and Thailand. These countries span the spectrum of bindings in developing countries. Brazil's tariffs are all bound, though the average rate for industrial products is 14.9 percentage points above the current applied rate. This gap is called a 'binding overhang'. India and Thailand's tariffs are partially covered by bindings, again with significant binding overhang. For many developing countries the situation of Brazil applies: substantial binding means that reductions on bound rates in the range of 50% are necessary to force reductions in average applied rates. For many countries, even this will have little or no effect, as tariffs are largely unbound. For example, note that one-third of India's manufacturing tariffs and 84 per cent of Zimbabwe's tariffs are unbound (Francois, 2001). Of course, this limits severely the negotiating leverage of developing countries in the WTO. This is also why the debate of using bound, applied, or 'historic' rates as a starting point is important.

For services, 'market access' is a problematic concept. From the outset, service negotiations have been 'qualitative.' They have not targeted numeric measures, but rather commitments in the cross-border movement of consumers and providers and the establishment of foreign providers. In fact, the GATS actually confuses FDI with international trade. As a result, efforts to quantify market access in service sectors (a basic requirement if we want to then quantify liberalisation) have been problematic at best. The standard approach (as exemplified by Hoekman, 1995) has been to produce inventory measures.

Our modelling exercise will exclude a simulation of liberalised services trade. It is difficult to find reliable data on traded services, and more so for Africa. For an exploratory study on the impact of reforms in services trade, the reader is referred to Francois et al. (2003b).

Table 4.6   *Applied non-agricultural tariffs on imports in selected regions (% ad valorem)*

	Post-UR and ITA tariffs			
	Simple average	Standard deviation	Maximum tariff	Binding overhang
European Union	3.7	3.6	17.0	0.4
Japan	2.3	3.4	30.9	0.1
United States	3.2	4.3	37.5	0.2
Brazil	15.9	6.0	35.0	14.9
India	19.2	16.5	40.0	3.9
Thailand	10.5	10.8	80.0	7.8

Source: Francois and Martin (2003).

4.4   Trade Preferences

Most African imports into OECD countries are traded under preferential conditions. The European Union, Japan, the United States and several developed countries reduce import duties and/or quantity restrictions on imports from Africa. Trade preferences follow a common format. First, all countries classified as developing countries are eligible for preferential trade under a Generalised System of Preferences. Second, a set of 'deeper' and 'wider' preferences for the least developed countries (LDCs) complements the GSP scheme. For example, the EU grants (with some major exceptions) all products from LDCs unrestricted market access at zero-duty under the 'Everything But Arms' initiative. The US has a similar but less comprehensive scheme for African LDCs under the African Growth and Opportunity Act. Third, a myriad of bilateral deals or trade integration arrangements with favoured trade partners adds (or reduces) the depth of preferences. In this category we find the EU scheme for African, Caribbean and Pacific (ACP) countries under the Cotonou Agreement, and various trade deals with North African countries. Most large importers have trade arrangements with important African economies such as Egypt and South Africa.

The value of a trade preference is the preference margin, i.e. the per cent reduction on the Most Favoured Nation tariff applied on imports from the beneficiary country. Generally, the preference margins are substantial for LDCs but rather moderate under GSP schemes. GSP generally is of little effect on large import duties: large tariffs occur mostly on sensitive agricultural products, for which preference margins are low or nonexistent. Table 4.7 reports on preferences margins as these have been calculated for this study. Appendix A documents the data and methods applied. For exporters, the application of a preferential tariff rate generally implies a certain transaction cost, often in the form of an administrative procedure or the need to present certified information regarding the make of the product (UNCTAD, 2001). Exporters balance these costs against the preference margin, and may find that the benefits do not outweigh the costs. When preferences are in fact not utilised, the data presented here exaggerate the potential benefits of preferential trade.

Table 4.7   *Preference margins for Africa (% cut on MFN tariffs) a)*

	EU-25			US/Canada			High-income Asia		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	0	7	6	0	0	0	0	0	0
Vegetable	14	69	65	16	46	16	5	6	5
Oilseeds	0	16	16	30	30	30	0	0	0
Sugar	3	23	21	0	0	0	5	5	5
Cotton	0	0	0	1	1	1	0	0	0
Other Crops	14	63	63	2	6	2	18	34	18
Animal	0	33	30	2	3	2	0	0	0
proFood	19	59	57	13	32	13	7	12	7
Extract	0	0	0	0	0	0	0	0	0
Light	23	100	100	2	3	2	44	56	44
Industry	41	84	77	47	61	47	100	100	100
Trade	0	0	0	0	0	0	0	0	0
Other Services	0	0	0	0	0	0	0	0	0

a) Under 0% preference margin, the full MFN tariff applies, under 100% margin the applied duty is nil. Data sources: applied tariffs from the GTAP database v5.3; average preference margins based on Hoekman et al. (2001).

To beneficiaries, an important feature in trade negotiations is that preference margins erode in the process of a global reduction of MFN tariffs. However, a modest tariff cut on tariff lines with a large binding overhang (much 'water in the tariff') has little effect on applied tariffs, and does not reduce pre-reform preference margins for African producers vis-à-vis their competitors in other (developing) regions. An important implication is that one should analyse preferences and binding overhang in close connection to one another.

How does this relate to market access for African exports? In Figure 4.3 to Figure 4.5 we present the level and the composition of bound tariffs that the African exporters face in the importing countries. They are aggregated over all importing OECD countries, and non-OECD countries (including the African countries). Trade flows are used as aggregation weights, and therefore this presents a view on world market access from the perspective of African trade. Bound rates are taken from the GTAP database. Water and preference margins are computed as explained in Appendix A.

Regarding the *levels* of bound tariffs on exports of the African region, what is striking is that substantial tariff barriers remain from the Uruguay Round. As in most sectors tariffs above 10 per cent ad valorem are common, market access reforms can be expected to have substantial impact on export prices in the global trading system. Bound rates in manufactures (light and heavy industry) are generally higher in non-OECD markets than in OECD regions. In various agricultural sectors, non-OECD markets show better access than OECD markets.

In terms of their *composition*, bound rates can be cut into three ad valorem pieces: the binding overhang or water gives the wedge between UR committed bound rate and the applied MFN (most favoured nation) rate; the preference margin reflects the reduction on

MFN rates to the beneficiaries of trade preferences, providing them with a competitive edge. Preference margins generally range between 5 and 10 per cent ad valorem. They apply mostly to African exports of vegetables, sugar, and processed food in agriculture, and to manufactures. Sub-Sahara Africa benefits in almost all sectors, due to zero-duty access of its LDCs. If there are no preferences granted, as in most non-OECD countries, the MFN rate is the applicable rate to exporters. North Africa faces large applied tariffs for its exports of cereals, sugar and processed food. For the other two regions sugar has the highest applied tariff.

The diagrams confirm that non-OECD tariffs contain much more water than OECD rates. Water of 20 to 40 per cent ad valorem is common. Any partial tariff reform first squeezes this water out before applied rates are lowered, which is why partial reforms of border measures have but modest impact on market access in developing countries. However, any cut in tariff directly erodes trade preferences to African exporters. In addition, as will be explained in a later chapter, reforms drive up prices for many imported agricultural products. As a result, African consumers of imported goods and producers of export goods are vulnerable to a partial liberalisation under the WTO.
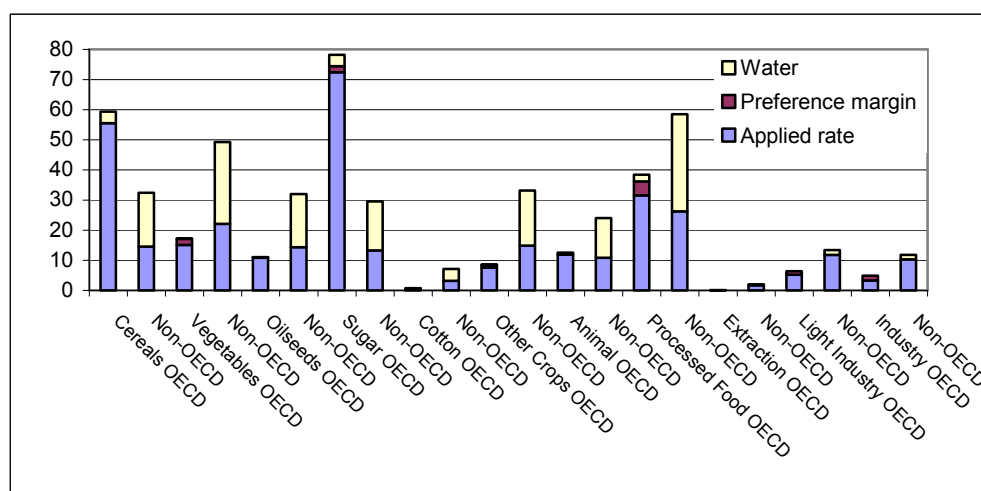
Figure 4.3   Level and composition of the bound tariffs for exports of North Africa (% ad valorem)
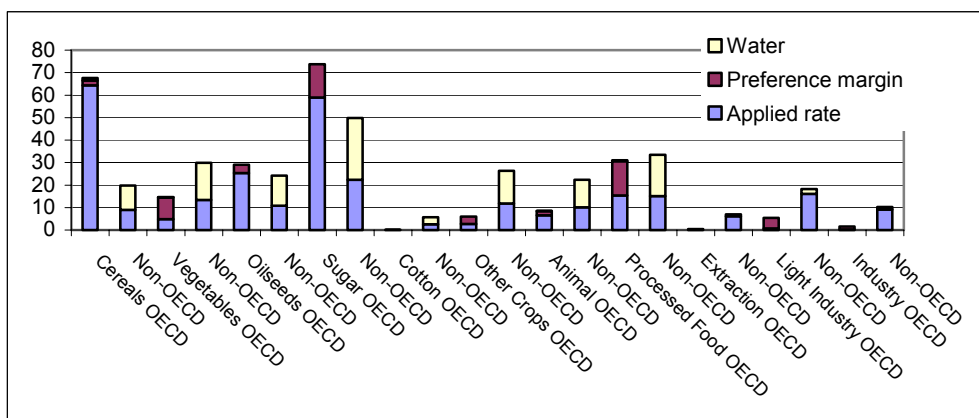
Figure 4.4   Level and composition of the bound tariffs for exports of sub-Saharan Africa (% ad valorem)
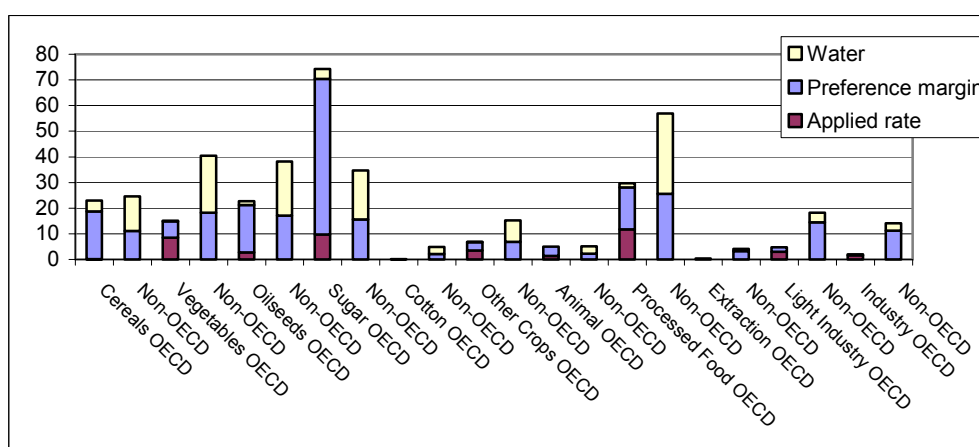
Figure 4.5   Level and composition of the bound tariffs for exports of Southern Africa (% ad valorem)

4.5   Assessing the Degree of Protection of OECD Trade Policies

Before examining the impact of OECD trade policies on African economies, it is useful to assess the degree of protection of OECD trade and agricultural policies. Relatively few studies have attempted to quantify the degree of protection associated with agricultural support policies in OECD countries using well-designed and rigorous econometric criteria. Two recent studies have tried to address this issue, although with contradictory results.

Bouet et al. (2001), examined the extent of trade barriers existing in developed countries using Market Access Maps (MAcMaps), which is a bilateral and disaggregated measure of market access that integrates various instruments of protection and takes account of the fact that developed countries' apply different rates of protection on products imported from their trading partners through preferential trade arrangements. The instruments of protection considered in the study are: ad valorem duties, specific duties, tariff quotas, anti-dumping duties, and sanitary, environmental and technical norms. The

study found that of the developed countries considered, the aggregate degree of trade protection in Switzerland was the highest with a MAcMaps tariff mean of 15.1 per cent (See Table 4.8). The United States ranked second with a tariff mean of 11.8 per cent, followed by the European Union (9.7 per cent), Japan (9.0 per cent), and Australia (8.8 per cent). An interesting point to note in the results is that the United States appears to be more protective than the European Union even though the data show that tariff quotas, prohibitions, and ad valorem and specific duties are more protective in the later (see Table 4.9). The authors argue that this has to do with the fact that the European Union has a greater incidence of discriminatory regimes and preferential trade agreements that give some developing countries more access to its markets.

Table 4.8   Ranking of Countries by Degree of Protection

Country	Tariff MacMaps (%)	Ranking of Countries
Australia	8.80	1
Japan	9.00	2
Morocco	19.40	8
EU	9.70	3
USA	11.80	4
Brazil	13.40	5
Switzerland	15.10	6
China	18.40	7

Source: Bouet et al. (2001).

Table 4.9   Protection Measures by Type of Instruments

	Canada	USA	Japan	European Union
Average Ad valorem taxes (%)	7.10	4.87	6.55	5.88
Specific Duties (%) *(Average ad-valorem equivalent)*	7.97	12.75	7.37	50.04
No. of Prohibitions	0	0	0	881
Average In-Quota Tariff Rate (%)	3.50	8.70	17.28	15.17
Average Out-Quota Tariff Rate (%)	169.12	41.83	234.83	60.19

Source: Bouet et al. (2001).

4.6   The African Agenda for Agricultural Trade Policy

The negotiations on agriculture are of great importance to African countries because of the critical role of the agricultural sector in the region. Agriculture is a major source of employment in the region and accounts for about 70 per cent of total employment. It also

plays a key role in economic growth, accounting for roughly 24 per cent of the regions GDP and 40 per cent of its foreign exchange earnings (Economic Commission for Africa, 2002). In addition, developments in the agricultural sector significantly affect the economic performance of the region with potential consequences for poverty reduction efforts.

The position of African countries within the framework of international negotiations on agricultural concerns evolves around two principles. On one side, it calls for greater access to developed-country markets for their agricultural products and the elimination of the most devastating forms of market support. At the same time, all these countries are calling for greater flexibility in the liberalisation process by maintaining some form of protection for their farmers to ensure food security. These protections have become, all the more necessary given the increase in food insecurity and growing poverty in the countryside. See Economic Commission for Africa (2004) for a historical discussion on African interests in the multilateral negotiations on agricultural trade. The demand of African countries now revolve around four main concerns:

4.6.1 Market Access

At this level, African countries are demanding for greater openness of markets for their product through the reduction of tariff-peaks. Most particularly, they are demanding for the reduction of tariff-peaks and the abandonment of the tariff escalation applied against their agricultural and processed products.

4.6.2 Domestic support to production

At this level, the African countries are demanding the elimination of subsidies in the blue box. Regarding support in the amber box, these should be progressively phased-out and eliminated around year 2015. Finally, in relation to assistance in the green box, African countries, while taking into account developed country concerns for the protection of the environment and maintenance of the rural landscape, are demanding more rigorous criteria for defining support measures which should enter this category. This rigour is necessary in order to avoid the situation whereby contested blue and amber box support items become progressively integrated into this category.

4.6.3 Export Subsidies

The African countries declared in favour of the elimination of these subsidies between now and year 2010.

4.6.4 Specific treatment for development

African countries demanded a less stiff reduction of custom duties on agricultural products, longer period for the implementation as well as complete exemption for the LDCs.

Furthermore, some African countries underscored the strategic character of agricultural policies in development, which made food security a fundamental imperative

within the fundamental rights of people. To this end, they suggested the establishment of a special support category for development in the agricultural sector.

This chapter gave an idea on the views of African countries on international negotiations. Therefore, the objective of this study is to inform better their positions on their main areas of concern

5. Model, Data and Scenarios

5.1 Model structure

The framework adopted in this study is the GTAP model, which is a comparative static, multi-sector, and multi-region general equilibrium model. Each country or region is depicted within the same structural model. The regional household to which the income of factors, tariff revenues and taxes are assigned represents the consumer side. It is assumed that the regional household allocates its income to three expenditure categories: private household expenditures, government expenditures and savings. Consumption of private household is depicted using a non-homothetic Constant Difference of Elasticities (CDE) function.

A representative producer for each sector of a country or region makes production decisions to maximise profits by choosing inputs of labour, capital, and intermediates to produce a single sector output. Producers can substitute primary factors for each other, and this substitution possibility is captured using a Constant Elasticity of Substitution (CES) functional form. In addition, it is assumed that intermediate goods are used in fixed proportions (Leontief). In the case of crop production, farmers also make decisions on land allocation. Intermediate inputs are produced domestically or imported, while primary factors cannot move across country. Internationally traded commodities are assumed to be distinguished according to the region of origin. Using this so-called Armington assumption implies that for example wheat imported from the US is different from wheat imported from the EU, and trade flows in both varieties have their own price tag. A great advantage of the Armington assumption is that it allows us to model bilateral trade flows and bilateral trade policies. We exploit this feature in the treatment of trade preferences vis-à-vis developing countries.

The GTAP model includes two global institutions. All transports between regions are carried out by the international transport sector. The trading costs reflect the transaction costs involved in international trade, as well as the physical activity of transportation itself. Using transport inputs from all regions the international transport sector minimises its costs under the Cobb-Douglas technology. The second global institution is the global bank, which takes the savings from all regions and purchases investment goods in all regions depending on the expected rates of return. The global bank guarantees that global savings are equal to global investments.

The welfare changes are measured by the equivalent variation. Taxes are included in the theory of the model at several levels. Production taxes are placed on intermediate or primary inputs, or on output. Some trade taxes are modelled at the border. Additional internal taxes can be placed on domestic or imported intermediate inputs, and may be applied at differential rates that discriminate against imports. Trade policy instruments are represented as import or export taxes/subsidies. A detailed discussion of the basic algebraic model structure of the GTAP model can be found in Hertel (1997).

A salient feature of many developing countries is unemployment (or under-employment) of human resources. This is at variance with the usual general equilibrium treatment of full employment of factors of production. We therefore modify the model to allow for unemployment of unskilled labour in African economies. This is achieved by fixing the nominal wage rate, and letting the volume of employment of unskilled labour adjust (see McDonald and Walmsley (2003)). This specification of the labour market still allows the real wage to adjust.

5.2 Aggregation

We employ the version 5.3 of the GTAP database, which refers to the year 1997 (Dimaranan and McDougall, 2002). For the analysis we aggregate the GTAP database into 12 regions (Table 5.1) and 13 sectors (Table 5.2). All African countries are split into three regions: North Africa (nAfrica), Southern Africa (sAfrica), and Sub-Saharan Africa (SSA). The region North Africa includes all countries with access to the Mediterranean Sea. South Africa, Lesotho, Namibia and Swaziland constitute the region Southern Africa while the region Sub-Saharan Africa comprises all remaining African countries. The aggregation of sectors has been designed to provide some degree of detail in the coverage of agriculture and food sectors, which are of central interest to this study. Five sectors cover the rest of the economy. More details about the aggregation can be found in Appendix B.

The study uses a fairly global division for the sectors and a quantitative approach to agricultural policy in both the EU and third countries. Naturally, each sector in each country has its own specific characteristics, which cannot be examined individually in such a global analysis. The results presented in the study should therefore primarily be seen as an indication of the scale and direction of the anticipated effects.

Table 5.1   Regions

Name	Region
nAfrica	North Africa (Algeria, Egypt, Libya, Morocco and Tunisia)
SSA	Sub-Saharan Africa
sAfrica	Southern Africa (South Africa, Lesotho, Namibia and Swaziland)
EU15	European Union (15 Member countries)
NAM	North America (United States and Canada)
SAM	South America
AUSNZ	Australia and New Zealand
HiASIA	High-income Asia (Japan, Korea, Singapore, Taiwan)
China	China and Hong Kong
OASIA	Other Asian Countries
CEEC	Central and Eastern European Countries (EU Accession in 2004) a)
ROW	Rest of the World

a) Also referred to as Transition countries.

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Table 5.2   Sectors

Name	Sector
Cereals	Wheat, Paddy Rice, other Cereals
Vegetable	Vegetables (also Potato) and Fruit
Oilseeds	Oil Seeds and oil processing
Sugar	Sugar Beet, Sugar Cane and Sugar Processing
Cotton	Fibre plants
Other Crops	Beverages and Spice Crops, Tobacco, Flowers
Animal	Cattle, Sheep, Pork, Poultry, Eggs, Raw Milk
ProFood	Processed Food including Meat and Dairy
Extract	Extraction Industries
Light	Textile and Wearing apparel Industries
Industry	Other Industries a)
Trade	Trade and Transport Services
Other Services	Energy Supply, Financial Services, Education

a) Also referred to as heavy industries.

5.3   Data Preparation and Simulation

In 2005 when the outcomes of the Doha round are expected to be implemented, the trade policy environment will have changed considerably. For this reason a baseline is constructed that includes several changes in the medium term. Then, trade reform of varying degrees of comprehensiveness are simulated, and welfare effects in African sub-regions are measured as deviations from the baseline.

In order to get the baseline run that serves as a starting point for our analysis, some important policy changes between 1997 - the reference year of the database - and 2005 are simulated: all Uruguay Round commitments; the reform of the Common Agricultural Policy of the EU under Agenda 2000 (van Meijl and van Tongeren, 2002); China's WTO accession;[9] the implementation of the Agreement on Textile and Clothing (ATC) that phases out all quota restrictions in textile trade from 2005 onwards; and the EU Eastwards Enlargement, simulated as a total trade liberalisation between the 15 EU member countries and the region CEEC and the adoption of EU border tariffs in CEEC countries.

Having simulated a range of policy measures between 1997 and 2005, we produce a baseline suitable for an analysis of the impact of the Doha Round. If the negotiations can be concluded according to schedule, commitments made under the Doha Round are to be implemented from 2005 onwards.

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[9] The integration of China in the WTO is incorporated by equalising all import tariffs according to the Most Favoured Nation clause.

5.4   Trading costs

With the reduction in traditional trade barriers, attention in the regional and multilateral trade arenas has not only shifted to quantity restrictions, but also to trade facilitation measures. These are meant to target less transparent trade barriers, such as customs procedures, product standards and conformance certifications, licensing requirements, and related administrative sources of trading costs. Studies of regional integration initiatives (Baldwin and Francois, 1997; Smith and Venables, 1988) have emphasised the potential for liberalisation initiatives to substantially reduce such barriers. Conceptually, these costs are different from the price and quantity measures used for manufactures and agriculture. They are a pure global deadweight loss. The estimates of trading costs are very rough (at best). Nonetheless, they provide some sense of the magnitudes involved. An overview of estimates is provided in Table 5.3. In the context of the EC single market program, elimination of internal customs procedures and related administrative streamlining were projected to reduce trading costs by up to 2 per cent of the value of trade (EC 1988). Globally, UNCTAD (1994) has noted that trading costs represent 7 to 10 per cent of the cost of delivered goods. Like the EC, UNCTAD also estimates that simple trade facilitation measures could reduce these costs by 2 per cent of the value of trade. The Australian Industry Commission (1995) has estimated potentially higher savings in the context of APEC, ranging from 5 to 10 per cent of the value of trade. Under more modest facilitation initiatives, the Japanese Economic Planning Agency (1997) has estimated savings at 2 per cent in an APEC context, while Francois (2001) has employed a similar range of estimates.

Table 5.3   Estimated cost savings from trade facilitation

European Commission (1992)	In the context of the Single Market program, savings may amount to 1.6 per cent to 1.7 per cent of the value of trade due to savings on administrative costs.
UNCTAD (1994)	Costs of transactions represent 7 to 10% of the value of trade. Trade facilitation could reduce this to 5% to 8%.
Australian Industry Commission (1995)	Trade facilitation may save 5% to 10% of the total value of trade, through reduced transaction costs, in the APEC context.
Japan EPA (1997)	A 'modest' APEC initiative may lead to 2% savings (as a share of the value of trade) due to reduced transaction costs.

5.5   Policy scenarios

The core of our analysis is structured around a set of scenarios. These scenarios are based on alternative liberalisation approaches for trade in agriculture and manufactured goods. They are meant to illustrate the implications of alternative approaches to market access liberalisation. They are stylised rather than exact representations. In part, this is because we are working with an aggregate model (i.e. we do not model trade at the 6-digit HS level), and as such detailed treatment of all product-specific proposals is simply impossible. In

addition, the actual market access modalities remain to be worked out. In agriculture, domestic support may or may not be affected, developing countries may or may not have to liberalise, and certain politically sensitive sectors may yet again escape meaningful liberalisation. Our scenarios are themselves decomposed into different components, related to specific sets of countries and specific sectors and instruments. This offers the advantage of allowing us (or the reader) to construct rough representations of hybrid liberalisation experiments later, since individual components can be taken from different scenarios and combined.[10]

In view of the proposals that have been made in the ongoing WTO Doha Round, we define and perform experiments for three scenarios of trade reform, namely, little, modest, and full liberalisation. The first two scenarios are partial liberalisation scenarios. The 'little' liberalisation scenario involves a linear 36% cut in agricultural tariffs; a 20% cut in industrial tariffs, export subsidies and domestic support for agriculture, and a partial reduction in trading costs, related to trade facilitation measures. The 'modest' liberalisation scenario involves a 50% reduction in all trade instruments. The third and most comprehensive scenario, involves full elimination of all border and support measures. Table 5.4 summarises the policy experiments.

Table 5.4   Liberalisation scenarios

Scenario	Policy Changes
Little	Tariff Reduction: Agricultural Goods 36%, all other Goods 20%
	Reduction of Export Subsidies 20%
	Reduction Domestic Support 20%
	Trade Facilitation 1%
Modest	Tariff Reduction: All Goods 50%
	Reduction of Export Subsidies 50%
	Reduction Domestic Support 50%
	Trade Facilitation 1,5%
Full	Tariff Reduction: All Goods 100%
	Reduction of Export Subsidies 100%
	Reduction Domestic Support 100%
	Trade Facilitation 3%

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[10] Technically, decomposition of general equilibrium-related effects of policy scenarios exhibit path dependence, meaning that the decomposition can be sensitive to the ordering of the elements of the experiment set. The impact of a particular instrument is also sensitive to the other members of the set. We employ a linear decomposition method here that does not exhibit path dependence (Harrison et al., 2000). As such, individual experiment elements are roughly additive.

6. Results

This chapter presents results of the static model showing precisely how various degrees of trade liberalisation could impact on African economies. We provide results at the sub-regional level for North Africa, Sub-Saharan Africa and Southern Africa. We focus on the sub-regional level because most African countries are not in the GTAP database and so it is not possible to conduct the analysis at the country level. However, to the extent that groups of countries have similar structures general inferences can be drawn on how the reforms might affect individual countries.

6.1 Aggregate results

Our simulations show that a very complete liberalisation of distortions in both agricultural and non-agricultural trade could bring modest benefits to the African continent, as it does for all regions in the world.[11] The results suggest that full reform would add 0.3 per cent to global income annually. Furthermore, they suggest that the gain to the African region is about 0.7 per cent of GDP. Although the absolute gains to the African region seem small, they are quite significant for two reasons. The first is that Africa reaps above average welfare gains (Figure 6.1). Its share of the global welfare gain is 5 per cent while its share in global GDP and trade is about 2 per cent. The second is that these benefits are expected to reoccur each year and so the long-term benefits of liberalisation to the region are likely to be substantial.

Appendix Table 1 (page 87) gives more detail on the welfare effects under various scenarios of trade reform. It shows that in all regions of the world the gains from reform are largest under a comprehensive reform. In fact, benefits grow with the depth of reforms. In Africa, reform results in yearly welfare gains of USD 3.7 billion under full liberalisation, of USD 216 million under modest reform, and in a loss of USD 605 million under little reform. The gains are unevenly distributed among the African sub-regions. National income gains in Southern Africa and North Africa amount to 0.9 per cent of GDP under full reform, about 3 times as much as the gains for sub-Saharan Africa. In addition, sub-Saharan Africa is vulnerable to little or modest reform, as it incurs losses.

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[11] We measure income gains as Equivalent Variation (EV). This is a single summary statistic to ascertain the net benefits from a policy change. The EV tells us how much money should be given or taken away from a consumer to compensate him for a change in the consumption pattern arising from a change in prices.
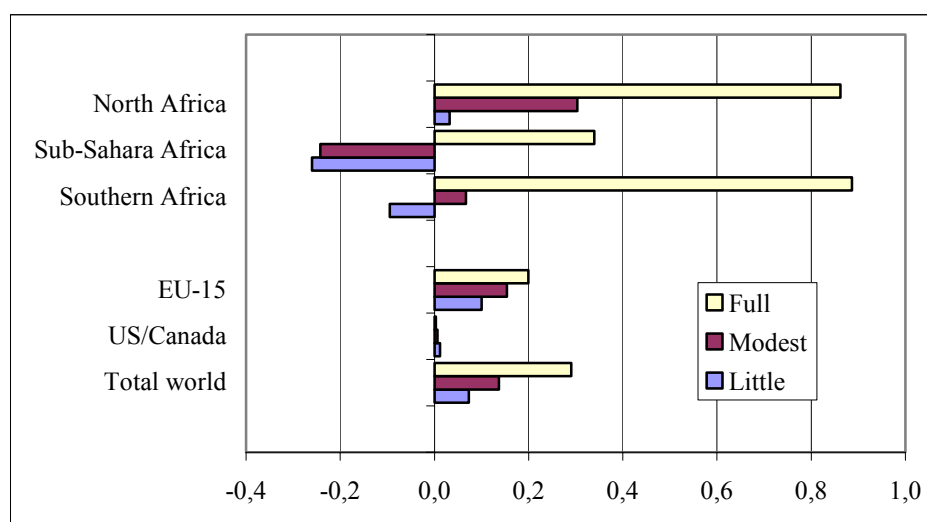
Figure 6.1   *Additional national income after trade reform, derived from equivalent variation (per cent change)*

The result that sub-Saharan Africa is vulnerable to 'little' and 'modest' reforms can be attributed to the effect of preference erosion. The sub-region is a major beneficiary of preferences and partial market access reforms reduce tariffs on products exported to preference granting countries from countries that are not part of the preferential trading arrangements, thereby eroding any given preferential market access benefits received by countries in sub-Saharan Africa. The effect of preference erosion is magnified by the existence of 'binding overhangs', that is the phenomenon of bound tariff rates being significantly higher than applied rates in several countries. Under 'little' and 'modest reforms', which involve 20 to 50 per cent tariff cuts, there is strong preference erosion in sub-Saharan Africa and the sub-region faces more competition with exporters from developing countries in other regions. But because of binding overhangs, partial reforms of the magnitude considered do not result in a reduction in applied tariffs in several countries. Consequently, there are no improvements in market access for African products in other regions. In contrast, however, under a comprehensive reform, African producers suffer from preference erosion but they also have more access to markets in other regions and so experience positive welfare gains. This accounts for the difference in the results between partial and full reforms.

What drives welfare changes after trade reform? Welfare is to be increased by making better use of available resources. Trade reform cuts barriers between economies, and thereby typically expands the range of choices for factors of production to be used, and increases consumer choice. The removal of subsidies and taxes has a similar impact. Better allocation results in more production and consumption, even with an unchanged amount of means. Expanded trade opportunities are instrumental in achieving such gains: typically, import goods can be obtained cheaper, and increased specialisation in a competitive production scheme allows more exports to the world market that can finance the imports. Table 6.1, which decomposes the global total welfare impact from full liberalisation into its main components, shows that the reshuffling of resources accounts for 3/4th of global

welfare gains, or about USD 70 billion. For the African region, a large share of the gains to the region can be attributed to an improvement in the allocation of resources.

The remainder of the global gains comes from the increased availability of resources in the global economy. The first of two resource increases in the simulation refers to an employment effect in Africa. The expansion of the African economies allows previously unemployed or underemployed unskilled labour resources to be better utilised in the wage economy. Tapping this reserve leads to an additional boost to macro-economic welfare, adding almost USD 2 billion annually. The second feature, trade facilitation, brings further gains, as goods can now be imported cheaper in all regions.[12] In this study, trade facilitation is implemented as a gain to be had at zero costs, which, as discussed in a section below, has serious implications for the feasibility of results.

Another component of welfare changes in the model is the terms of trade. By definition, terms of trade effects net out on the global level. It is, however, interesting to see the distribution of gains and losses over the twelve regions and sub-regions. In Africa, reforms result in a deterioration of the terms of trade and this has a negative effect on welfare. The composition of African exports (biased towards primary commodities) and its imports (biased towards manufactures) is instrumental in explaining the loss in the terms of trade. We shall return to the terms of trade below. Finally, we have to account for the change in the price of domestic savings relative to the price of foreign savings. This is similar to a terms of trade effect in our model, since each region 'exports' capital goods to the global bank and 'imports' savings from the global bank.

Table 6.1   Decomposition of global welfare effects under full liberalisation (mln USD) a)

	Allocative effects	Employment effects	Trade facilitation	Terms of trade	Terms of trade' (capital account)	Total
North Africa	2,713	431	424	-1,390	-284	1,894
Sub-Sahara Africa	1,025	821	223	-623	-357	1,089
Southern Africa	752	723	89	-21	50	1,593
EU-15	16,563	0	6,443	-8,047	1,744	16,702
US/Canada	4,005	0	2,003	-5,111	-477	420
South America	6,474	0	1,097	1,039	-216	8,394
Australia/New Zealand	106	0	127	4,578	71	4,881
High-income Asia	13,545	0	3,091	8,957	-738	24,855
China	4,614	0	885	1,204	394	7,097
Other Asia	5,376	0	944	-476	-9	5,835
Transition countries	510	0	553	-684	-447	-67
Rest of world	13,571	0	2,565	335	267	16,737
Total	69,254	1,975	18,442	-238	-2	89,431
Share	77%	2%	21%	0%	0%	100%

a) Welfare effects based on an equivalent variation measure.

[12] Technically, we model 'iceberg' trade cost. That is, a certain percentage of the commodity 'melts' away when shipped abroad. The amount of loss due to this melting is reduced with trade facilitation.

It should be noted that a terms of trade deterioration has two opposing effects in the model. On the one hand it reduces the international purchasing power of income earned on African exports. On the other hand, it makes African exports cheaper or more competitive on world markets, thereby increasing exports and income. The net welfare effect of a terms of trade deterioration therefore depends on which effect dominates. Appendix Table 2 shows the per cent change in the terms of trade for all regions in the model under the three different liberalisation scenarios. A deterioration in terms of trade means that the prices received for exports fall relative to the prices paid for imports. It can be seen from the table that all regions, except the EU-15, the transition countries and the African region, experience an improvement in their terms of trade after reform. The result for Africa is that the improvement in agricultural export performance acts as an important driver of African welfare gains under full reform. The lowering, and eventually phasing out, of trade restrictions opens avenues for African exports on OECD markets, especially in those agricultural products which will see a decline in production in OECD countries as a consequence of reduced support there.

What drives the change in relative import and export prices? Part of it is explained by the presence of unemployment in the model: by specification, nominal wages for unskilled labour are fixed in Africa such that unskilled labour cost do not rise much in real terms. Simultaneously - in accordance with standard trade theory - labour costs do rise in other regions where exports of labour-intensive products expand. As employment is fixed in all non-African regions, the increased use of labour resources drives up the wage there. In the process, African exports become cheaper to the rest of the world.

Comparing results across studies
The estimated USD 84 billion global gains (0.3 per cent of GDP) from a full liberalisation of border and support measures are quite modest compared to outcomes of recent studies. For example, as shown in Figure 6.2, the gains for the Sub-Sahara African region from this study are less than those reported in other studies. The welfare gains reported in earlier studies are around USD 2 billion, compared to USD 704 million in the present study. The difference can be attributed to the fact that the dimensions, model specification and the underlying country aggregations, differ across studies. The studies mentioned do not incorporate trade preferences and this plays and important role in the results. However, sub-Saharan African countries are involved in a number of preferential trading arrangements. By failing to take this into account, previous studies ignore the issue of preference erosion, thereby overestimating the welfare gains received by sub-Saharan Africa from a full liberalisation for trade.

Note that the current study may just as well have *overstated* the consequences of preference erosion. The scenarios presented here assume that the estimated preference margins effectively reduce the tariffs that African exporters are facing in the markets of OECD countries. Various observers (e.g., UNCTAD, 2001) have pointed to the low rate of utilisation of preferences, citing lack of transparency, complex procedures and rules of origin as the main reasons for the ineffectiveness of the current preference schemes. If indeed African exporters are not exploiting fully the benefits of the preferential arrangements, then, obviously, there is not much actual erosion taking place if market access is improved for all members participating in the Doha round. Therefore, if

preferences are unused, Sub-Saharan Africa is more likely to benefit from 'early harvest' or partial reforms.

US dollar billion
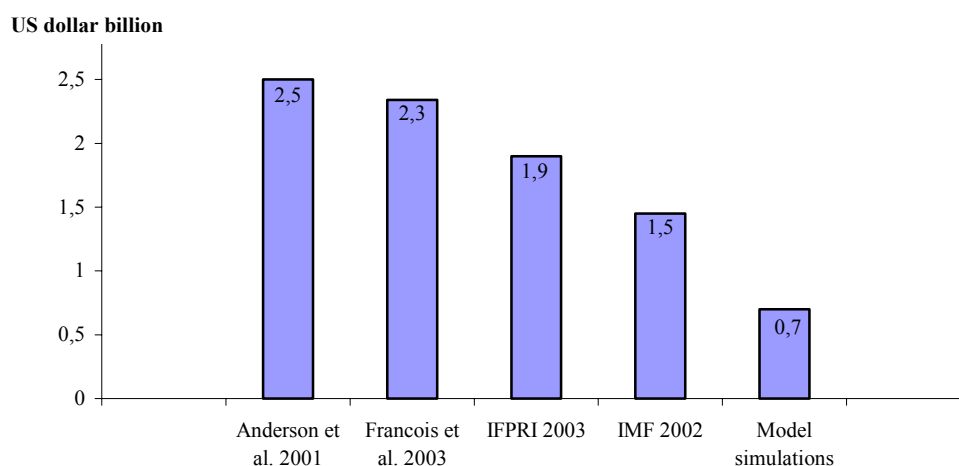
Figure 6.2   Estimates of welfare gains in Sub-Sahara Africa under full liberalisation of border protection and domestic support measures

6.2   Trade and specialisation

- Reform affects the pattern of international specialisation in the world economy;
- Industrial expansion occurs mainly in OECD countries, not developing countries;
- South-American countries expand production of commodities previously subsidised by OECD countries (the program commodities), and agro industries;
- Africa shifts resources into program commodities.

6.2.1 The global picture

The reduction of trade distorting border measures and domestic policies in all countries leads to a shift in resource allocation within economies and between economies. As certain activities shrink with the removal of distortions, resources are freed that are subsequently employed elsewhere in the economy. As a consequence, countries tend to specialise more in those activities in which they have a comparative advantage. That is, they specialise in goods that use relatively intensively the abundant production factors. Hence, we expect to observe shifts in the international specialisation of activities in the results and this is indeed the case.

A measure of specialisation is given by the specialisation index, which reveals a country's net trade position by product.[13] The top panel of table 6.2 shows the global specialisation pattern prior to reform. Across the sectors identified, in Australia/New

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[13] The specialisation index is the ratio of the trade balance over the trade volume: $(X-M)/(X+M)*100$. If this measure takes the value −100, all the country's trade in this product is imports, if it is +100 all the trade is exports.

Zealand specialisation is deepest, and approaches total specialisation in livestock products. In North America, South America and Asia specialisation goes to substantial depth, as the absolute value of indices reach 30 to 40. In Africa, and more so in Europe, the extent of specialisation is modest. Africa is a net exporter in agriculture (crops and livestock), and a net importer in agro-processed products.

The lower panel of the table shows the changes to the index (in per cent point) under a full liberalisation experiment. The numbers in both panels can be added to arrive at post-reform index levels. While the African continent, South America and Asia are able to specialise more in crops and livestock products, and reduce their need for imports of processed foods, the reverse can be observed in Europe. North America is currently a net exporter of agricultural products, and remains so after reform. The Australia & New Zealand region expands its trade in processed foods.

The 'cost' to be paid for more specialisation in agricultural products is a shift of resources away from industry and manufacturing. In the (enlarged) Europe and North America we see an increased specialisation in industry, while Asia is able to expand in labour intensive light manufacturing.[14]

Table 6.2   Specialisation index, before reform and after full reform a)

BASE (%)	Africa	Europe	North America	South America	Asia	AusNZ	Rest of World
Crops	7	-16	36	45	-30	71	-32
Livestock products	15	-3	21	3	-43	91	-16
Agro processing	-16	8	5	23	-33	66	-32
Light manufacturing	-2	-6	-26	2	29	-23	-19
Industry & extraction	1	2	-9	-12	4	-15	10
Services	-11	-1	13	-8	-4	6	-9
Total	-2	0	-5	-4	4	1	1

CHANGE (%-points)	Africa	Europe	North America	South America	Asia	AusNZ	Rest of World
Crops	5	-10	1	1	7	-3	4
Livestock products	19	-4	6	6	6	-4	4
Agro processing	5	-9	9	16	1	14	11
Light manufacturing	-4	-1	-8	-8	1	-18	2
Industry & extraction	-4	1	1	-2	-1	-9	-2
Services	0	2	2	-3	-4	-11	-2
Total	-2	0	1	0	-1	-1	-1

a) A positive number indicates a net exporting position; a negative number indicates net imports. See footnote 13. Numbers in the top and lower panel can be added to derive the post-reform index.
Source: trade data in the GTAP database v5.3, and model simulations.

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[14] In this regard it is important to mention that our baseline already incorporates the phasing out of the export quota on textiles and garments under the Agreement on Textiles and Clothing (ATC). Any further changes in the textiles and garments sectors stem from the reduction of import tariffs, and are rather small compared to the effect of the ATC. See Van Tongeren and Huang (2004) for an analysis of ATC phase out.

6.2.2 Specialisation in Africa

Against the background of a change in global specialisation, what is the impact on the three African regions and the thirteen sectors in the economy?

For each of the regions, current specialisation patterns can be observed from the left columns of Table 6.3. Africa clearly finances agricultural imports with export revenues from the extraction industries, mining and oil. All regions are net importers of cereals and oilseeds, and net exporters of vegetables. North Africa is a net exporter in light industries, and relies heavily on agricultural imports in almost all products. Cereal and oilseed imports partly serve the substantial animal products industry. Sub-Sahara Africa is almost fully specialised in crops and a major net importer in industrial products. Southern Africa is also a net importer in agriculture, except for cereals, oilseeds and cotton, and shows deep specialisation in the sugar sector. Its trade balance in manufactures approaches zero. From Appendix Table 3, which reports further detail on exports, imports and output, it is clear that agriculture accounts for but a small share of total trade. The African economies are not all that integrated into the world economy: the added sum of exports and imports flows amount to just $1/4^{th}$ to $1/3^{rd}$ of output. The specialisation of sub-Saharan agriculture in exported commodities shows in the sector 'other crops', which includes cocoa, coffee, tea, tobacco, groundnuts and spices.[15] Note that the processed food sector ('ProFood') is the most important agricultural sector in terms of output and imports.[16] The manufacturing sectors are important both in terms of output and imports. The service economy (other services in the table) is large in all regions, reflecting large government and large sums of value-added generated by financial services and the like. There is a substantial African transport sector ('trade').

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[15] The sector 'Other crops' further covers a variety of commodities (roots and tubers) and high-value products (cut flowers, seeds).
[16] Processed food is a wide aggregate that consists of meat and dairy products, processed fisheries products, beverages and tobacco, and all other processed food products.

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Table 6.3   *Specialisation index for Africa under base and after full liberalisation, by region and sector (%) a)*

	North Africa		Sub-Sahara Africa		Southern Africa	
	Base	Full	Base	Full	Base	Full
Cereals	-92	-80	-78	-58	-8	9
Vegetable	28	23	65	58	87	83
Oilseeds	-63	-53	-9	4	-64	-64
Sugar	-88	-75	-2	30	76	78
Cotton	-32	-11	93	95	-15	-5
OCrops	-74	-74	94	92	16	6
Animal	-16	11	38	57	36	50
ProFOOD	-39	-27	-10	-4	11	11
Extract	84	85	89	89	44	44
Light	6	4	-22	-30	-3	-10
Industry	-51	-52	-58	-58	0	-4
Trade	37	38	-53	-52	8	8
Services	9	10	-26	-27	0	-1

a) The index ranges between –100 (all trade are imports) and +100 (all trade are exports). See footnote 13 for detail on the index. Base refers to baseline data; full to results in the full reform scenario.
Source: model simulations.

A view at the deepening specialisation in agriculture under a full liberalisation reveals, in fact, that it is composed of two counteracting effects. (See the right columns in Table 6.3 for the specialisation index after reform. Changes in trade volume relative to base are revealed in Appendix Table 4 and Appendix Table 5). First, the results show both import substitution and increased exports in the program commodities (i.e. the agricultural goods that currently benefit from heavy protection in OECD countries), including sugar, cotton and oilseed crops, as well as beef and dairy products. Exports increases are notable for cereals, sugar and cotton but absolute volume changes are small. In general, the displacement of imports in program commodities into Africa by home production is an important driver of the simulation results.

Second, there is a move away from commodities with both modest levels of protection in OECD countries and large value-added, such as vegetables and flowers (included in other crops). Exports decline in these sectors, especially to the loss of Sub-Sahara Africa (SSA). Only in North Africa exports of these products grow. The processed food sector generates moderate results; under a total liberalisation exports increase largely in all African regions, under less ambitious reform the processed food performance varies. Unfortunately, the aggregate level of results limits the detail on the important sector 'other crops', which includes most of African traditional export commodities.

While manufacture exports from both light and heavy industry increase for all African regions, imports grow even more. As discussed above, these effects relate to

changes in the terms of trade. Exports of extraction products (extract), the most important export good, grow steadily with the comprehensiveness of reform.[17]

The pattern to the import and export changes that result from reform is clear: Africa displays an import substitution in grains, sugar and cotton that is driven by policy changes towards these program crops in OECD countries. Agricultural production in the African regions moves partly away from other commodities and horticulture products, and the share of light and heavy industry in trade declines. Figure 6.3 presents a graphical demonstration. The graph reports changes to the specialisation index when moving from modest to full reform, for Africa and the EU-15, Africa's main trade partner. Given that a move from a reform of Little to Modest depth renders small specialisation effects, the graph helps to explain the jump in results between partial reform and a comprehensive liberalisation.
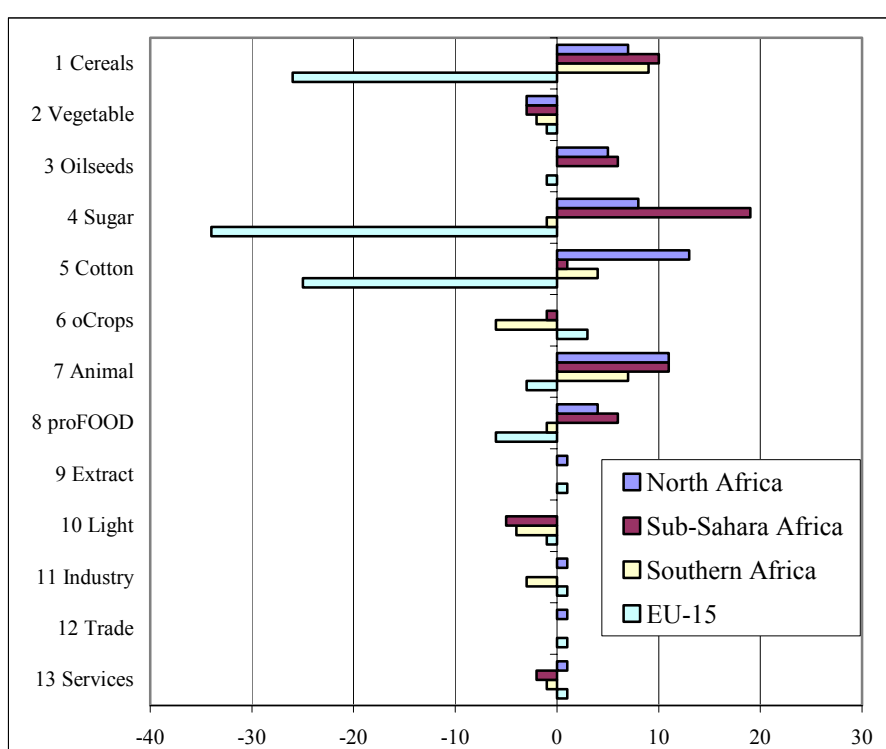
Figure 6.3   *Altered specialisation in Africa and EU-15 when moving from modest to full reform (change to the specialisation index in %-points)*

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[17] The aggregate extraction sector consists of basic products from forestry, fishing, and the extraction of coal, oil, gas and minerals.

6.3   Changing structure of production

- African economies move more into the supply of commodities that currently receive support in OECD countries;
- Simultaneously they move away from non-subsidised commodities and agricultural goods with large value-added;
- In some countries, factors of production now in manufacturing shift into agriculture;
- Risk of de-industrialisation in Africa.

The resulting output changes follow the pattern of international specialisation. While the African regions expand output in cereals, sugar and cotton, and moderately in animal products, output declines in commodities like vegetables, fruit and flowers and commodity crops. Not only are resources reallocated within agriculture, light and heavy industry contracts in all African regions. Under little reform, industrial activity reduces by less than 1 per cent, under modest reform 2 to 4 per cent. Under full reform, the impact differs across regions. There are substantial reductions in the Sub-Saharan and Southern African regions amounting up to 9 per cent activity loss. After reform, African governments face quite a substantial loss of revenue from import duties on manufacturing imports. The output effects, presented in Appendix Table 7 and summarised for Sub-Sahara Africa in Table 6.4, point to a de-industrialisation tendency in all African sub-regions - the flip side of deeper specialisation in agriculture. In the comparative static general equilibrium model, it becomes more efficient to specialise in those activities that use intensively the relatively abundant production factors, i.e. (unskilled) labour.[18] Since industrial activities use the relatively scarce capital inputs, these activities tend to decline.

Table 6.4   Share of agriculture and food in output in Sub-Sahara Africa

	Before reform	After reform
Total economy including services:		
Agriculture	0.38	0.39
Non-agriculture	0.62	0.61
Merchandise economy:		
Agriculture	0.72	0.74
Non-agriculture	0.28	0.26

Source: Model simulations.

In as far as the industrial sector is the main engine for future growth, the de-industrialisation tendency produced by our model is an alarming signal. Such effects have been discussed in the 'new economic geography' literature which shows that regions that

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[18] The fixing of nominal wages for unskilled labour in the African region further induces this process, as it makes skilled labour the scarce factor in Africa, driving skilled wages upwards relative to unskilled wages.

are similar (or even identical) in their structure (endowments, technology) can endogenously differentiate into rich 'core' regions and poor 'peripheral' regions in the presence of increasing returns to scale. If industry can be characterised by increasing returns, and agriculture by constant returns, then a shift away from industry will lead to a low-level growth path compared to the growth in regions that are specializing more in industrial activities.[19]

In the model simulations, the production factors move towards those activities that yield the relatively highest returns, and changes in relative prices are important drivers of adjustments between scenarios. Factor prices in Africa increase after full reform, as economic activity grows. All factor prices reflect the demand for factors of production except for the unskilled wage. The nominal wage rate for unskilled labour is fixed by specification, while the real wage rate adjusts to labour demand. Rising by 4 to 8 per cent across the continent, land prices rise most, a logical fact given the deeper specialisation in land-intensive agriculture such as cereals, cotton, sugar and husbandry (see Appendix Table 8). Factor prices decrease in the regions Sub-Sahara Africa and Southern Africa under minor and moderate reform, reflecting the downscale in economic activity in these regions.

A closer look at developments in cereal trade is instructive for understanding the drive towards import substitution in program crops. Before reform, most African imports of wheat, rice and other grains are produced in the US and EU. Farm-income support to cereal farmers in these countries amounts to over 40 billion dollars, and keeps export prices low. Consequently, the US and EU supply half of North African, and 80 per cent of Sub-Sahara African cereals imports. South America and Southern Africa have far lower shares in this trade. Even minor reductions in support render cereal production far less attractive to European and American farmers, and output contracts strongly.[20] One would reason that African importers just seek replacing trade in other developing countries but the balance of trade constrains this: African producers loose much of their horticulture exports to US and EU farmers. Also, Africa cannot take over EU and US export markets for cereals under minor and modest trade reform, because preference margins for African products erode. As a result, Africa is forced to produce cereals that were previously imported, but at an inefficient scale. Only under full reform can Africa specialise far enough into agriculture to allow for positive allocation gains.

Box 1   Import substitution in program crops

Trade liberalisation and employment

As explained above, we specified the model such that the employment rate for unskilled workers adjusts endogenously. Figure 6.4 shows that under the scenarios specified trade reform has limited impact on the employment of unskilled workers. In Sub-Sahara Africa and Southern Africa minor and moderate trade reform results in decreased employment of unskilled workers. Some sectors draw additional unskilled labour into the wage economy, as real wages drop. But the contraction of labour intensive activities in such sectors as

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[19] A survey of the new economic geography is provided in Ottaviano and Puga (1998). See Francois et al. (2003) for an analysis of the regional impact of increasing returns in the setting of a global trade liberalisation.

[20] For example, after a simulated full reduction of support and border measures cereal and cotton output in the EU drop by 40 per cent, and sugar production decreases by 25 per cent.

horticulture and textiles & clothing and the like leads to a net reduction of unskilled labour employment in the partial reform scenarios. Accordingly, to substitute unskilled labour with other factors reduces production costs. North Africa shows a positive employment effect in all scenarios, as do all regions under the full liberalisation scenario. Then, the additional purchasing power generated by the positive employment impact creates a beneficial multiplier effect in African economies, thereby resulting in large welfare gains.
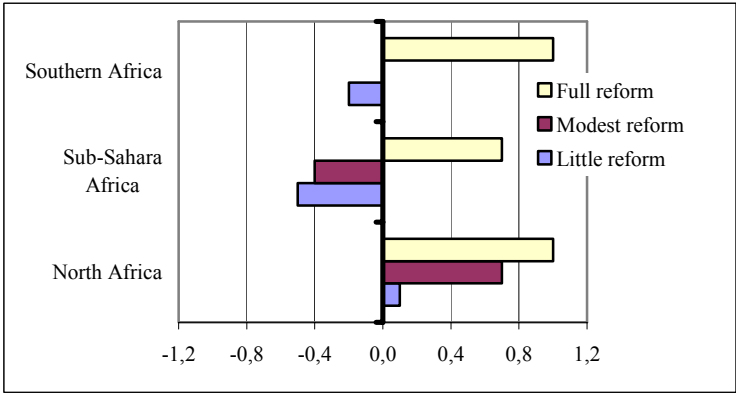
Figure 6.4   Employment effects, % change to base number employed

The above describes the structural transformation in the African regions as they appear after a simulated round of trade liberalisation. Each of the three scenarios is composed of five policy instruments. One wants, however, to bring to the negotiation table data on the impact of single policies such that priorities and trade-offs can be assessed. The following sections contribute to this debate by relating aggregate welfare effects for the African regions to policy changes in OECD countries, in Africa, and in other non-OECD countries.

6.4   Domestic support and border measures

- From the three pillars, agricultural market access and domestic support are the most important for Africa;
- NA and SA will benefit both from improved market access and reduced domestic support measures because they do not benefit from trade preferences and operate in the internationally competing markets;
- SSA does not benefit from little and modest reform due to preference erosion, increased competition and reduced employment;
- Under full reform, SSA will benefit largely from export increases under improved market access.

This section contributes to the debate on the relative importance of the three pillars in the agriculture negotiations - export competition, market access, and domestic support

measures - on African economies. The results indicate that as we move from little and modest reforms to full reform, the gains to all sub-regions increase significantly. However, the different sub-regions within Africa are affected differently by the three different forms of agricultural support provided to farmers in OECD countries. Table 6.5 decomposes the welfare effects along the two policy instruments and along the region in which the policy change takes place. Detail on the other three policies considered in this study (export competition in agriculture, non-agricultural market access (NAMA) and trade facilitation) is provided in Appendix Table 10 to Appendix Table 12.

This study finds that market access and domestic support are the most important policy issues for North and Southern Africa in the agriculture negotiations. This has to do with the fact that most countries in these regions do not benefit from trade preferences given to ACP countries. While the Sub-Saharan African region experiences losses under the little and modest reform scenarios, it gains under both market access and domestic support measures in the full scenario, although the gains are larger under the former. These results are due to the fact that Sub-Saharan African countries experience preference erosion as well as increased competition in international markets under modest and little scenario. For full liberalisation, improved market access and the resulting increase in allocative efficiency resulting from specialisation outweighs the loss due to preference erosion as well as deteriorations in the terms of trade, and so the region experiences a net gain.

The region North Africa faces some losses in all scenarios from an export subsidy reduction in OECD countries. As an importer of subsidised exports North Africa has to deal with price increases. The situation is different for Southern Africa where exports are in fact facilitated when the OECD reduces its export subsidies. Accordingly, and to no surprise, Southern Africa shows positive welfare effects.

Table 6.5   *Welfare impact of global agricultural reform on African regions: market access & domestic support (mln. USD)*

Affected region	Scenario	Agricultural market access	Domestic support
North Africa	Little	197	125
	Modest	391	280
	Full	578	595
Sub-Sahara Africa	Little	-242	-221
	Modest	-175	-117
	Full	933	328
Southern Africa	Little	-125	89
	Modest	-139	220
	Full	336	449

Source: Model simulations.

The impact of tariff reductions by OECD countries is different. Minor tariff reductions on imports into the OECD result in welfare losses for the African regions

between 63 and 371 million dollar (Appendix Table 10 to Appendix Table 12). Since the African regions have preferential access to most of the OECD countries their position erodes vis-à-vis their competitors. Stronger tariff reductions under the modest and full scenarios have a positive impact on North Africa, as is clear from the tables in the Appendix.

A reduction of domestic support in the OECD countries has two effects. First, due to a reduction of subsidies the production costs of agricultural goods rise and the outputs decrease. Second, land rents decline as a consequence of lower agricultural production. The effect is a decrease of production costs. As a result agricultural goods in OECD countries with modest protection like vegetable and other crops can improve their competitiveness. At the same time the output of strongly protected commodities (cereals, sugar and cotton) declines. Dependent on their export pattern the regions North Africa and Southern Africa take advantage of a domestic support reduction in OECD countries. For the region Sub-Sahara Africa the resulting welfare effect depends on the degree of the liberalisation. Sub-Sahara Africa suffers welfare losses in the little and modest scenarios, while the full reform scenario is beneficial.

6.5   Trade facilitation

Trade facilitation is one of the four Singapore Issues that have generated so much controversy in the current round of trade talks. It was also one of the key issues that led to the collapse of the Fifth WTO ministerial conference in Cancun, Mexico. African countries have been opposed to the launching of negotiations in this area partly because they are not sure of the economic consequences for their economies and also because they fear that it may lead to huge implementation costs. Consequently, they are of the view that there is the need for more work to be done in this area before a decision is taken on whether or not negotiations should be launched in this area. In this section, we examine the impact of trade liberalisation on the African region and also on other regions of the world. In the model trade facilitation reduces transactions costs associated with international trade in an 'iceberg' specification.

Trade facilitation accounts for 736 million (or 16 per cent) of the net African welfare gain under full reform. The impact of trade facilitation on African economies under different degrees of liberalisation is shown in Appendix Table 10 to Appendix Table 12. Three points are evident from these results. First, all African regions derive gains from trade facilitation irrespective of whether the reform is partial or complete. The critical factor here is that the reform must be carried-out by all regions. Second, North Africa derives more gain from trade facilitation than Southern and Sub-Saharan African countries. For example, in the full liberalisation scenario, North Africa gains USD 322 million while the gains for Southern Africa and Sub-Saharan Africa are USD 113 million and USD 84 million respectively. Third, unilateral trade facilitation in other developing and transition economies hurts countries in Sub-Saharan Africa. In the full liberalisation scenario, unilateral trade facilitation in non-African developing and transition economies results in an income loss in Sub-Saharan Africa of USD 10 million. This may be due to the fact that countries in the sub-region compete with other developing countries and so when they

unilaterally engage in trade facilitation their transactions costs fall thereby increasing their degree of competitiveness relative to the Sub-Saharan African region.

These positive results on trade facilitation should however be interpreted with caution because the study does not incorporate the implementation costs of trade facilitation for African countries. To the extent that these costs are large, they may outweigh the gains derived in this study.

6.6 Non-Agricultural Market Access

The negotiations in the field of non-agricultural market access (NAMA) are presented as a conflict between OECD and non-OECD countries. This can partly be understood from the composition and level of tariffs on manufactures. There are at least two relevant observations from the analysis of market access for imports from Africa into other regions of the world in Chapter 3. First, in general, non-OECD countries apply more border protection to manufactures than OECD countries. Second, tariff schedules in non-OECD countries reveal more binding overhang.

Non-agricultural market access (NAMA) raises a number of issues for Africa. First, is the potential loss of government tariff revenue that may result from liberalisation and the likely impact on Africa. In several countries in the region, import duties represent a substantial part of government revenue. The second point is that Africa is currently a net importer of industrial goods (both light and heavy) and may, in fact, move even further away from industrial activity if there is trade reform.

The simulation results provide some indicative results on the net welfare effects. Despite some bleak expectations, Africa reaps a modest national income gain of USD 224 million from a full liberalisation of border measures for manufactures (all else equal), as can be seen in the diagram below. Under partial reforms, however, the losses in tariff revenue outweigh gains from improved export performance and reduced import prices. There are losses to be incurred both under reform of Little and Modest scope. Underlying the small difference in net effect are possible large deviations in - when moving from little to modest reform - tariff revenue loss and export gains. The results for the three sub-regions are broadly consistent with Figure 6.5, except that Sub-Sahara Africa also incurs a net loss under full reform.
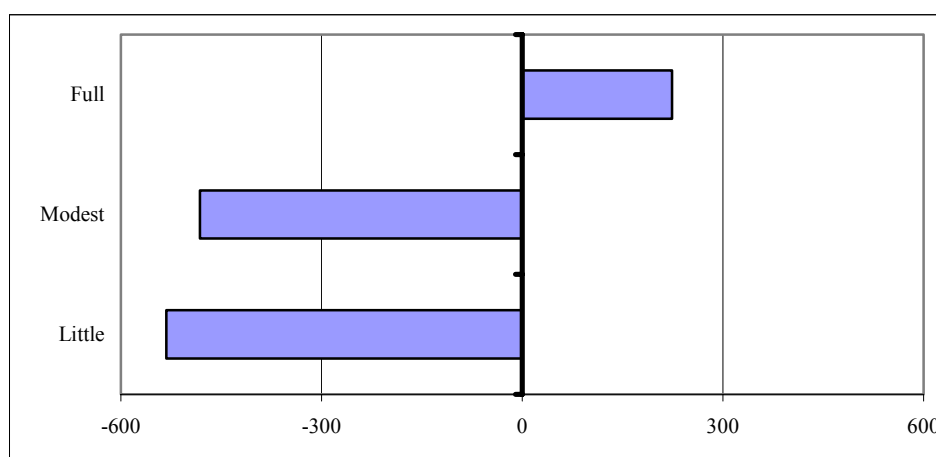
Figure 6.5   Welfare impact on Africa from NAMA reform (mln USD)

6.7 Dynamic Effects

The analysis so far concentrates on the static (or direct) welfare gains from liberalisation. These gains result from an improved allocation of resources. No fresh resources are injected into the global economy, except for un(der)utilised labour in African countries. The estimated effects on employment are, however, very limited, as labour intensive activities in African economies do not expand very much in the simulations. Alternatively, one could consider whether trade liberalisation induces shifts in the regional pattern of savings and investment.

Relating to classical models of capital accumulation and growth, rather than to endogenous growth mechanisms, capital shifts have been explored extensively in the trade literature.[21] The scope of these 'accumulation effects' depends on a number of factors, including the marginal product of capital, country risk and underlying savings behaviour. In this section, we work with a classical savings-investment mechanism (discussed in Francois et al., 1997). This means we model long-run linkages between changes in income, savings, and investment. The results reported here therefore include changes in the capital stock, and the medium- to long-run implications of such changes.

For the dynamic analysis, the model specification is changed to allow for the endogenous adjustment of each region's capital stock (in the static closure the amount of capital is fixed in each region). This is achieved by a so-called 'Baldwin closure', which mimics classical savings behaviour: the savings rate is fixed and the economy moves from one (pre-reform) steady state to a new (post-reform) steady state. The global bank disburses global savings in such a way as to maintain the regional composition of its investment portfolio, and hence regional differences in return to capital persist.[22]

Welfare results of the model with capital accumulation are presented in Table 6.6 (the left panel of which reproduces the results from the static model). The key differences

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[21] Research in this area includes Baldwin and Francois (1999), Smith (1976, 1977), and Srinivasan and Bhagwati (1980).
[22] See Francois et al. (1996) for an implementation in the GTAP framework.

between the results from the static model and those from the dynamic model are as follows. First, the introduction of capital accumulation increases the welfare gains to most regions in each of the liberalisation scenarios. For example, the global welfare gain under full liberalisation jumps from 0.3 per cent to 0.7 per cent of global GDP, or from USD 84 billion to USD 201 billion (see Appendix Table 13) for 1997 dollar terms). Second, there is a tremendous increase in the welfare gains to Sub-Saharan Africa. In the full liberalisation scenario, welfare increases from USD 704 million to USD 4.3 billion, that is six times as large as in the static model. In fact, Sub-Sahara Africa, shortly followed by the region other Asia, experiences the biggest growth in the capital stock. Under full reform, the capital stock grows by about 5 per cent in these regions, against a world average growth of just over 1 per cent. Moreover, unlike in the static model, Sub-Saharan Africa derives welfare gains in the moderate liberalisation scenario. Finally, when expressed as a percentage of base GDP, the gains to Sub-Saharan Africa in the full liberalisation scenario are far greater than those accruing to the world. For Sub-Saharan Africa it is 2.1 per cent of base GDP while for the world it is 0.7 per cent.

The simulations with capital accumulation clearly highlight the importance of complementing trade liberalisation with investment enhancing policies. Without additional investments in the domestic economy the opportunities of trade liberalisation remain largely untapped in Africa. A successful conclusion of the DDA can contribute to this. As the simulation results confirm, investments are instrumental in achieving output growth, enhanced labour productivity, and rising wages.

Table 6.6   *National income gains as a percentage of base GDP*

	Static Model				Dynamic Model		
	Little	Modest	Full		Little	Modest	Full
North Africa	0.0	0.3	0.9		0.1	0.4	0.9
Sub-Sahara Africa	-0.3	-0.2	0.3		-0.2	0.2	2.1
Southern Africa	-0.1	0.1	0.9		-0.1	0.0	1.3
EU-15	0.1	0.2	0.2		0.2	0.3	0.5
US/Canada	0.0	0.0	0.0		0.0	0.1	0.1
South America	0.1	0.2	0.4		0.3	0.7	1.5
Australia/New Zealand	0.2	0.3	1.0		0.3	0.7	2.2
High-income Asia	0.1	0.2	0.5		0.1	0.3	0.6
China	0.2	0.3	0.7		0.3	0.5	1.0
Other Asia	0.1	0.3	0.5		0.4	1.2	2.2
Transition countries	0.0	0.1	0.0		0.0	0.2	0.1
Rest of world	0.1	0.2	0.8		0.3	0.7	1.7
Total	0.1	0.1	0.3		0.1	0.3	0.7

* Based on Equivalent Variation.

7. Conclusion

This study provides a quantitative estimate of the potential economic consequences of multilateral trade reform for Africa using the GTAP model. It focuses on impacts at the sub-regional level because most African countries are not in the GTAP database. Consequently, there have been no attempts to transfer general conclusions to the country level because of the wide variety of economic conditions in African countries.

Three types of reform scenarios are considered: 'little', 'modest,' and 'full' liberalisation scenarios. Our model results indicate that benefits increase with the depth of reforms. North Africa benefits from all liberalisation efforts, be they comprehensive or partial. Sub-Saharan Africa and, to a lesser extent, Southern Africa incurs welfare losses when a partial liberalisation is carried out, reflecting largely the combined impact of preference erosion and binding overhang.

Furthermore, whilst the African region would benefit from a comprehensive trade liberalisation, any measure of reform will likely imply heavy risks on certain economies and specific sectors. Under full reform the reduction of agricultural support allows far reaching specialisation in cereals, cotton and sugar. In order to accommodate the change African producers partly abandon commodity crops and horticulture. The African export position in these products on European markets worsens as preference erosion opens opportunities for competitors from South America and Asia. Labour resources are drawn into agriculture, which creates some new employment opportunities, and takes away some in the contracting manufacturing sectors. This adjustment drives the large 'kink' that occurs between the results of minor/modest reform and of full reform of all trade-distorting border and support measures. Whether the allocation of more resources in agriculture, and the move away from manufactures is progress or regress in terms of development of the African region, is a matter of debate.

The model simulations presented here assume that the estimated preference margins effectively reduce the tariffs that African exporters are facing. Consequently the value of these preferences is eroded if market access is improved multilaterally and globally. This may not be realistic in the face low rates of preference utilisation. If African exporters are currently not making use of preference margins, then the actual erosion and concurring losses will be limited. Stated otherwise, the lower the actual use of preference, the more Africa will gain from early harvest trade reforms.

Regarding NAMA, the results indicate that the African region is also vulnerable to partial reforms due largely to the potential loss of tariff revenue. Several countries in the region rely on trade taxes and so partial liberalisation that does not yield significant market access to the region's exports is likely to result in welfare losses for the region.

On trade facilitation, the results suggest that Africa would derive positive benefits from this area of negotiations. This, however, should be interpreted with caution because the study does not incorporate the costs of implementation of trade facilitation in the African region. An interesting result on trade facilitation is that countries in the African

region would incur losses if they do not reciprocate any actions made by other developing countries to facilitate trade.

The introduction of dynamic effects in the model, through capital accumulation, increases the welfare benefits from trade reform in all regions of the world. For example, the gains to Sub-Sahara Africa in the dynamic model are six times larger than in the static model. Sub-Saharan Africa attracts large amounts of funds from global capital markets, which results in a jump in welfare gains to the sub-region. This points to the need for domestic policies in Africa aimed at stability and investor confidence that complement trade reform.

What are the implications of our findings for the Doha round of trade negotiations? First, the study stresses the need for reforms to be as comprehensive as possible. Second, it underscores the vulnerability of African countries to partial trade reforms. Clearly, nobody expects a full liberalisation of trade under the Doha round and so it is not a feasible option. That leaves us with some consensus scenario of partial reform. All but the African partners to the negotiations have an incentive to support partial reforms since they will derive positive benefits. Consequently, to ensure that partial reforms do not have serious adverse effects on the African region, WTO members need to find appropriate mechanisms to make special and differential treatment a more effective instrument for development in Africa and other least developed countries.

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Appendix A Adjusting Tariffs for Preferences and Binding Overhang

The GTAP database comprises bound tariff rates. However, in most countries bound rates are different from applied rates and this has implications for trade reforms. There are two reasons. First, some countries apply lower tariffs in order to provide cheaper imports to domestic consumers. Nevertheless, the negotiation of the WTO refers to the bound rates. While the EU and NAM apply their bound rates, developing countries show impressive difference between bound and applied rates. A tariff reduction on bound rates means that the EU and NAM reduce their applied tariffs more than other regions.

Second, the QUAD countries[23] allow developing countries a preferential access, meaning they apply tariffs even lower than the applied rate. In order to introduce the real tariff cuts we have to take account of the differences between bound and applied rates on the one hand and bound rate and preferential access on the other (Figure A1.1). If tariffs are completely eliminated and there is no difference between bound and applied rates we use shock A.[24] In the case of the applied rate in Figure A1.1 shock B is suitable. Accordingly, we have to alter the shock A with the correction B.[25] Otherwise we would overestimate the tariff cut and simulation results would not be reliable.
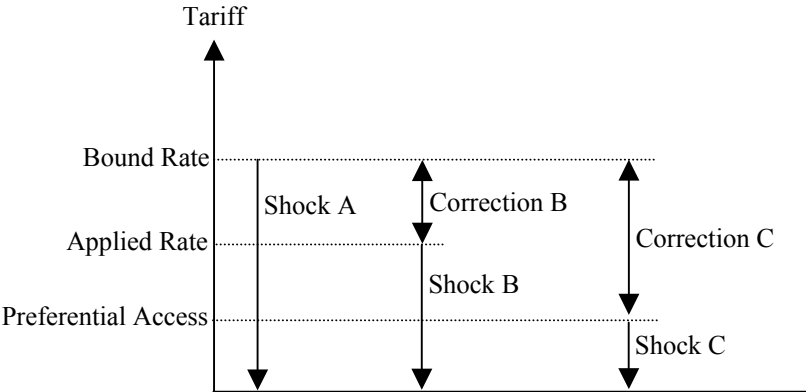
Figure A.1.1 Bound and Applied Tariff Rate as well as Preferential Access

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[23] The QUAD countries comprise the EU, Canada the USA as well as Japan. Furthermore, we assume that CEEC is applying the same preferences as the EU15. In the data preparation step C (Figure 1) we adjust the border protection of the CEEC towards the level of the EU15.

[24] In general equilibrium modeling 'shock' means exogenous change.

[25] Assuming a small reduction of the bound rate, say −10%, and an applied rate of 80% the new bound rate would still be higher than the actual applied rate. In this case no shock is used because nothing is changing.

The difference between applied and bound tariff rates is also known as 'water in the tariff'. We use information from Francois and Martin (2002) as well as Walkenhorst and Dihel (2003) to calculate the correction B. For the correction C we require information about the treatment of African exports in the QUAD countries, which are in our aggregation included in the regions EU15, CEEC, NAM and HiASIA. Hoekman et al. (2001) provide preferential rates of the QUAD countries. We aggregate them for the sectors presented in section 5.2.

There are three different levels of preferences. All African countries are allowed to export under the Generalised System of Preferences (GSP). The African, Caribbean and Pacific Countries (ACP) get a more favourable access to the European Union than the GSP. Compared with the APC the Least Developed Countries (LDC) can export under even more facilitated conditions.[26] Table A1.2 provides an overview of the preferential scheme that applies to each African country.

Table A1.1   Preferences of African Exporters into QUAD Countries

	EU15	NAM	HiASIA
nAfrica	GSP	GSP	GSP
SSA	ACP-LDC	GSP-LDC	GSP-LDC
sAfrica	ACP	GSP	GSP

Table A1.1 includes the preferences for the regions of our aggregation. All exports of North Africa (nAfrica) to the QUAD countries are treated according to the GSP. The region Sub-Saharan Africa (SSA) includes least developed countries as well as countries with a less beneficial export conditions. We assume an average between the LDC and ACP or rather GSP preferences. The region South Africa (sAfrica) has an ACP accession to the EU while the other QUAD countries are applying the GSP for its exports.

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[26] A detailed discussion of preferences is provided in Achterbosch et al. (2003).

Table A1.2   Preferences of African Countries

Aggregation	Country	GSP	ACP	LDC
North Africa	Algeria	X		
	Egypt	X		
	Libyan Arab Jamahiriya	X		
	Morocco	X		
	Tunisia	X		
SSA	Angola	X	X	X
	Benin	X	X	X
	Botswana	X	X	
	Burkina Faso	X	X	X
	Burundi	X	X	X
	Cameroon	X	X	
	Cape Verde	X	X	X
	Central African Republic	X	X	X
	Chad	X	X	X
	Comoros	X	X	X
	Congo/ Zaire	X	X	
	Democratic Republic of Congo	X	X	X
	Côte d'Ivoire	X	X	
	Djibouti	X	X	X
	Equatorial Guinea	X	X	X
	Eritrea	X	X	X
	Ethiopia	X	X	X
	Gabon	X	X	
	Gambia	X	X	X
	Ghana	X	X	
	Guinea	X	X	X
	Guinea-Bissau	X	X	X
	Kenya	X	X	
	Liberia	X	X	X
	Madagascar	X	X	X
	Malawi	X	X	X
	Mali	X	X	X
	Mauritania	X	X	X
	Mauritius	X	X	
	Mayotte	X	X	
	Mozambique	X	X	X
	Niger	X	X	X
	Nigeria	X	X	
	Rwanda	X	X	LDC
	São Tomé and Príncipe	X	X	X
	Senegal	X	X	X
	Seychelles	X	X	
	Sierra Leone	X	X	X
	Somalia	X	X	X
	Sudan	X	X	X
	Tanzania	X	X	X
	Togo	X	X	X
	Uganda	X	X	X
	Zambia	X	X	X
	Zimbabwe	X	X	
South Africa	Lesotho	X	X	X
	Namibia	X	X	
	South Africa	X	X	
	Swaziland	X	X	

Appendix B   Aggregation of GTAP Database

Table B1.1   Aggregation of 12 Regions

Abrev.	GTAP-Region		Abrev.	GTAP-Region	
nAfrica	Morocco	MAR	AUSNZ	Australia	AUS
	Rest of North Africa	XNF		New Zealand	NZL
SSA	Botswana	BWA	HiASIA	Japan	JPN
	Malawi	MWI		Korea	KOR
	Mozambique	MOZ		Taiwan	TWN
	Tanzania	TZA		Singapore	SGP
	Zambia	ZMB	China	China	CHN
	Zimbabwe	ZWE		Hong Kong	HKG
	Other Southern Africa	XSF	oASIA	Indonesia	IDN
	Uganda	UGA		Malaysia	MYS
	Rest of Sub-Saharan Africa	XSS		Philippines	PHL
sAfrica	Rest of South Afr. Custom Union	XSC		Thailand	THA
EU15	Austria	AUT		Vietnam	VNM
	Belgium	BEL		Bangladesh	BGD
	Denmark	DNK		India	IND
	Finland	FIN		Sri Lanka	LKA
	France	FRA		Rest of South Asia	XSA
	Germany	DEU		Rest of South Asia	XSA
	United Kingdom	GBR	CEEC	Czech Republic	CZE
	Greece	GRC		Hungary	HUN
	Ireland	IRL		Malta	MLT
	Italy	ITA		Poland	POL
	Luxembourg	LUX		Slovakia	SVK
	Netherlands	NLD		Slovenia	SVN
	Portugal	PRT		Estonia	EST
	Spain	ESP		Latvia	LVA
	Sweden	SWE		Lithuania	LTU
NAM	Canada	CAN		Cyprus	CYP
	United States	USA	ROW	Switzerland	CHE
SAM	Mexico	MEX		Rest of EFTA	XEF
	Central America, Caribbean	XCM		Albania	ALB
	Colombia	COL		Bulgaria	BGR
	Peru	PER		Croatia	HRV
	Venezuela	VEN		Romania	ROM
	Rest of Andean Pact	XAP		Russian Federation	RUS
	Argentina	ARG		Rest of Former Soviet Union	XSU
	Brazil	BRA		Turkey	TUR
	Chile	CHL		Rest of Middle East	XME
	Uruguay	URY		Rest of World	XRW
	Rest of South America	XSM			

Table B1.2   Aggregation of 13 Sectors

Abrev.	GTAP-Sector	
Cereals	Paddy rice	PDR
	Processed rice	PCR
	Wheat	WHT
	Cereal grains nec	GRO
Vegetable	Vegetables, fruit, nuts	V_F
Oilseeds	Oil Seeds	OSD
	Vegetable oils and fats	VOL
Sugar	Sugar cane, sugar beet	C_B
	Sugar processing	SGR
Cotton	Plant-based fibers	PFB
oCrops	Crops nec	OCR
Animal	Cattle,sheep,goats,horses	CTL
	Animal products nec	OAP
	Wool, silk-worm cocoons	WOL
	Raw milk	RMK
proFOOD	Meat of cattle,and sheep	CMT
	Meat products nec	OMT
	Dairy products	MIL
	Food products nec	OFD
	Beverages and tobacco	B_T
Extract	Forestry	FOR
	Fishing	FSH
	Coal	COL
	Oil	OIL
	Gas	GAS
	Minerals nec	OMN
Light	Textiles	TEX
	Wearing apparel	WAP
	Leather products	LEA
	Wood products	LUM
	Paper products, publishing	PPP
Industry	Petroleum, coal products	P_C
	Chemical,rubber,plastic prods	CRP
	Mineral products nec	NMM
	Ferrous metals	I_S
	Metals nec	NFM
	Metal products	FMP
	Motor vehicles and parts	MVH
	Transport equipment nec	OTN
	Electronic equipment	ELE
	Machinery and equipment	OME
	Manufactures nec	OMF
Trade	Trade	TRD
	Transport nec	OTP
	Sea transport	WTP
	Air transport	ATP
Services	Electricity	ELY
	Gas manufacture, distribution	GDT
	Water	WTR
	Construction	CNS
	Communication	CMN
	Financial services nec	OFI
	Insurance	ISR
	Business services nec	OBS
	Recreation and other services	ROS
	PubAdmin/Defence/Health/Educat	OSG
	Dwellings	DWE

Appendix C An Overview of the Computational Model

1.   Introduction

This Appendix provides an overview of the basic structure of the global CGE model employed for our assessment of Doha Round-based multilateral trade liberalisation. The model is implemented in GEMPACK - a software package designed for solving large applied general equilibrium models. The model is solved as an explicit non-linear system of equations, through techniques described by Harrison and Pearson (1994). More information can be obtained at the following URL – www.monash.edu.au/policy/gempack.htm. The reader is referred to Hertel (1996: www.agecon.purdue.edu/gtap/model/Chap2.pdf) for a detailed discussion of the basic algebraic model structure represented by the GEMPACK code. While this Appendix provides a broad overview of the model, detailed discussion of mathematical structure is limited to added features, beyond the standard GTAP structure.

The model is a standard multi-region computable general equilibrium (CGE) model. See Van Tongeren et al. (2001) for a review and assessment of the features of applied agricultural trade models. Social accounting data are based on Version 5 of the GTAP dataset (McDougall, 2001), with an update to reflect post-Uruguay Round protection, Agenda 2000, China's accession to the WTO, and EU enlargement, as discussed in the body of the report.

2.   General structure

The general conceptual structure of a regional economy in the model is represented in Figure C1.1. Within each region, firms produce output, employing land, labour, capital, and natural resources and combining these with intermediate inputs. Firm output is purchased by consumers, government, the investment sector, and by other firms. Firm output can also be sold for export. Land is only employed in the agricultural sectors, while capital and labour (both skilled and unskilled) are mobile between all production sectors. Capital is fully mobile within regions.

All demand sources combine imports with domestic goods to produce a composite good, as indicated in the figure. In constant returns sectors, these are Armington composites. In increasing returns sectors, these are composites of firm-differentiated goods. Relevant substitution and trade elasticities are presented in Table C1.1.

3.   Taxes and policy variables

Taxes are included in the theory of the model at several levels. Production taxes are placed on intermediate or primary inputs, or on output. Some trade taxes are modelled at the border. Additional internal taxes can be placed on domestic or imported intermediate inputs, and may be applied at differential rates that discriminate against imports. Where relevant, taxes are also placed on exports, and on primary factor income. Finally, where relevant (as indicated by social accounting data) taxes are placed on final consumption, and can be applied differentially to consumption of domestic and imported goods.

Trade policy instruments are represented as import or export taxes/subsidies. This includes applied most-favoured nation (mfn) tariffs, antidumping duties, countervailing duties, price undertakings, export quotas, and other trade restrictions. One exception are service-sector trading costs, which are not covered by the database. Tariff rates for China's accession to the WTO are taken from Francois and Spinanger (2001) and Van Tongeren and Huang (2004).

4.   Trade and transportation costs

International trade is modelled as a process that explicitly involves trading costs, which include both trade and transportation services. These trading costs reflect the transaction costs involved in international trade, as well as the physical activity of transportation itself. Those trading costs related to international movement of goods and related logistic services are met by composite services purchased from a global trade services sector, where the composite 'international trade services' activity is produced as a Cobb-Douglas composite of regional exports of trade and transport service exports. Trade-cost margins are based on reconciled f.o.b. and c.i.f. trade data, as reported in version 5.3 of the GTAP dataset.

5.   The composite household and final demand structure

Final demand is determined by an upper-tier Cobb-Douglas preference function, which allocates income in fixed shares to current consumption, investment, and government services. This yields a fixed savings rate. Government services are produced by a Leontief technology, with household/government transfers being endogenous. The lower-tier nest for current consumption is also specified as a Cobb-Douglas. The regional capital markets adjust so that changes in savings match changes in regional investment expenditures. (Note that the Cobb-Douglas demand function is a special case of the CDE demand function employed in the standard GTAP model code. It is implemented through GEMPACK parameter files.)

6. Trade

The basic structure of demand in constant returns sectors is Armington preferences. In Armington sectors, goods are differentiated by country of origin, and the similarity of goods from different regions is measured by the elasticity of substitution. Formally, within a particular region, we assume that demand goods from different regions are aggregated into a composite import according to the following CES function:

$$(1) \qquad q_{j,r}^M = \left[\sum_{i=1}^R \alpha_{j,i,r} M_{j,i,r}^{\rho_j} \right]^{1/\rho_j}$$

In equation (5), $M_{j,i,r}$ is the quantity of M_j from region i consumed in region r. The elasticity of substitution between varieties from different regions is then equal to σ_j^M, where $\sigma_j^M = 1/(1-\rho_j)$. Composite imports are combined with the domestic good q^D in a second CES nest, yielding the Armington composite q.

$$(2) \qquad q_{j,r} = \left[\Omega_{j,M,r} \left(q_{j,r}^M \right)^{\beta_j} + \Omega_{j,D,r} \left(q_{j,r}^D \right)^{\beta_j} \right]^{1/\beta_j}$$

The elasticity of substitution between the domestic good and composite imports is then equal to σ_j^D, where $\sigma_j^D = 1/(1-\beta_j)$. At the same time, from the first order conditions, the demand for import $M_{j,i,r}$ can then be shown to equal

$$(3) \qquad
\begin{aligned}
M_{j,i,r} &= \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}} \right]^{\sigma_i^{\backslash m}} \left[\sum_{i=1}^R \alpha_{j,i,r}^{\sigma_j^M} P_{j,i,r}^{1-\sigma_j^M} \right]^{-1} E_{j,r}^M \\
&= \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}} \right]^{\sigma_j^M} \left(P_{j,r}^M \right)^{\sigma_j^M - 1} E_{j,r}^M
\end{aligned}$$

where $E_{j,r}^M$ represents expenditures on imports in region r on the sector j Armington composite.

7. Capital accumulation

Dynamic effects through capital accumulation are modelled as a classical savings-investment mechanism (discussed in Francois et al., 1997). This means we model long-run linkages between changes in income, savings, and investment. For the dynamic analysis, the model specification is changed to allow for the endogenous adjustment of each region's capital stock (in the static closure the amount of capital is fixed in each region). This is achieved by a so-called 'Baldwin closure', which mimics classical savings behaviour: the savings rate is fixed and the economy moves from one (pre-reform) steady state to a new (post-reform) steady state. The global bank disburses global savings in such a way as to maintain the regional composition of its investment portfolio, and hence regional

differences in return to capital persist. The capital accumulation mechanisms are described in Francois et al. (1996b: http://www.agecon.purdue.edu/gtap/techpapr/tp-7.htm).

Technically, we fix each region's trade balance (pre-reform steady state), in order to fix the regional savings-investment balance. Each region's investment demand is matched by savings from domestic sources and foreign sources. Investment demand is translated into capital expansion, which shifts the regional production possibility frontier outward.
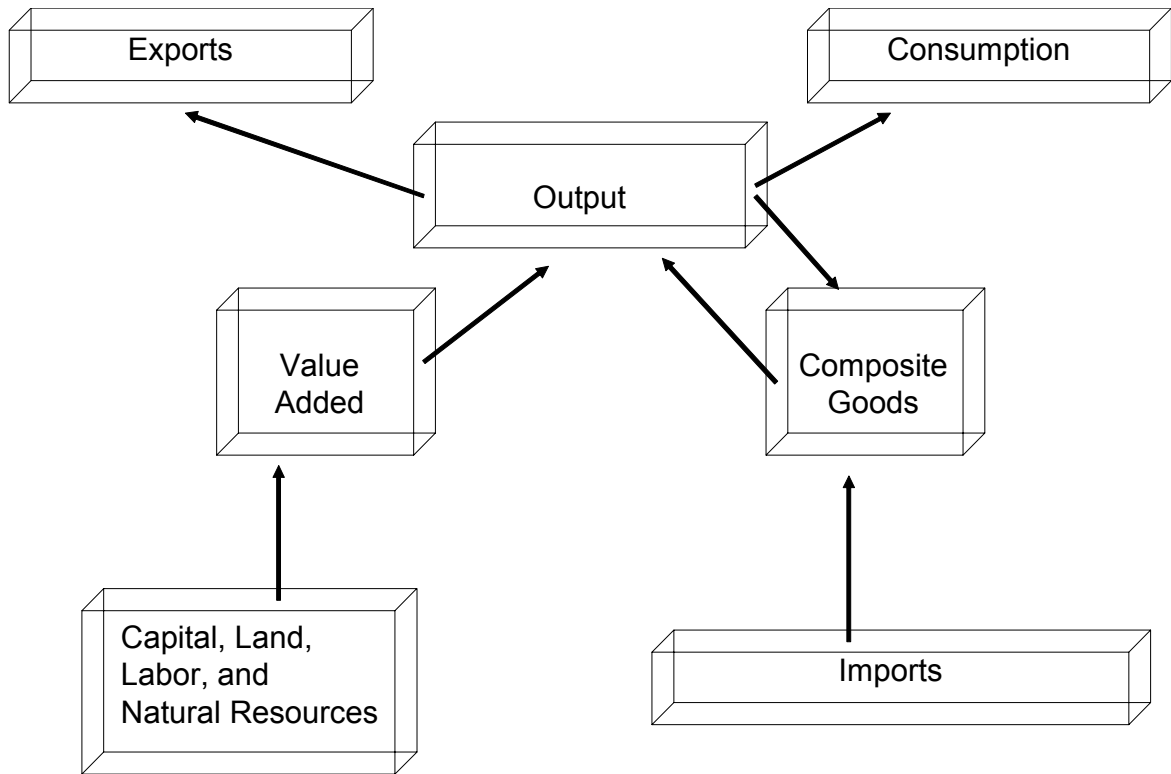
Figure C1.1   The Flow of Production

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Table C1.1   Substitution elasticities in the model

	Armington elasticity, domestic/imported	Armington elasticity, allocation of imports	CES elasticity of substitution primary factors
Cereals	2.2	4.4	0.3
Vegetable	2.2	4.4	0.2
Oilseeds	2.2	4.4	0.6
Sugar	2.2	4.4	0.6
Cotton	2.2	4.4	0.2
oCrops	2.2	4.4	0.2
Animal	2.6	5.5	0.2
proFOOD	2.4	4.8	1.1
Extract	2.8	5.6	0.2
Light	2.7	6	1.3
Industry	2.9	6	1.3
Trade	1.9	3.8	1.7
Services	1.9	3.9	1.3

Table C1.2 Income elasticity private household demand

	nAFRICA	SSA	sAFRICA	EU15	NAM	SAM	AUSNZ	HiASIA	China	oASIA	CEEC	ROW
Cereals	0.2	0.5	0.4	0.2	0.2	0.2	0.1	0.1	0.4	0.3	0.1	0.2
Vegetable	0.7	0.6	0.6	0.3	0.3	0.5	0.2	0.4	0.9	0.7	0.5	0.6
Oilseeds	0.7	0.6	0.6	0.3	0.2	0.5	0.2	0.4	0.8	0.7	0.5	0.6
Sugar	0.7	0.6	0.6	0.3	0.3	0.5	0.3	0.3	0.8	0.7	0.5	0.6
Cotton	0.7	0.6	0.6	0.3	0.3	0.5	0.3	0.3	0.8	0.7	0.5	0.6
oCrops	0.7	0.6	0.6	0.3	0.3	0.6	0.1	0.3	0.5	0.7	0.5	0.5
Animal	0.7	0.6	0.6	0.3	0.3	0.4	0.2	0.5	1.1	0.6	0.4	0.4
proFOOD	0.7	0.6	0.6	0.4	0.4	0.6	0.5	0.5	0.9	0.7	0.6	0.6
Extract	0.9	1	1	0.6	1.1	0.9	0.3	0.6	0.9	1	1	0.9
Light	1.1	0.9	1	1	1	1	1	0.9	0.9	0.9	1	1
Industry	1.4	1.3	1.1	1.1	1	1.2	1.1	1.1	1.1	1.3	1.1	1.1
Trade	1.4	1.4	1.1	1.1	1	1.2	1.1	1.1	1.2	1.4	1.2	1.2
Services	1.3	1.4	1.1	1.1	1	1.2	1.1	1.1	1.1	1.3	1.2	1.2

Calculated from the CDE expenditure system.

Appendix D Results Tables

Appendix Table 1   *National income gains under trade reform a)*

	Million 1997 USD			Per cent of GDP		
	Little	Modest	Full	Little	Modest	Full
nAfrica	67	625	1,775	0.0	0.3	0.9
SSA	-540	-502	704	-0.3	-0.2	0.3
sAfrica	-132	93	1,233	-0.1	0.1	0.9
EU15	7,996	12,226	15,860	0.1	0.2	0.2
NAM	1,000	543	253	0.0	0.0	0.0
SAM	1,855	3,559	8,181	0.1	0.2	0.4
AUSNZ	687	1,279	4,629	0.2	0.3	1.0
HiASIA	4,470	11,115	23,965	0.1	0.2	0.5
China	1,648	3,285	6,533	0.2	0.3	0.7
oASIA	1,649	3,311	5,893	0.1	0.3	0.5
CEEC	113	139	-33	0.0	0.1	0.0
ROW	2,274	3,999	15,173	0.1	0.2	0.8
Total	21,087	39,672	84,164	0.1	0.1	0.3

a) Based on the measure of equivalent variation.
Source: model simulations.

Appendix Table 2   *The terms of trade, % change after reform*

	Reform scenario		
	Little	Modest	Full
North Africa	-0.3	-0.9	-2.2
Sub-Sahara Africa	-0.3	-0.7	-1
Southern Africa	-0.1	-0.2	-0.1
EU-15	-0.1	-0.2	-0.3
US/Canada	-0.1	-0.3	-0.4
South America	0.2	0.1	0.3
Australia/New Zealand	0.7	1.2	5
High-income Asia	0.1	0.5	0.9
China	0.2	0.3	0.4
Other Asia	0.2	0.1	-0.1
Transition countries	-0.1	-0.2	-0.5
Rest of world	0.2	0.2	0

Source: model simulations.

Appendix Table 3   *Output, Exports and Imports (mln USD 1997)*

	Output[S1]			Export[S2]			Import[S3]		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	14,859	30,056	1,537	147	161	239	3,432	1,283	291
Vegetable	10,003	10,061	1,703	663	840	736	397	200	56
Oilseeds	1,935	4,605	1,083	347	435	81	1,650	579	386
Sugar	6,508	4,766	993	54	613	308	853	644	42
Cotton	1,767	2,767	52	59	1,515	31	164	46	38
Other Crops	527	14,214	1,040	87	5,832	166	548	207	127
Animal	23,870	10,633	5,234	166	160	218	207	69	93
proFood	21,525	23,959	17,316	1,074	2,348	1,105	2,556	2,939	885
Extract	36,365	43,998	15,363	18,168	26,582	4,057	1,771	1,636	1,689
Light	46,837	19,143	16,045	6,885	2,958	2,703	7,818	4,918	2,828
Industry	75,132	36,269	63,089	9,393	7,933	19,716	28,927	31,339	20,855
Trade	57,053	75,607	51,135	5,425	4,064	3,052	2,929	13,715	2,673
Other Services	140,233	101,630	100,000	8,025	4,256	2,192	6,712	7,379	2,242
Total	436,615	377,708	274,590	50,492	57697	34604	57963	64,956	32,204

Source: GTAP database version 5.3 (Dimaranan and McDougall, 2002).

Appendix Table 4   *African Export Volume, % change to the baseline*

	Little			Modest			Full		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	28.7	18.5	7.1	59.6	39.6	15.3	157.7	110.4	53.0
Vegetable	-1.7	-8.0	-8.8	-1.6	-11.7	-13.3	19.9	-2.7	-7.4
Oilseeds	11.8	6.7	-1.2	18.3	15.3	-2.5	48.9	52.9	16.5
Sugar	29.7	7.1	6.7	46.5	24.4	15.5	170.9	113.3	73.8
Cotton	5.8	6.4	5.7	17.3	18.2	13.7	55.5	44.8	32.1
Other Crops	-4.1	-4.9	-3.3	-6.8	-6.9	-5.4	2.1	-5.2	-8.1
Animal	13.6	6.5	4.2	33.2	21.9	17.8	114.6	76.3	44.4
proFood	5.9	-4.2	-1.9	17.0	-2.1	-1.0	80.8	32.8	45.7
Extract	0.6	0.7	0.8	1.9	1.7	1.7	4.2	3.1	2.9
Light	-0.2	1.5	1.4	7.5	6.0	5.9	27.6	13.3	14.5
Industry	0.5	1.6	0.7	5.3	7.2	3.0	21.5	18.1	7.5
Trade	0.6	1.4	0.8	1.0	3.5	1.5	3.2	6.6	2.1
Other Services	0.4	1.4	0.7	0.8	2.7	0.8	3.4	3.4	-0.4

Appendix Table 5   *Imports into Africa, % change to the baseline*

	Little			Modest			Full		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	-5.7	-6.2	-4.3	-11.7	-12.3	-8.6	-16.3	-9.2	-3.3
Vegetable	3.3	2.5	0.0	5.4	4.0	0.4	37.2	25.8	25.4
Oilseeds	-0.1	0.4	-0.5	-0.3	0.2	-0.7	9.3	20.5	16.7
Sugar	-2.6	-3.8	0.5	-6.4	-9.5	1.3	8.1	-2.0	60.9
Cotton	-2.8	-0.4	-0.2	-8.7	-4.0	0.5	-14.9	-5.2	7.4
Other Crops	0.4	1.1	1.5	1.0	1.5	3.0	9.8	24.4	14.6
Animal	-1.0	-0.3	-0.2	-5.6	-4.1	-2.1	13.1	1.2	-2.0
proFood	-1.5	-1.4	-0.8	-5.5	-5.0	-2.9	27.3	11.6	41.3
Extract	-0.2	-0.1	-0.2	0.0	0.2	-0.2	1.2	2.3	0.3
Light	2.3	1.9	1.8	12.7	12.1	10.7	32.9	33.7	30.3
Industry	1.8	0.8	0.8	9.2	5.8	5.4	22.6	15.9	14.9
Trade	-0.2	-0.9	-0.4	0.0	-1.4	-0.4	-0.5	-1.4	0.5
Other Services	0.0	-0.4	-0.3	0.8	1.1	-0.1	1.1	5.0	1.4

Appendix Table 6   *Prices of Imported Goods (CIF-Price, % change)*

	Little			Modest			Full		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	4.2	3.3	3.2	9.4	7.2	7.1	17.6	12.3	13.5
Vegetable	-1.0	-1.2	-0.2	-1.4	-1.8	-0.1	-2.3	-2.2	0.1
Oilseeds	0.2	-0.2	0.3	0.7	-0.1	0.6	0.9	-2.4	0.9
Sugar	2.0	2.1	0.0	4.9	5.3	0.0	8.9	9.7	0.0
Cotton	2.2	0.1	-0.1	6.5	0.5	0.0	13.9	1.3	0.3
Other Crops	-0.6	-0.8	-0.8	-0.9	-1.2	-1.2	-1.3	-1.6	-1.6
Animal	1.0	0.3	0.4	3.5	2.1	1.6	8.9	5.0	4.4
proFood	1.3	0.8	0.7	3.7	2.6	2.0	7.1	5.0	4.2
Extract	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	-0.3
Light	-0.1	0.0	0.0	-0.4	-0.2	-0.2	-1.1	-0.8	-0.7
Industry	-0.1	-0.1	-0.1	-0.3	-0.3	-0.3	-0.9	-0.8	-0.8
Trade	0.0	0.3	0.1	0.0	0.6	0.0	-0.2	1.1	-0.1
Other Services	0.0	0.0	0.0	-0.2	-0.1	-0.1	-0.5	-0.4	-0.5

Appendix Table 7   Output (% change in value-terms)

	Little			Modest			Full		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Cereals	1.7	0.3	2.0	4.0	0.8	4.8	4.3	1.4	9.3
Vegetable	-0.3	-0.9	-3.8	-0.3	-1.3	-5.7	-1.1	-0.8	-3.8
Oilseeds	1.2	0.4	-0.6	2.3	1.4	-0.7	-3.1	2.4	-9.3
Sugar	0.5	1.4	2.2	1.5	5.4	5.4	-1.1	17.6	21.7
Cotton	0.5	2.5	2.7	2.1	6.4	7.0	3.8	15.8	13.1
Other Crops	-2.2	-2.3	-0.8	-3.4	-3.2	-1.1	-12.9	-2.7	-2.1
Animal	0.1	-0.1	0.0	0.6	0.4	0.9	0.3	1.7	2.3
proFood	0.3	-0.6	-0.2	1.6	0.1	0.1	-3.8	0.9	0.3
Extract	0.0	0.2	0.1	0.0	0.5	0.3	0.2	0.8	0.6
Light	-0.8	-0.8	-0.3	-1.4	-4.0	-1.5	-0.7	-9.9	-3.6
Industry	-0.7	-0.8	-0.1	-2.8	-3.6	-0.5	-5.6	-8.3	-1.0
Trade	0.1	-0.1	0.0	0.4	0.1	0.2	0.7	0.7	0.8
Other Services	0.2	-0.2	-0.1	1.0	0.3	0.2	2.3	1.6	1.0

Appendix Table 8   Factor and Producer Prices (% change)

	Little			Modest			Full		
	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica	nAfrica	SSA	sAfrica
Factor Prices									
Land	2.0	-2.4	-2.7	6.4	-1.6	-0.6	5.0	3.8	8.2
Unskilled Labour a)	0	0	0	0	0	0	0	0	0
Skilled Labour a)	0.1	-0.4	-0.2	0.8	-0.1	0.1	1.7	1.1	1.1
Capital	0.1	-0.4	-0.2	0.7	-0.3	0.0	1.1	0.6	0.8
Producer Prices									
Cereals	0.2	-0.3	-0.2	0.6	-0.5	-0.1	0.2	-0.6	0.5
Vegetable	0.1	-0.4	-0.6	0.3	-0.6	-0.7	-0.2	-0.3	-0.1
Oilseeds	0.2	-0.3	-0.2	0.4	-0.6	-0.3	-0.6	-1.0	-2.7
Sugar	0.2	-0.3	-0.2	0.6	-1.0	-0.1	-0.2	-1.7	-0.1
Cotton	0.1	-0.2	-0.2	0.5	-0.5	0.1	-0.3	-0.4	0.8
OCrops	-0.1	-0.5	-0.4	0.1	-1.0	-0.4	-1.0	-1.2	0.0
Animal	0.0	-0.3	-0.3	0.1	-0.5	-0.2	-1.2	-0.5	0.0
ProFood	0.2	-0.3	-0.2	0.3	-0.5	-0.3	-0.8	-1.0	-1.0
Extract	0.0	0.0	0.0	-0.3	0.1	-0.1	-0.7	0.3	0.1
Light	-0.2	-0.4	-0.2	-0.9	-1.3	-0.8	-2.8	-2.7	-1.7
Industry	-0.2	-0.4	-0.2	-0.8	-1.4	-0.5	-2.1	-3.0	-0.9
Trade	0.0	-0.3	-0.1	0.0	-0.7	-0.2	-0.4	-1.3	-0.2
Services	-0.1	-0.3	-0.1	-0.3	-0.8	-0.3	-1.1	-1.1	-0.2

a) Refers to the real wage rate.

Appendix Table 9   *Unskilled Employment (% change in the number employed)*

	Little	Modest	Full
nAfrica	0.1	0.7	1.0
SSA	-0.5	-0.4	0.7
sAfrica	-0.2	0.0	1.0

Appendix Table 10   *Welfare impact of policies under 'Little reform' (USD mln) a)*

		Export Subsidy	Agricultural Market Access	Non-Agricultural Market Access	Domestic Support	Trade Facilitation	Total
nAfrica	Africa	0	0	-42	-1	89	47
	OECD	-36	197	-260	117	10	27
	Rest	-3	0	-16	8	4	-8
	Total	-39	197	-318	125	102	67
SSA	Africa	-7	0	35	-6	24	47
	OECD	-6	-242	-115	-225	1	-587
	Rest	7	0	-13	10	-3	0
	Total	-6	-242	-93	-221	23	-540
sAfrica	Africa	-20	0	154	0	30	164
	OECD	6	-125	-246	79	5	-282
	Rest	3	0	-29	10	2	-14
	Total	-11	-125	-121	89	36	-132

a) Based on Equivalent Variation.

Appendix Table 11   *Welfare impact of policies under 'Modest reform' (USD mln) a)*

		Export Subsidy	Agricultural Market Access	Non-Agricultural Market Access	Domestic Support	Trade Facilitation	Total
nAfrica	Africa	1	0	-354	-1	136	-220
	OECD	-91	391	309	260	14	883
	Rest	-8	0	-57	21	5	-39
	Total	-98	391	-102	280	155	625
SSA	Africa	-18	0	76	-14	38	82
	OECD	-9	-175	-266	-128	4	-573
	Rest	17	0	-49	25	-4	-11
	Total	-10	-175	-238	-117	38	-502
sAfrica	Africa	-50	0	730	0	45	725
	OECD	16	-139	-602	193	7	-526
	Rest	7	0	-142	26	3	-105
	Total	-27	-139	-14	220	54	93

a) Based on Equivalent Variation.

Appendix Table 12   Welfare impact of policies under 'Full reform' (USD mln) a)

		Export Subsidy	Agricultural Market Access	Non-Agricultural Market Access	Domestic Support	Trade Facilitation	Total
nAfrica	Africa	1	-776	-1370	-2	284	-1863
	OECD	-149	1208	1888	516	28	3491
	Rest	-20	146	-30	41	11	148
	Total	-168	578	488	555	322	1775
SSA	Africa	-38	-644	-213	-30	78	-847
	OECD	0	1419	-384	302	16	1352
	Rest	42	158	-48	57	-10	198
	Total	4	933	-645	328	84	704
sAfrica	Africa	-114	17	1638	1	95	1636
	OECD	49	231	-915	394	14	-228
	Rest	19	89	-341	54	4	-175
	Total	-46	336	381	449	113	1233

a) Based on Equivalent Variation.

Appendix Table 13   National income gains under alternative model specification (USD mln) a)

	Static Model			Dynamic Model		
	Little	Modest	Full	Little	Modest	Full
nAfrica	67	625	1,775	170	744	1,767
SSA	-540	-502	704	-499	419	4,331
sAfrica	-132	93	1,233	-124	47	1,771
EU15	7,996	12,226	15,860	14,554	26,819	41,647
NAM	1,000	543	253	2,183	4,570	9,988
SAM	1,855	3,559	8,181	5,249	13,020	30,552
AUSNZ	687	1,279	4,629	1,471	2,982	10,107
HiASIA	4,470	11,115	23,965	5,878	16,060	32,582
China	1,648	3,285	6,533	2,640	5,230	9,927
oASIA	1,649	3,311	5,893	4,963	12,801	24,519
CEEC	113	139	-33	130	481	281
ROW	2,274	3,999	15,173	5,077	14,118	33,617
Total	21,087	39,672	84,164	41,692	97,291	201,089

a) Based on Equivalent Variation.

Appendix Table 14   *Capital stock effects*

	Per cent change in capital stock		
	Little	Modest	Full
nAfrica	0.3	1.4	2.3
SSA	0.0	1.6	5.5
sAfrica	0.0	0.6	2.7
EU15	0.2	0.4	0.7
NAM	0.0	0.1	0.2
SAM	0.5	1.3	3.1
AUSNZ	0.6	1.2	3.7
HiASIA	0.1	0.4	0.6
China	0.4	0.8	1.4
oAsia	0.8	2.3	4.6
CEEC	0.0	0.2	0.0
ROW	0.6	2.0	3.5
WORLD	0.2	0.6	1.2